EasyChair Preprint

№ 9214

Effect of the General Government Fiscal Deficit on the Inflation Rate: OECD Countries with the Upper Middle Income.

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November 1, 2022

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Abstract

The aim of this research was to explicate the impacts of fiscal deficits, Gross Domestic Product and expansionary money supply on inflation rate over the period 1990-2020 for Colombia, Costa Rica, Mexico, and Turkey, which are among the upper middle-income countries in the OECD country group. Fiscal deficit and inflation rate data were obtained from the Public Finance Statistics, the public database of the International Monetary Fund; whereas GDP and expansionary money supply data were obtained from the World Bank's World Development Indicators database. In the analysis, the Driscool and Kraay's (1998) estimator method was employed since it correctly predicted the parameters under the assumptions of heteroscedasticity, autocorrelation, and cross-sectional dependence.

Keywords: Inflation Rate, Fiscal Deficit, Driscoll-Kraay's AR (1) Linear Regression Estimator with Residual

JEL Codes: E31, H59, C23

Introduction

The phenomenon of inflation is a dilemma that is difficult to be solved in many countries, especially in developing countries. This study investigates the impact of fiscal deficit (FD) on inflation rate (IR). In this study, the effects of the FD, GDP and expansionary money supply on the IR are investigated by utilizing the obtained data over the period 1990-2020 for Colombia, Costa Rica, Mexico, and Turkey, which are among the upper middle income countries of the OECD country group. The objective of the research is to examine whether such problem is reflected in IR, especially in those upper middle-income level countries in the OECD country group with FD problems. In the first section of the manuscript, theoretical views on the FD and empirical literature are introduced. In the second section, the IR and FD development in the countries are mentioned. In the third section, such an effect is analyzed econometrically.

1. Literature Review

In this part, the theoretical and empirical literature is introduced. In theoretical literature, FDs are discussed in terms of the Classical, Monetarist, Keynesian, Neoclassical, and Ricardian views. In the empirical literature part, the studies and their findings are also included.

1.1. Theoretical Literature

According to the Classical view, the substitution of the FD with current taxation in autarchic economies increases the total consumer demand, and thus, the real interest rate increases and investment decreases. Accordinly, the production capital declines in the long-run. In open economies, the main country's substitution of the FD with current taxes causes foreign borrowing, hence, the current account deficit. The FD also causes a decline in domestic investment, while a decline in the capital stock in the long-run by excluding domestic investments.

In the Monetarist view, two situations are considered in terms of the predominance of fiscal and monetary policies.

In case of the predominance of monetary policy on fiscal policy along with a FD, such a deficit is offset by the fiscal authority using a combination of the monetary authority's seigniorage revenues and bond sales to the public sector. The monetary authority constantly controls IR in the monetary economy since it is authorized to freely determine the monetary base. In the second case, where fiscal policy predominates over monetary policy, the fiscal authority creates its budget independently by declaring all current and future FDs and surpluses which, in turn, determines the amount of revenue that needs to be increased through the sale of bonds and seigniorage. In the event that the fiscal authority has a deficit in the budget, the monetary authority cannot control neither the economic growth that constitutes the monetary base nor the IR.

Instead of accepting the deficit budget as wrong, Keynes advocated the fiscal policies implemented against the conjuncture in accordance with the economic fluctuations. Keynesian economists increase taxes and prevent inflation to soothe the economy when demand-side growth is high.

According to the Neoclassical view, FDs are increased by imposing taxes on future generations and making lifetime total consumptions. Increasing consumption, by definition, reduces saving. Thus, the interest rate should rise to bring the capital market into equilibrium. Permanent FDs reduce private capital accumulation by creating a crowding-out effect.

According to the Ricardian view, overlapping generations are altruistic about resource transfer through voluntary bonds. With future generations paying taxes, the FD is passed on to future generations without altering the total resources of taxpayers and their descendents.

1.1.1. Classical View

According to the standard view, the substitution of the FD with current taxation causes an increase in aggregate consumer demand. Meaning that, national savings decrease as private savings increase less than tax deductions. In a closed economy, this results in a rise in the expected real interest rate to improve the equity between demand for investment and national savings. Investments are crowded out by a rise in the real interest rate and production capital is reduced in the long-run. Thus, Modigliani (1986) perceived public debt as the reason for future generations to attain less capital. As Martin Feldstein (1974) mentioned, social security programs enhance aggregate demand for goods, thus, cause a rise in the real interest rate and a decline in the productive capital stock. In autarkic economies, the host country's substitution of the FD with current taxes causes foreign borrowing. Thus, the FD causes the current account deficit to increase. The FD excludes domestic investment in the host country, causing a decrease in domestic investment, and a decline in the capital stock in the long-run. The increase in the current account deficit also reduces social welfare in the long-run and leads to foreigners to complain about borrowing (Barro, 1989: 37-38).

1.1.2. Monetarist View

Sargent and Wallace (1981) stated that in the first case where monetary policy gained predominance over fiscal policy, for instance, the monetary authority acted independently of monetary policy in declaring the growth rate of the current and future period of the base money. In doing so, monetary policy determines the level of revenue to be supplied by the fiscal authority. The fiscal authority, which is subject to the constraint determined by the demand for

bonds, offsets a FD using a combination of the monetary authority's seigniorage revenues and bond sales to the public sector. The monetary authority constantly controls IR in the monetary economy since it is free to determine the base money. In the second case, where fiscal policy gained predominance over monetary policy, the fiscal authority constituted its budget independently by declaring all current and future FDs and surpluses which, in turn, determined the amount of revenue that needed to be increased through the sale of bonds and seigniorage. In this case, the monetary authority is subject to the constraint determined by the demand for public bonds, and such demand is crucial for the monetary authority to determine whether or not it should constantly have control over IR. In particular, upon demanding for public bonds, the interest rate of the bonds is thought to be higher than the growth rate of the economy. Once the fiscal authority has a deficit in the budget, the monetary authority cannot control neither the economic growth that constitutes the monetary base nor the IR. Although the monetary authority can constantly control IR, in the second case the monetary authority is weaker than in the 1st one. In the 2nd case, the fiscal authority's FD cannot be offset solely by the sale of new bonds since the monetary authority would have difficulty in creating money and tolerating additional inflation (Sargent and Wallace, 1981: 1-2). Friedman (1984) stated that if the prices of the final products were not set correctly and the factors of production were inelastic, the condition of full employment could not be met. It was also stated that cyclical fluctuations in output and employment could not be fully resolved. Leaving the authority to control the amount of money and supply money to offset FDs to the government may lead to irresponsible governmental behavior and inflation. Therefore, the state's control over the amount of money should be eliminated (Friedman, 1948: 263-264).

1.1.3. Keynesian View

Instead of assuming the deficit budget as wrong, Keynes advocated the fiscal policies implemented in accordance with the economic fluctuations against the conjuncture. For instance, Keynesian economists advocated deficit-based public expenditures on labor-intensive infrastructure projects throughout a recession. Keynesian economists increased taxes and prevented inflation to alleviate the economy when demand-side growth was high. Monetary policy practices tend to enhance investment, for instance, by lowering interest rates to stimulate the economy. The exceptional case arises with the liquidity trap leading to an increase in output and employment. Keynes argued that the government was effective in solving problems in the short-run. The theory of Keynesian economists became predominant throughout the period following the Second World War until the 1970s. Keynesian economists could not find any solution to the phenomenon of stagflation, in which slow growth was accompanied by high levels of IR (Jahan, Mahmud and Papageorgiou, 2014: 2).

1.1.4. Neoclassical View

According to the Neoclassical view, forward-thinking individuals tend to plan their consumption throughout their life span. FDs are increased by imposing taxes on future generations and making lifetime total consumption. Upon utilizing economic resources for full employment, enhanced consumption compulsorily reduces savings. Thus, the interest rate should be increased to fulfill the capital market equilibrium. Persistent FDs reduce private capital accumulation via the crowding-out effect (Bernheim, 1989: 55).

1.1.5. Ricardian View

According to the Ricardian view, overlapping generations are altruistic through voluntary transfer of resources. Under certain conditions, consumption becomes a function of the total resources of taxpayers and future generations of taxpayers. With future generations paying taxes, the FD would be devolved on to future generations without affecting the total resources (Bernheim, 1989: 56).

1.2. Empirical Literature

Empirical literature is sorted from the most recent to the outdated. Upon examining the empirical literature, some of the studies (Duodu et al., 2022; Eita et al., 2021; Durguti, Kryeziu, and Gashi, 2020; Ssebulime and Edward, 2019; Ahmad and Aworinde, 2019; Danlami, Hidthiir, and Hassan, 2019; Maraş and Dumrul, 2019; Myovella and Kisava, 2017; Jalil, Tariq, and Bibi, 2014; Chu and Lin, 2013) asserted that FD positive affected IR; some studies (Güneş, 2020; Ezeabasılı, Mojekwu, and Herbert, 2012) found negative impacts in hat regard; and some other studies concluded that the FDs did not affect IR (Karadeniz, 2021; Olaniyi, 2020; Tiwari, Tiwari, and Pandey, 2012). In some studies (Doğan and Günel, 2021; Kaur, 2021; Olubiyi and Bolarinwa, 2018; Cata˜o and Terrones, 2005) FDs were detected to affect IR, either positively or negatively, according to maturity date, country, or analysis methods used.

Duodu et al. (2022) investigated the influence of FD on IR with the Granger causality analysis and VECM over the periods 1999:Q1-2019:Q4 in Ghana. IR was used as the dependent variable; while the rate of change in money supply, foreign trade balance, ratio of FD to IR, GDP, and nominal exchange rate are used as independent variables. As a result of Granger causality analysis; neither the FD causes IR nor IR causes FD. According to the VECM result, the FD leads to a rise in the IR.

Doğan and Günel (2021) investigated the impacts of FDs on IR in 8 Balkan countries employing the panel ARDL method and using the data obtained over the period 1999-2019. It was detected that the FD increased IR in the short-run, whereas the FDs and the 4th difference of the FD negatively affected the IR in the long-run.

Kaur (2021) examined the impact of the FD on the IR in India by employing the ARDL boundary approach method and using the monthly data obtained over the period 1996-1997 and 2016-2017. IR was used as the dependent variable; whereas the ratio of total budget deficit to GDP, M3 money supply, exchange rate, gasoline (energy) index, and GDP were used as independent variables. The FD and M3 money supply positively affected the IR; whereas the exchange rate and gasoline (energy) index negatively affected the IR. In the short-term; although the lag of the IR and the 5th lag of the interest rate as well as the 5th, 6th, and 7th lags of the FD negatively affected the IR; M3 money supply positively affected the IR. In the short-run, the gasoline (energy) index negatively affected the IR, whereas the 1st lag of the gasoline (energy) index positively affected the IR.

Karadeniz (2021) estimated the impact of FD on current account deficit, economic growth and IR in 14 developing countries over the period 1994-2019 employing the Panel Average Group Estimator (AMG) method. In the first model, current account deficit was used as the dependent variable, whereas the FD and growth rate were used as the independent variables. In the second model, the growth rate was used as the dependent variable, while the FD and IR were used as the independent variables. In the third model, the IR was used as the dependent variable, whereas the FD and money supply were used as the independent variables. It was detected that the rise in the FD and growth rate in the first model increased the current account deficit; in the second model, the decrease in the FD and the IR increased the growth rate; and in the third

model, the rise in the money supply increased the IR. In the third model, it was determined that the FD did not have a statistically significant effect on IR.

Eita et al. (2021) examined the impact of FD on IR in Namibia over the period 2002:Q2-2017:Q2 by employing the ARDL and Granger causality methods. Namibia's IR was used the dependent variable; whereas the ratio of FD to GDP, IR, and interest rate of South Africa were used as independent variables. The rise in the FD and South Africa's IR increased Namibia's IR. The first lag in Namibia's IR, South Africa's IR, and the rise in the FD increased the IR. However, a causality from FD to IR was detected, but no causality from IR to FD could be found.

Olaniyi (2020) investigated the relationship between FD and IR in Nigeria using the quarterly data obtained over the period 1981:Q1-2016:Q4 by conducting both symmetrical and asymmetrical causality analysis developed by Hatemi-J and El-Khatib (2016). As a result of the analysis, neither symmetrical nor asymmetrical causality relationships were detected.

Güneş (2020) examined the impact of FDs on IR for 28 OECD countries over the period 1995-2018 by conducting Vector Autoregressive (VAR) and Panel Granger Causality Analyses. Although a causal relationship running from IR to FD was determined; no causality from FD to IR was detected. The VAR analysis revealed that the FD had a negative impact on the IR.

Durguti, Kryeziu and Gashi (2020) analyzed the impact of FD on IR in 6 Western Balkan countries over the period 2001-20017 by employing the VECM. IR is used as the dependent variable; whereas FD, ratio of government debt to GDP, real exchange rate, and unemployment rate are used as independent variables. Although it was detected that of the FD and public debts increased the IR; it was detected that the real exchange rate and unemployment rate decreased the IR.

Ssebulime and Edward (2019) estimated the impact of the FD on the IR in Uganda over the period 1980-2016 performing a cointegration analysis. IR was used as the dependent variable, whereas the change in money supply, trade balance, GDP change rate, and nominal interest rate were used as the independent variables. The first difference of the FD, the second difference of the money supply, the trade balance, and the second difference of the trade balance were detected to have positive impacts on the IR. The rate of change in GDP negatively affected the IR.

Ahmad and Aworinde (2019) examined whether or not the FD caused IR in 12 African countries utilizing the quarterly data obtained over the period 1980-2018 by emoploying the TAR and the M-TAR. It was found that the FD had a positive impact on the IR.

Danlami, Hidthiir and Hassan (2019) investigated the impact of FD on IR in Nigeria over the years 1970-2016 performing the ARDL bounds test approach. The first lag of IR, GDP, exchange rate and FD were chosen as dependent variables; whereas IR was chosen as the independent variable. At the end of the analysis, the rise in the 1st lag of IR and the rise in the FD increased the IR in the short-run, whereas the rise in GDP and exchange rate reduced the IR. In the long-run, the rise in the FD increased the IR; whereas the rise in GDP and exchange rate reduced the IR.

Maraş and Dumrul (2019) analyzed the relationship between FD and IR for Turkey by performing the ARDL bounds test approach with the help of the monthly data obtain over the period 2006:01-2018:10. IR was used as the dependent variable; whereas M3 money supply, the TL/USD exchange rate, and FD were used as the independent variables. It was revealed that the budget balance caused a decline in the IR in the long-run, and therefore, the IR was increased with the rise in the FDs. The money supply and the TL/USD exchange rate negatively affected the IR.

Olubiyi and Bolarinwa (2018) investigated the impact of the FD on IR over the period 1994-2015 by performing the ARDL Boundary Approach test for Nigeria, South Africa, Mali, Kenya, and Egypt. IR was used as the dependent variable, and the first lag of the IR, the real exchange rate, the first lag of the real exchange rate, the expansionary money supply, the foreign debts, and the first lag of the foreign debts were used as independent variables. As a result of the analysis; external debts increased the IR for South Africa, Mali, and Nigeria, whereas foreign debts decreased the IR for Egypt. The first lag of external debt increased the IR in Kenya. The first lag of the IR negatively affected the IR in Egypt and Nigeria, whereas the first lag of the IR in South Africa and Mali positively affected the IR in the short-run. In the short-run, expansionary money supply negatively affected the IR in Nigeria; whereas it had a positive impact in Mali, Kenya, and Egypt. In the short-run, the real effective exchange rate positively affected the IR in Kenya, Nigeria, and Egypt. In the short-run, the first lag of the real effective exchange rate increased the IR in Nigeria. In the long-run; although foreign debts increased the IR in Nigeria, external debt negatively affected the IR in Kenya and Egypt. In the long-run, expansionary money supply positively affected the IR in all countries. The real exchange rate increased the IR in Nigeria, South Africa, Mali, and Kenya in the long-run.

Myovella and Kisava (2017) investigated the impact of the FD on IR over the period 1970-2015 using the ARDL Bounds Test for Tanzania. It was detected that the FD had a positive effect on IR in the long-run.

Jalil, Tariq and Bibi (2014) investigated the impacts of FDs, interest rates, trade openness, exchange rates, petroleum prices, public sector borrowings, private sector borrowings, real money demand for real money supply, wheat prices, import price index, and the lag in IR on IR in Pakistan over the period 1972-2012 by employing the ARDL bounds approach. It was detected that the FD had a positive influence on the IR, and the budget imbalance caused inflation.

Chu and Lin (2013) analyzed the impact of FD on IR in 91 countries over the years 1960-2006 by employing the Dynamic Panel Quantile Regression (DPQR) method. IR was chosen as the dependent variable; whereas the ratio of FD to money supply, ratio of FD to GDP, growth rate of money supply, IR of gasoline prices, and trade deficits were used as the independent variables. It was asserted that the FD caused inflation. It was determined that such impact was higher in countries with high and moderate IR, whereas lower in countries with low IR.

Ezeabasılı, Mojekwu and Herbert (2012) explicated the impact of the FD on IR in Nigeria over the years 1970-2006 by conducting cointegration analysis. IR was used as the dependent variable; whereas FD, money supply, GDP, depreciation of the national currency, exchange rate, and the previous year's the IR were used as the independent variables. As a result of the analysis; although the first lag of the FD and the first lag of depreciation of the national currency negatively affected the IR; the first and second lags in the money supply enhanced the IR. Although the rise in GDP decreases the IR, the third lag of GDP increased the IR. An rise in the first lag of the IR increased the IR.

Tiwari, Tiwari and Pandey (2012) examined the factors affecting the FD, IR, money supply and public expenditures in India over the periods 1970-1971 and 2008-2009 by conducting the Granger Causality analysis, standard Granger Causality analysis, and VAR analysis developed by Dolado and Lütkepohl (DL) (1996). Each variable was used as the dependent variable, respectively, and the ones that were not used as the dependent variable were used as the independent variables. As a result of the Granger Causality analysis developed by DL; unilateral causal relationships running from public expenditures and money supply to FD were found. As a result of the standard Granger causality analysis, unilateral causal relationships running from the first difference in the FD to the first difference in the money supply, from the first difference

in public expenditures to the first difference in the FD, and from the first difference in the money supply to the first difference in the FD were detected. The VAR analysis revealed a inverse causal relationship from the second lag of the FD to the money supply was found. There was a positive causality running from the first lag of public expenditures to the FD and public expenditures, whereas a negative causality from public expenditures to the second lag of money supply existed. A positive causal relationship from the first lag of the IR to the IR was found. Negative causal relationships from the first lag of the money supply to public spending and from the second IR of money supply to money supply were detected. It was determined that the FD did not affect the IR.

Catao and Terrones (2005) examined the impact of FD on IR for 107 developed and developing countries using the MG and PMG estimators over the period 1960-2001. IR was chosen as the dependent variable, whereas the ratio of money stock to GDP, the ratio of central FD to GDP, trade deficit, and petroleum prices were used as independent variables. According to the MG estimator result, it was determined that the FD positively affected the IR in all countries and country groups. According to the PMG estimator, FD had a negative impact on the IR in developing countries, whereas it had a positive impact on developing countries.

2. Development of IRs and FDs in OECD Countries with Upper Middle Incomes

The high IRs and high FDs in these countries account for considering the upper middle-income countries for the sample of the study.

Figure 1 illustrates the IR development of Colombia, Costa Rica, Mexico, and Turkey over the period 1990-2020.

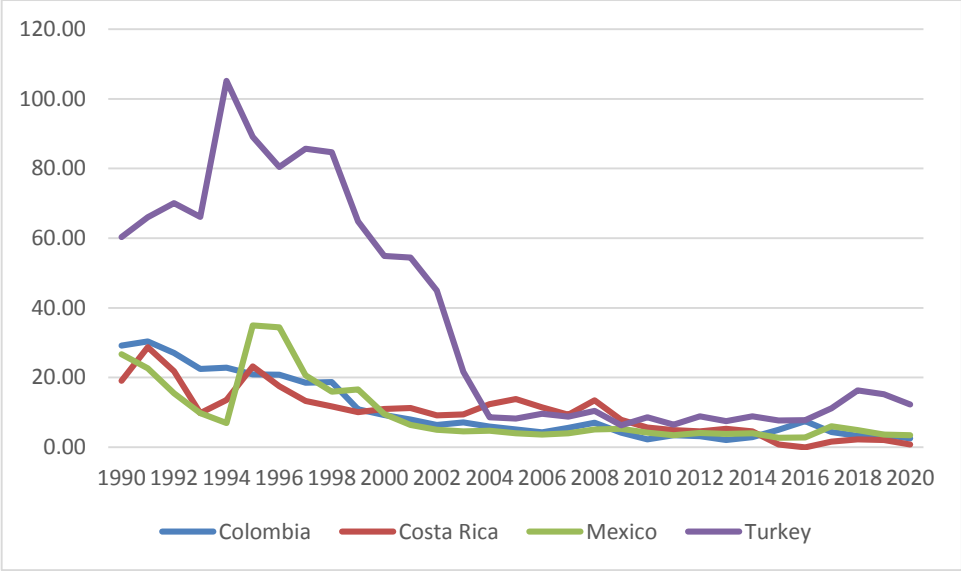

Figure 1. Development of IR

Upon examining Figure 1; it is seen that the countries with the highest IRs are Turkey Mexico, Colombia, and Costa Rica, respectively. Inflation in Turkey was on the rise over the period 1990-1992, it decreased in 1993, and climaxed as of 1994. The IR, which generally decreased over the period 1995-2005, has been stable since 2006. The IR in Mexico, which decreased over the period 1990-1994, climaxed in 1995 and declined over the period 1996-2007, and has, in general, remained stable since 2008. The IR in Colombia, which has been on the rise since 1990, climaxed in 1991. The IR, which fell over the period 1992-2007, increased in 2008 and has followed a stable trend since 2009. In Costa Rica, the IR increased over the period 1990-1991 and climaxed in 1991. The IR, which fell until 1993, increased until 1995, and followed a downward trend from 1996 onwards, except for the periods 2004-2005 and 2007-2008.

Figure 2 illustrates the development of FD.

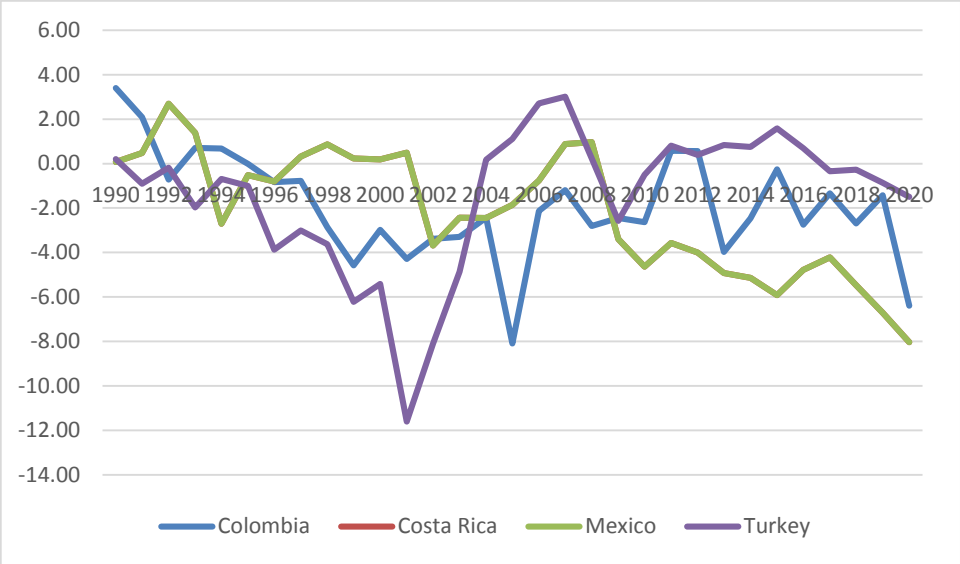

Figure 2. Development of FD

Upon examinig Figure 2, it is seen that the countries with FDs are Turkey, Colombia, Costa Rica, and Mexico, respectively. For Turkey, the FD was high during the 1990-2001 period, this deficit decreased over the period 2002-2008, the FD increased during the 2009-2010 period, the FD decreased over the period 2011-2016, and the FD, in general, increased in 2017. For Colombia, the FD decreased during the 1990-1994 period, but increased over the period 1995-2010, decreased over the period 2011-2012, and have been increasing since 2013. For Costa Rica, the FD increased over the periods 1994-1996, 2002-2006, and 2009-2020, whereas decreased during other periods. In Mexico, the FD was high over the periods 1994-1996, 2002-2006, and 2009-2020, but decreased during other periods.

3. Econometric Method

The study covers the annual data of Colombia, Costa Rica, Mexico, and Turkey which are the OECD countries with upper middle incomes overthe period 1990-2020. The data of CPI and FD variables are obtained from the Government Finance Statistics section, which is the public database of the IMF; whereas the data of GDP and MONEY variables are obtained from the WDI database of World Bank. Stata 14 software is utilized for the analysis.

Table 1. Variables Used in Analysis and Their Explanations

Variables	Explanation of the Variables
CPI	Annual Percentage Change in the Consumers's Price Index (CPI)
FD	Ratio of the Government's Fiscal Balance to GDP
GDP	Real GDP Per Capita
MONEY	Rate of Change in Expansionary Money Supply

Upon examining Table 1; the Annual Percentage Change of the CPI is seen as the dependent variable, and the Ratio of Government's Fiscal Balance to GDP (FD) is seen as the independent variable.

3.1.Examination of Descriptive Statistics of the Panel Data Model

Descriptive statistics of the panel regression model are examined. The descriptive statistics results are presented below.

Table 2. Descriptive Statistics

Variables	Mean Value	Standard Deviation	Minimum	Maximum	# of Obs. (N)/ # of Observed Groups
CPI	16.48241	20.8948	0.0174789	105.215	124/31
LOGCPI	0.9624123	0.5020158	-1.757487	2.022078	124/31
FD	2.533304	2.221358	0.0198232	11.60721	124/31
GDP	7687.083	2390.256	3639.719	12755.17	124/31
LOGGDP	3.863211	0.144209	3.561068	4.105686	124/31
MONEY	25.28749	28.79917	-45.47297	154.3908	124/31
LOGMONEY	1.237892	0.3965632	-0.0262785	2.188621	124/31

Upon examining Table 3, it is seen that a huge difference exist between the maximum and minimum values of the CPI, GDP, and MONEY variables. Therefore, the differences are reduced by taking the logarithm of this variable. Thus, the model is detected as follows;

$$LOGCPI_{it} = \alpha_{it} + \beta_{1it} FD_{it} + \beta_{2it} LOGGDP_{it} + \beta_{3it} LOGMONEY_{it} + u_{it} \quad (1)$$

3.2. Determining the Estimation Method of the Model

The study involves a panel dataset since it includes data from various units (4 countries) and long periods (31 years). Although studies on panel data were first conducted by Hildreth (1950), Kuh (1959), Grunfeld and Griliches (1960), Zellner (1962), Balestra and Nerlove (1966), and Swamy (1970), the panel data model has been employed since the 1990s (Yerdelen Tatoğlu, 2018: 3). A linear panel data model can be written as:

$$Y_{it} = \beta_{0it} + \beta_{1it} X_{1it} + \beta_{2it} X_{2it} + \cdots + \beta_{kit} X_{kit} + u_{it} \qquad i=1,\ldots, N;\ t=1,\ldots,T \quad (2)$$

Briefly;

$$Y_{it} = \beta_{0it} + \sum_{k=1}^{K} \beta_{kit} X_{kit} + u_{it} \qquad i=1,\ldots, N;\ t=1,\ldots,T \qquad (3)$$

Here, *i* denotes the unit size, and *t* denotes the time dimension. β_{0it} is the constant term; β_{kit} is vector of parameters with K×1 dimension; X_{kit} is the value of the k^{th} explanatory variable at time *i* for the value of the i^{th} unit; Y_{it} is the value of the dependent variable for the i^{th} unit at time *t*. If both the constant and slope parameters are fixed with respect to the unit and time, the Classical model is involved. If the slope parameter is fixed and the constant parameter is variable with respect to units, there is a unit effects model. This model is called the one-way model. If the slope parameter is fixed and the constant parameter is variable with respect to both units and time, the unit and time effects model is involved. This model is also called the two-way model (Yerdelen Tatoğlu, 2018: 37-40).

To decide whether the research model is Classical or not, the result of the F test in Table 3 is considered. Since the p value of the F test is lower than 0.05, the model is determined not to be Classical. Thus, the presence of time and unit effects in the model should be tested with the within-group estimator (WE).

Table 3. Results of the Within-Group Estimators

Probability Value of Within-Group Estimator for the Unit Effect	Probability Value of Within-Group Estimator for the Time Effect
0.0000	0.0000

According to the WE results; the null hypothesis, which implies that there is no unit and time effect, is rejected at the 95% confidence interval. Accordingly, unit and time effect exists. Then, it is determined whether such effect is fixed or random.

Although it is assumed that no correlation exists between unit effects and explanatory variables in the REM, this correlation is assumed to be different from zero in the FEM (Yerdelen Tatoğlu, 2018: 79).

By performing the Hausman test developed by Hausman in 1978, it is determined whether the model is FEM or REM. In the Hausman test, it is tested whether a difference occurs between between the REM estimator ($\hat{\beta}_{GLS}$) and the FEM estimator ($\hat{\beta}_{FE}$) for the following model.

$$Y_{it} = X_{it}\beta + \mu i + \varepsilon_{it} \qquad i=1,\ldots, N;\ t=1,\ldots,T \qquad (5)$$

$$\hat{q} = \hat{\beta}_{GLS} - \hat{\beta}_{FE} \qquad (6)$$

The hypotheses used for this test are as follows (Hausman, 1978: 1261-1263).

$$H_0: \text{corr}\ (\mu_i, X_i) = 0 \qquad (7)$$

There is no difference between the REM and FEM estimators. The REM is efficient.

$$H_1: \text{corr}\ (\mu_i, X_i) \neq 0 \qquad (8)$$

There is a difference between the REM and FEM estimators (FEM is efficient).

If the calculated $p < 0.05$ according to the hypotheses determined as a result of the Hausman test, H_0 is rejected, whereas it is accepted if $p > 0.05$. Accordingly, if the p value of the Hausman test is lower than 0.05, the REM would be considered, and if the p value of the Hausman test

exceeds 0.05, the FEM would be applicable. The result of the Hausman estimator is presented in Table 4.

Table 4. Hausman Estimator for the Unit and Time Effects

Hausman Test for the Unit Effects			**Hausman Test for the Time Effects**		
Chi²	**Probability Value (p)**	**Estimation Method**	**Chi²**	**Probability Value (p)**	**Estimation Method**
47.85	0.0000	FE	30.30	0.0000	FE

Upon examining the above table, since the probability values of the Hausman test for unit and time effects are lower than 0.05, a two-way FEM is involved.

3.3. Testing the Assumptions of the Model

3.3.1. Normality Assumption

Spiegel and Stephens (2011) and Oral Erbaş (2008) asserted that; according to the central limit theorem, in samples of N selected from a finite population, for quite large values of N (N≥30), the sampling distributions of the means exhibited an approximately normal distribution regardless of the population. The unit size (n) representing the number of countries is 4, whereas the time dimension (t) representing years is 31. Thus, to express the sample number in another way, since the number of observations is N=n*t= 124, it is assumed that the mean value of the samples exhibits a normal distribution.

3.3.2. Multicollinearity Assumption

In multiple regression models with more than one independent variable, the relationship between two, some or all of the independent variables is known as multicollinearity. With the variance inflation factor (VIF), it is determined how far the variances of parameter estimates diverge from their actual values due to multicollinearity:

$$VIF_i = \frac{1}{1-R_i^2} \quad i=1, 2, \ldots, k \tag{9}$$

Here, R_i^2 is the R^2 value of the models in which the independent variables are the dependent variable one by one and the other independent variables are the independent variables. Starting from the model with *k* independent variables below, the auxiliary regression models are estimated *k* times, and the VIF value is calculated from all of them.

$Y_{it} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k + u$

$X_1 = \beta_0 + a_1 X_1 + a_1 X_2 + \cdots + a_k X_k + u \qquad VIF_1 = \frac{1}{1-R^2_{X_1.X_2X_3\ldots\ldots X_k}}$ (10)

$X_k = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k + v \qquad VIF_k = \frac{1}{1-R^2_{X_k.X_1X_2\ldots\ldots X_{k-1}}}$ (11)

When the above criteria are examined;

VIF=1 if R_i^2=0, and no multicollinearity exists .

The VIF value ranges between 0 - 5 if $0 < R_i^2 < 0.5$, and no multicollinearity exists.

The VIF value ranges between 5 - 10 if $0.50 < R_i^2 < 0.80$, and the multicollinearity is moderate.

The VIF value exceeds 10 if $0.80 < R_i^2 < 1$, and a strong multicollinearity exists.

It is called 1/VIF tolerance number and is used as a criterion providing information about multicollinearity. When VIF>10, the multicollinearity problem is quite strong (Yerdelen Tatoğlu, 2020a: 111, 115). Table 5 presents the result of the VIF criterion by which multicollinearity is measured.

Table 5. Multicollinearity Test Results

VIF Criterion		
Variables	**VIF Value**	**1/VIF Value**
FD	1.20	0.835360
LOGGDP	1.13	0.884931
LOGMONEY	1.08	0.928215
Mean VIF: 1.13		

In Table 5, it is seen that the VIF values of the model are lower than 5 and no multicollinearity problem exists.

3.3.3. Testing the Omitted Variable in the Model

Ramsey (1969) proposed a model to test whether the model specification was correct and this model has been the most performed test to determine the specification error in the literature. Based on the following model in the Ramset Reset test,

$$Y=X\beta+u \quad (12)$$

X is of dimension NT*k and u is assumed to be normally distributed with a zero mean.

$E\left[u \mid X\right] = \xi \neq 0$ if Model (12) has specification error. In the Ramset Reset test, ξ is considered as Zθ.

In the following model:

$$Y=X\beta + Z\theta + u \quad (13)$$

The null hypothesis:

H_0: θ=0 (model specification is correct)

The constrained F test is performed to test constrained model specification error in Model (12), and unconstrained model specification error in Model (13) as follows:

$$F=\frac{R_{UR}^2-R_R^2/p}{1-R_{UR}^2/NT-k-p} \quad (14)$$

R_{UR}^2 denotes the salience coefficient of the unconstrained model in Equation (10); whereas R_R^2 denotes the salience coefficient of the constrained model in Equation (13). The calculated F value, p, fits the F distribution with NT-k-p degrees of freedom.

If H_0 is rejected, it is accepted that a specification error exists (Yerdelen Tatoğlu, 2020a: 308). The result of this test, called Ramsey Reset, is presented in Table 6.

Table 6. Ramsey's Reset Test

Testing the Omitted Variable in the Model with the Ramsey Reset Test	
Test Value	Probability Value (p)
2.12	0.1016

Since the p-value of the Ramsey Reset test exceeds 0.05 in Table 6, it is determined that there is no omitted variable in the model.

3.3.4. Autocorrelation Assumption

The fact that the error terms are correlated with the error terms of other periods is described as autocorrelation (Yerdelen Tatoğlu, 2020a: 130). For the Model, which is FEM; autocorrelation is tested with the help of Durbin-Watson test proposed by Bhargava, Franzini and Narendranathan and LBI tests proposed by Baltagi-Wu. The test result is presented in Table 7.

Table 7. Autocorrelation Test

Determining Autocorrelation by Performing Durbin-Watson and LBI Tests			
For the Unit Effect		**For the Time Effect**	
Test Name	**Test Value**	**Test Name**	**Test Value**
Durbin-Watson	1.2235021	Durbin-Watson	2.3696565
LBI	1.264315	LBI	2.7405054

Upon examining Table 7; Durbin-Watson test suggested by Bhargava, Franzini and Narendranathan for the unit effect and LBI test suggested by Baltagi-Wu for the unit effect indicate that values are lower than 2, and thus, a first-order autocorrelation exists (Yerdelen Tatoğlu, 2018: 225). It is seen that there is no autocorrelation problem.

3.3.5. Heteroscedasticity Assumption

If the conditional variance of the error term remains the same depending on the independent variable, there is homoscedacity, and if it varies depending on the independent variable, there is heteroscedasticity (Gujarati and Porter, 2012: 365). The results of heteroscedasticity tested with the modified Wald test for the unit and time effects for the FEM is presented in Table 8.

Table 8. Heteroscedasticity Test

Testing Heteroscedasticity for the Unit Effect by Performing the Modified Wald Test		**Testing Heteroscedasticity for the Time Effect by Performing the Modified Wald Test**	
Test Value	Probability Value (p)	Test Value	Probability Value (p)
80.98	0.0000	2916.57	0.0000

Upon examining Table 8, it is determined that a heteroscedasticity problem exists for the time and unit effects, according to the results of the heteroscedasticity assumption test for the FEMs.

3.3.6. Cross-sectional Dependence Assumption

After determining the estimation method of the model, the assumption of cross-sectional dependence (CSD) should be examined.

To test the cross-sectinal dependence, Breusch Pagan's (1980) LM test is performed when T is large and N is small; Pesaran's (2004) CD test is performed when N is large and T is small; Pesaran et al. (2008) NLM test is performed when T and N are both large (Yerdelen Tatoğlu, 2020b: 237). Here, Breusch Pagan's (1980) LM test is performed since T (time dimension) is 31 and N (unit size) is 4. Table 9 presents the result of this test calculated by using the Stata 14 software.

Table 9. Breusch Pagan's (1980) LM Test Results

Test statistic	Probability Value (p)
37.56800	0.0000

Upon examining Table 9, it is concluded that there is autocorrelation according to the test results for the model.

3.3.7. Unit Root Test

The measurement of stationarity in time-series and panel datasets is made by unit root tests (Yerdelen Tatoğlu, 2013: 199). If there is autocorrelation in the series, the 2nd-generation tests are performed, otherwise the 1st-generation tests are performed (Yerdelen Tatoğlu, 2020b: 21). Since autocorrelation exists, the 2nd-generation tests should be performed. The 2nd-generation tests are categorized into three groups. In the first group consists of Levin, Lin and Chu (LLC); Harris and Tzavalis (HT); Breitung, Hadri, Im, Pesaran and Shin (IPS); Fisher ADF; Fisher Philips and Perron (Fisher PP); and Choi Fisher ADF panel unit root tests. In the second group of 2nd-generation tests, there are the Multivariate Augmented Dickey Fuller (MADF) and the Seemingly Unrelated Regression Augmented Dickey Fuller (SURADF) panel unit root tests. Panel unit root tests in the third group of 2nd-generation tests are Moon and Perron (2004); Cross-Sectional Augmented Dickey Fuller (CADF); Augmented Cross-Section Im, Pesaran and Shin (CIPS); Panel Analysis of Nonstationarity in Idiosyncratic and Common (PANIC); Augmented Sargan and Bhargava (CSB); and PANICCA (Yerdelen Tatoğlu, 2020b: 67-100).

Here, one of these tests, IPS panel unit root test is performed.

Table 10. Im, Pesaran and Shin's (IPS) Panel Unit Root Test Results

Variables	Test Level	Constant/ With Trend	Statistic Value of the Test	p value	Decision
LOGCPI	Level	Constant	-0.1789	0.4290	I(1)
	1st Diff.	Constant	-8.2251	0.0000	
FD	Level	Constant	-4.3700	0.1510	I(1)
	1st Diff.	Constant	-10.2179	0.0000	
LOGGDP	Level	Constant	0.8963	0.8150	I(1)
	1st Diff.	Constant	-5.5870	0.0000	
LOGMONEY	Level	Constant	-1.5405	0.0617	I(1)
	1st Diff.	Constant	-15.4885	0.0000	

Table 10 presents the IPS panel unit root test results. According to this result, it is seen that all variables are stationary at the 1st difference (I(1)).

3.3.8. Testing the Homogeneity of Slope Parameters

In order to test the Random Coefficients Model (RCM), the difference between the Ordinary Least Squares (OLS) estimators that ignore the panel structure of the data and the weighted average matrices of the WE can be considered. If no statistically significant difference exists between them, the parameters are homogeneous. The hypothesis to be tested would be established as follows;

$$H_0: \beta_i=\beta \tag{19}$$

This means that the parameters are homogeneous. Statistics in the Swamy S test, which was derived by Swamy (1971) and is a Hausman type, would be written as follows:

$$\hat{S} = X^2_{k(N-1)} = \sum_{i=1}^{N}\left(\hat{\beta}_i - \bar{\beta}^*\right)'\hat{V}_i^{-1}(\hat{\beta}_i - \bar{\beta}^*) \tag{20}$$

Here, $\hat{\beta}_i$ denotes the OLS estimators obtained from the regressions according to units, $\bar{\beta}^*$ represents the weighted WE estimator, and $\hat{V}_i$ indicates the difference between the variances of the two estimators. The test statistic exhibits a χ^2 distribution with K(N-1) degrees of freedom. The parameters are heterogeneous if the test statistic exceeds the critical value; whereas homogeneous if the test statistic is lower than the critical value (Yerdelen Tatoğlu, 2020b: 247). Table 11 presents the Swamy S homogeneity test results.

Table 11. Swamy S Homogeneity Test Results

Chi² Test statistic	**p value**
100.62	0.0000

Upon considering Table 11, according to the Swamy S test results, H_0 is rejected, it is accepted that the parameters are not homogeneous and tend to vary from unit to unit, and are heterogeneous.

3.4. Analysis of the Model

Upon examing the basic assumption tests, it is seen that autocorrelation problem exists for the unit effect; whereas heteroscedasticity and CSD exist for the unit and time effects. The Driscool and Kraay's (1998) estimator can accurately estimate the parameters using the pooled least squares method, under the assumptions that the error term is heteroscedastic, autocorrelated, and CSD. Furthermore, for fixed effects, Driscoll-Kraay has derived a AR(1) linear regression with residuals model, where residual first-order autocorrelation follows a regressive process (AR(1) correlation, which is the case with first-order autocorrelation) (Yerdelen Tatoğlu, 2018: 276, 279).

Accordingly, the result of Driscoll-Kraay's AR (1) linear regression with residuals model for Model (9) is presented in Table 12.

Table 11. Results of the Driscoll-Kraay's AR (1) Linear Regression with Residuals

$$LOGCPI_{it} = \alpha_{it} + \beta_{1it}\, FD_{it} + \beta_{2it}\, LOGGDP_{it} + \beta_{3it}\, LOGMONEY_{it} + u_{it}$$

Dependent Variable (LOGCPI**)**	**R-sq**	**F Test Value**	**Prob. Value (p)**
	0.5682	52.63	0.0000
Independent Variables	Coefficient	t Test Value	Prob. Value (p)
FD	-0.0217854	-1.55	0.124
LOGGDP	-0.5929577	-2.67	0.009
LOGMONEY	0.8188152	9.86	0.000

Upon examining Table 11, it is seen that the entire model and all independent variables of the model are statistically significant at the 5% level, according to the result of the p-value of the F test, which determines the significance of the overall model. Although LOGGDP variable positively affects economic growth, LOGMONEY variable negatively affects economic growth. A 1% increase in LOGGDP decreases the LOGCPI variable by about 0.6 units; whereas a 1% rise in LOGMONEY enhances LOGCPI by almost 0.82%. FD is not statistically significant. An rise in GDP reduces IR, whereas a rise in money supply increases IR.

CONCLUSION

In this study; the impacts of FD, GDP, and expansionary money supply on the IR were investigated for Colombia, Costa Rica, Mexico and Turkey, which are the OECD-member countries in the upper middle-income group, over the period 1990-2020. Since heteroscedasticity, autocorrelation, and CSD problems were detected as a result of the assumption tests, the Driscool and Kraay's (1998) estimator method was employed because it estimated the parameters correctly even if those problems were present. It was detected that the

FD did not have a statistically significant impact on the IR. It was found to be consistent with the findings of Karadeniz (2021), Olaniyi (2020), and Tiwari, Tiwari and Pandey (2012). According to this result, policymakers should pay attention to the money supply, which affects the inflation phenomenon, instead of considering the FD problem upon examining IR. The expansion in the money supply encourages both households and producers to consume more.

Future studies can be expanded by inclusion of different country groups and period, and even import and export data to be used as the independent variables.

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