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Deficit Financing, Money Supply and Inflation in Ethiopia

Tsegay Mebrahtu Gerezgiher[1], M. Prasada Rao[2]

[1]PhD Scholar at Andhra University

[1]Economics Professor at Andhra University

Abstract: ***This paper has examined the causal link among budget deficit financing, money supply (M2), and inflation, in Ethiopia using time series annual data over the period 1974/75 – 2013/14. In analyzing the data, cointegration approach under the framework of the vector error correction model was employed. The model has supported several statistical tests and hence it is robust. The study concluded that domestic sources of budget deficit financing and money supply (M2) growth were long term determinants of inflation. In the short run, in contrast, inflation inertia and local currency depreciationwere found the prime sources of inflation.The policy recommendations arising from the study are, intensify policies to achieve food security, boosting revenue generation through a comprehensive tax reform (expanding the tax base, improving tax administration and collection), improve the financial markets of the country and rely on it (as a sources of financing deficit) rather than on debt monetization and enhancing credibility and transparency of the national Bank of Ethiopia to curb inflationary expectations.***

Keywords: Ethiopia, budget deficit financing, Money Supply (M2), Inflation, Cointegration, Public spending

1. Introduction

It's common for governments in developing countries to use fiscal and monetary policy tools to achieve their desired objectives. In that process budget deficit policy and credit expansion are considered as an instrument to bring sound economic growth and such intervention is commonly happened when private and foreign investment becomes insufficient. In such economic environment budget deficit financing is the only option to mobilize resources.

Budget deficit financing, in simple words, means the way the gap between excess of government expenditure over its receipts is financed. Thus, budget deficit and deficit financing are two different concepts. Budget deficit is a narrower concept, referring to excess of public expenditure over current revenues. In developing countries, like Ethiopia, the dominant role of the public sector in stimulating and financing economic development makes budget deficit inevitable. In these countries the mounting public pressure to spend coupled with the inability of these countries to generate the required tax revenue due to poor tax collection mechanism and inefficient domestic financial markets have not only contributed to persistent budget deficits but also forced many developing countries to finance these deficits primarily through money creation thereby cause persistent inflation.

In economics literatures, the causal links among budget deficit, money supply and inflation has been empirically and theoretically open question. Thus, the causal link among budget deficit, money supply and inflation is a universal phenomenon and it is peculiar to every country in the world. On an empirical basis, the dynamic and long term interdependence among these variables has been explored extensively both in industrial and developing economies, thereby coming with mixed results.

In developing countries, aggressive public spending induced Economic growth is among the key macroeconomic objectives to be achieved. However, the methods of financing it may have serious repercussions to macroeconomic stability. This implies that budget deficit per se does not cause inflationary pressures rather it affects the price level through its impact on money supply and public expectations, which in turn trigger movements in prices. Furthermore, it is not only the mode of financing determines the long run impacts of budget deficit on inflation but also the way governments allocate such resources in the economy. This implies that fiscal deficit resulted from increased spending on productive public investments (like public schools and hospitals, transport, communication and power infrastructures) could improve the supply-side capacity of the economy thereby, promoting long-run growth. However, wasteful spending such as excessive government expenditure on purchasing expensive armaments, official travels and conferences might not contribute to economic growth and development in the long run, thereby causing inflation to persist.

The possible methods of financing budget deficit are printing money (monetization), running down of foreign reserves, borrowing (domestic and external) and privatization of public holds. An excessive use of any of these sources cause specific macroeconomic problem. Printing money (which in many economic literatures called inflation tax) may led to inflation, running down foreign reserves may led to exchange rate problems causing depreciation, external borrowing may led to external debt accumulation problem and excessive use of domestic borrowing may crowd out domestic investment.

In Ethiopia, persistent inflation, Deficit financing induced economic growth and money supply were not a big deal before 2003/04, but dismal economic growth, unemployment, absolute poverty and balance of payment were among the problems that persistently prevailed for centuries. After 2004, the existed inversely relationship

between inflation and economic growth has started to reverse. This sudden surge in inflation and its coincidence with the persistent and fast public spending driven economic growth was really puzzling to the country as a whole. In addition to this, growth of money supply persistently got overwhelmed over real GDP growth. This historically unprecedented surge in money supply growth (measured in M2) could be attributed to increase in credit claims by private sectors (credit expansion was triggered by negative real interest rate) and monetization of budget deficit.

A number of studies have been conducted on the issues related to this topic. This study, however, differs from these studies in different ways. Thus, in pursuing this study I was motivated by a number of reasons presented below. It covers a period which includes some of the most important economic, political and social transformations and hence the study used data of two different regimes.

From the methodological point of view, the study has employed an assumption free approach called vector error correction model (VECM). VECM strategy is a recent and unexploited approach. This approach has now become standard tool to explore dynamic causal relationships among integrated of order one, $I(1)$, variables. Thus, by identifying the short run and long run causal relationships among the variables of interest, it is expected to provide an additional piece of evidence on the growing body of literature on the topic.

2. Methodological Issues

This study has incorporated annual time series data that covered 40 years (1974/75 to 2013/14). In analyzing the data, the study has employed a vector error correction model.

A generalized unrestricted VAR modeling with a lag length p is defined as:

$$\mathbf{y_t} = \mathbf{v} + \mathbf{A_1 y_{t-1}} + \mathbf{A_2 y_{t-2}} + \cdots + \mathbf{A_p y_{t-p}} + \mathbf{e_t} \ldots\ldots\ldots (1)$$

Where, $yt$is a k * 1 random vector, the Ai are k * k fixed coefficient matrices, v is a k * 1 fixed vector of deterministic terms (constants structural dummies), and $\mathbf{e_t}$is a k * 1 white noise process. k indicates the number of endogenous variables in the model. The error terms (e_t) satisfy the classical assumptions.

The validity of the VECM model is ensured after checking necessary (unit root problem and cointegration) and sufficient (Exclusion and Weakly Exogenous Tests, Individual and Joint Causality Tests, VAR/VECMStability Tests) tests.

Unit Root Test

A stationary series fluctuates around a constant long-run mean and, this implies that the series has a finite variance which does not depend on time. On the other hand, non-stationary series (a series with unit root) have no tendency to return to a long-run deterministic path and the variances of the series are time-dependent.

In detecting unit root in each series, Phillips Perron test was employed. If the series contain a unit root, differencing and hence run OLS is the conventional solution. This action, however, would loss an important long-run information. As a remedial action, the cointegration test was carried out. It is possible for two (or more) variables to be $I(1)$, and yet a certain linear combination of those variables to be $I(0)$.If this is happened, then $I(1)$ variables are said to be co integrated. Cointegration refers to a long-run equilibrium relationship between variables. It implies that variables may wander away from each other in the short-run but move together in the long- run. If we find any cointegration relationships among the $I(1)$,VECM is considered the appropriate strategy and hence, restricts the long-run behavior of the endogenous variables to converge to their corresponding cointegrating relationships while allowing a wide range of short-run dynamics.

The starting point for Johansen procedure is the VECM representation of Ytgiven in Equation (1) above and reproduced here:

$$\Delta y_t = \Gamma_1 \Delta y_{t-1} + \Gamma_{\rho-1} \Delta y_{t-\rho+1} + \Pi y_{t-1} + \Phi D_t + \varepsilon_t \ldots (2)$$

$$\Delta y_t = \Gamma_1 \Delta y_{t-1} + \Gamma_{\rho-1} \Delta y_{t-\rho+1} + \alpha\beta' y_{t-1} + \Phi D_t + \varepsilon_t \ldots (3)$$

$\mathbf{y_t}$'s represents the log value of the variables ($logP, logDF, logMS\ and\ logEXR$) in the system. The$\Gamma_i$sare k * k fixed coefficient matrices, $P, DF, MS\ and\ EXR$ stands for inflation, deficit financing, money supply and exchange rate depreciation respectively.$This\ \alpha\beta' y_{t-1}$,contains all the long-run information on the process of cointegration. The rows ofβ' are interpreted as the distinct co-integrating coefficients and the rows of "α" shows the speed of adjustment of dependent variable towards its long-run equilibrium path. Negative and significant values of "α" close to zero imply slow convergence of the deviation to its long run counterpart. In contrast, the greater the co-efficient of the parameter, the higher the speed of adjustment of the model from the short-run to the long-run.

In determining the number of cointegrating equations, we employedJohansen tests. Johansen test gives two likelihood ratio tests.

$Maximum\ Eigenvalue\ test$:

$$H0: Rank(\Pi) = r, \quad Against\ Ha: Rank(\Pi) = r + 1$$

$Trace\ Test$:

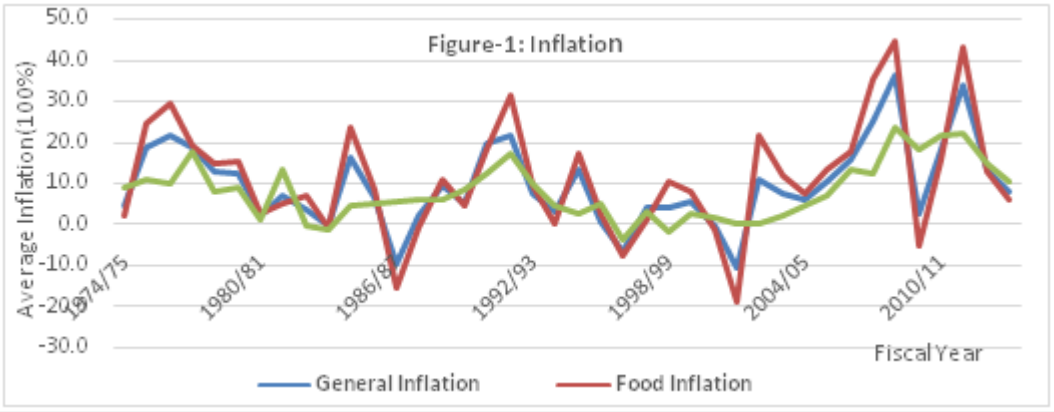
$$H0: Rank(\Pi) = r, \quad Against\ Ha: Rank(\Pi) > r$$

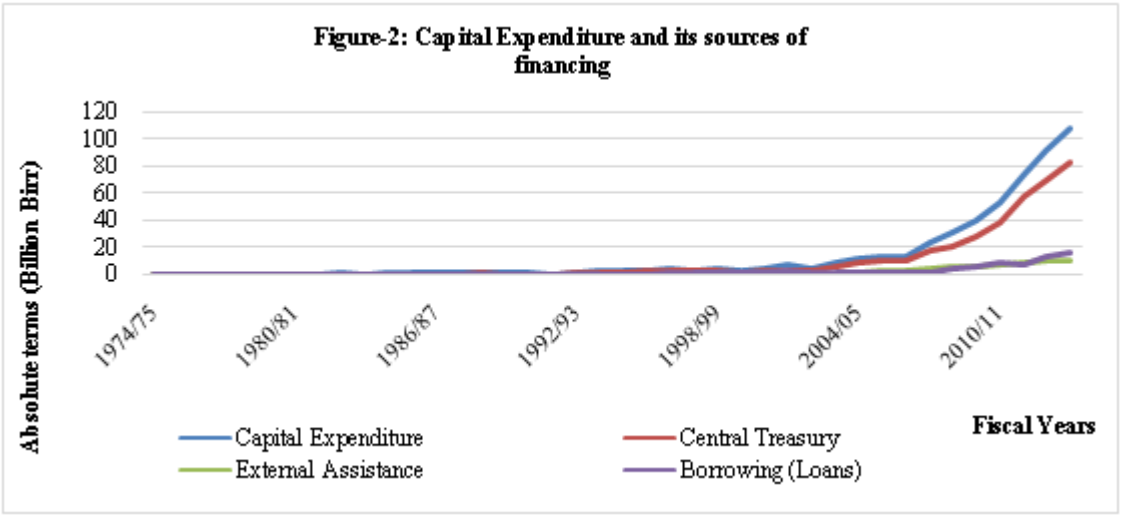
If the results of the two statistics is different, we will take the result of Trace statistics. This is because trace test has assumed high power than Maximum Eigen value test.

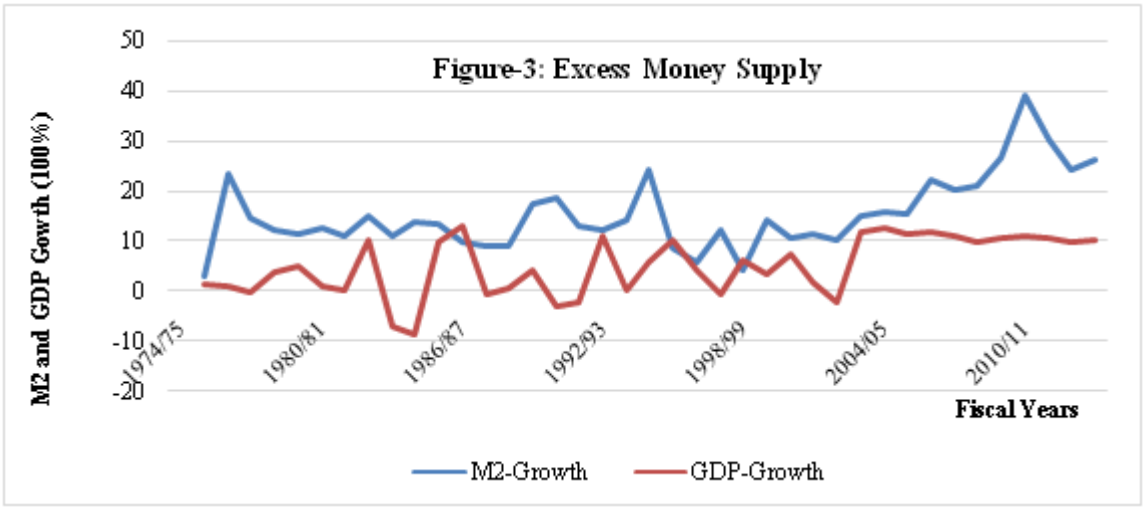
The above VECM model gives a convenient reformulation in terms of differences, lagged differences, and levels of the process. The interpretation of the estimates is more intuitive, as the coefficients can be naturally classified into short-run and long-run effects.

3. Trends of the Variables: Descriptive Summary

The trends of selected macroeconomic variables that employed in this paper are presented graphically in the following way. The trends of the variables of interest show that inflation, budget deficit financing, money supply (M2) growth, credit expansion and GDP growth had not been a great issue and hence remained relatively stable until 2002/03.From 2003/04 then on, however, the trends of the stated macroeconomic variables have shown an upward surge simultaneously.







Firmly speaking, trends in inflation has long been moved along with the growth of money supply (M2) and (budget deficit financing) driven economic growth signifying the possibility of a causal effect running from increase in deficit financing and money supply to price levels. The credible verdict about which caused which and which influenced more are all left to the econometric analysis, and presented as follows.

4. Model Estimation and Interpretation of Results

Before representing the VECM, two statistical properties from the series are required. These are nonstationary (integrated of oner one) and cointegration.

PP unit root test and its results (Variables are at level): **H0: Unit root (non stationary series); Ha: stationary**

Variable	PP (Drift), PP (Trend and Drift)						Decision: I(d)
	Test Statistic (Drift)	5% Critical value	P-value	Test Statistic(Drift & Trend)	5% Critical value	P-value	
$logP$	0.583	-2.961	0.9872	-0.545	-3.544	0.9816	I(1)
$logBD$	-1.106	-2.961	0.71	-4.765	-3.544	0.005	I(1)
$logMS$	4.152	-2.961	1.00	2.445	-3.544	1.00	I(1)
$logDF$	0.604	-2.961	0.98	-1.492	-3.544	0.832	I(1)
$logEXR$	0.621	-2.961	0.988	-1.908	-3.544	0.65	I(1)

All variables are non stationary at level. The next step would be pursuing unit roo test at first difference.

H0: Unit root (non stationary series); Ha: stationary (no unit root problem)

Variable	PP (Drift), PP (Trend and Drift)						Decision: I(d)
	Test Statistic (Drift)	5% Critical value	P-value	Test Statistic (Drift & Trend)	5% Critical value	P-value	
$\Delta logP$	-3.896	-2.964	0.0021*	-3.893	-3.548	0.0124	I(0)
$\Delta logBD$	-10.722	-2.964	0.000*	-10.664	-3.548	0.000	I(0)
$\Delta logMS$	-3.405	-2.964	0.0108*	-4.013	-3.548	0.0084	I(0)
$\Delta logDF$	-5.813	-2.964	0.0000*	-5.897	-3.548	0.000	I(0)
$\Delta logEXR$	-3.750	-2.964	0.0035*	-3.785	-3.548	0.0174	I(0)

At fisrt difference, all series revealed stationarity, thereby rejecting the H0.

Johansen Cointegration Rank Test (both Trace and Max-Eigen Statistic)

Maximum Rank (r)	Trace Statistic Tests			Max-Eigen Test		
	Eigen Value	Trace Statistic	5% Critical Value	Eigen Value	Max- Eigen Statistic	5% Critical value
None	-	59.7671	47.21		30.8134	27.07
$r = 1$	0.55553	28.9537*	29.68	0.48426	15.2813*	20.97
$1 = 2$	0.33111	13.6724	15.41	0.34566	10.7734	14.07
$r = 3$	0.24687	2.8989	3.76	0.17553	2.8989	3.76

Note that Asterisk (*) indicates the number of cointegrating equation.

The Johansen test revealed only one cointegrating equation and the long run equation is derived from the following table.

Ho: Coefficients are statistically insignificant

Variables	Coefficient	Std. Error	P - Value
ECM	-0.3629894	0.0838738	0.000*
$logP$	$(\beta_0) = 1$	-	-
$logMS$	$(\beta_1) = -0.21$	0.0811425	0.010*
$logDF$	$(\beta_2) = -0.26$	0.0680154	0.000*
$logEXR$	$(\beta_2) = 0.014$	0.0792283	0.863
Constant	7.63	-	-

Note that Asterisk (*) indicated rejection of null hypothesis

The full VECM of inflation is given as

$$\Delta lnP = 0.41\Delta logP_{-1} + 0.12\Delta logDF_{-1} + 0.56\Delta logMS_{-1} + 0.3\Delta logEXR_{-1} - 0.36ECM + \varepsilon_i \ldots \quad (4)$$

This grand equation consists the dynamics (short run) along with long run inflation equations and the speed of adjustment. The long run inflation equation can be presented separately as follows.

$$\text{LogP} = 0.26\text{LogDF} + 0.21\text{LogMS} \ldots\ldots\ldots\ldots\ldots (5)$$

The coefficientswould provide economically and statistically significant information, if the model passes two important tests. These are weakly exogenous test and variable exclusion test. The following two tables reflect the tests accordingly.

Weakly Exogenous Test: zero Restriction to adjustment coefficients.

Variable	Chi-sq.(chi^2)	P-value	Decision
$logP$	18.72991	0.0000*	Reject: Endogenous
$logMS$	3.902665	0.0582	Accept: Weakly Exogenous
$logDF$	2.474753	0.1157	Accept: Weakly Exogenous
$logEXR$	9.672335	0.0019	Accept: Weakly Exogenous (albeit insignificant cointegrating coefficient)

Note that Asterisk (*) indicated rejection of null hypothesis. Thus, all the right hand side variables are weakly exogenous whereas the left hand side variable (CPI Inflation) is endogenous.

Exclusion Tests, LR $\sim X^2(r)$; Ho: Relevant Variable has excluded

Lag	chi$^2(X^2)$	df	$Prob >$ chi$^2(X^2)$
1	33.84238	4	0.000*
2	13.7015	4	0.000*

Note that Asterisk (*) indicated rejection of null hypothesis implying that no other relevant variable in model was excluded.

The above long run inflation equation satisfies the two necessary (weakly exogenous, exclusion and weakly stationary) tests and hence the model is robust. Thus, we could interpret (economically) the coefficients of weakly exogenous variables.

The coefficient of money supply (0.21) suggested that a one percent increase in the M2 supply induced, on average, an increase of 0.21 percentin inflation. The response of long run inflation to domestic sources of deficit financing was measured by the coefficient of $logDF$ (0.26) and indicated that a one percent rise in domestic sources of financing deficit approximately increased the general price of goods and services by 0.26 percent. It need to bear in our mind that, the money market is the dominant part of the financial sector in a least developed economy like Ethiopia, where the market for bonds and equity is almost non-existent. Money market involves dealings in notes, bank deposits, interbank loans and treasury bills. In Ethiopia, treasury bills has constituted the lion share in financing capital expenditures.Apparently, during a fiscal distress, the government may finance its deficit through direct advance to National Bank of Ethiopia,thereby leading to inflationary economy.

Another interesting result of the system is that the coefficient of ECM was negative (-0.363) and significant. This implies that there has been significant inflation disequilibrium in the short run. The coefficient measures the rate at whichthe gap between short run dynamics and long run equilibrium is narrowed. 36.3 percent of the gap is adjusted in each year to its long run equilibrium path, and hence the gap minimizes each year.

Short run Inflation Analysis

We can now model changes in inflation in a responses to departures from the specific stationary linear combinations of the I (1) variables, augmented by short-run dynamics from the last year (lag 1) first differences of the each variables.The short-run dynamics of inflation was positively and strongly affected by its preceding prices (inertia), changes in money supply and exchange rate depreciation. The short run (that portrays the dynamics) inflation was derived from the following table.

The parsimonious error correction model (ECM): Dependent Variable: ΔlnP

Variable	Coefficient	Std. Err.	t-Statistic	P-Value
ΔlnP_{-1}	0.4149879	0.1442817	2.88	0.004*
$\Delta lnDF_{-1}$	-0.1389933	0.0424365	-3.28	0.001*
$\Delta lnMS_{-1}$	0.5752696	0.2138163	2.69	0.007*
$\Delta lnEXR_{-1}$	0.3043749	0.1008198	3.02	0.003*
ECM	-0.3629894	0.0838738	-4.33	0.000*
Cons	0.0379277	0.028176	1.35	0.178

$$R^2 = 0.7732$$

$$\chi^2 = 109.0847\ ;\ p > \chi^2 = 0.0000$$

$$ECM: \chi^2 = 835.6081\ ;\ p > \chi^2 = 0.0000$$

$$\Delta lnP = 0.41\Delta logP_{-1} - 0.14\Delta logDF_{-1} + 0.56\Delta logMS_{-1} + 0.3\Delta logEXR_{-1} - 0.36ECM + \varepsilon_i \ldots . (6)$$

The model satisfied all the classical assumptions. The statistics of coefficient of determination which measures the goodness of fit of the model in this model was 77.32 percent, which is desirable result.

From the above general equation, the augmented values obtained from the last year first differences of the each variables indicates the short run dynamics of inflation. Therefore, inflation inertia and exchange rate depreciation, with their respective coefficients 0.41 and 0.3 respectively, were found short run determinants of inflation.

5. Concluding Remarks

The trends of the variables used in model have given a brief insight that inflation, deficit financing induced GDP growth, money supply (M2) and credit claimed by private sector had not been a great issue and remained relatively stable until 2002/03. From 2003/04 onwards, however, the trends of these macroeconomic variables have shown an unprecedented upward surge simultaneously. Thus, inflation has been trending up along with growth of money supply (M2) and deficit financing induced GDP growth and hence signifying the possibility of a joint causal effects running from growth in the money supply and deficit financing induced growth to general price levels.

From the long run inflation equation, we found that domestic sources of financing budget deficit (particularly treasury bills) and money supply (M2) were the factors behind the inflationary pressures in Ethiopia. Exchange rate depreciation and inflation inertia, in contrast, were provento be short run determinants of inflation.Based on the findings of the analyses, the study suggests the following policy implications:

- A credible and sustained fiscal adjustment, aiming to boost revenue generation can reduce fiscal deficit. From public finance perspective, therefore, a comprehensive tax reform (expanding the tax base, designing an inflation-proof tax system, and improving tax administration and collection), rationalization of public spending, and privatization of lossmaking state enterprises are crucial in establishing fiscal policy credibility.
- To handle inflation inertia, it is profoundly necessary to enhance credibility and transparency of the national Bank of Ethiopia and improve its institutional ability to curb inflationary expectations more effectively. In this regard the national bank should be fully independent.
- To catch the money supply growth,the government should launch policies that certainly boost the production of real goods in order to meet both domestic demand and exports, thereby improving trade balance in the long run. Policy makers need to ascertain the liquidity needs of the economy, thereby creating greater certainty in the amount of credit and money to be supplied to achieve macroeconomic objectives.
- The government should do its level best to improve the financial markets of the country and rely on it (as a sources of financing deficit) rather than on debt monetization. This implies debt (monetary) monetization are more inflationary than financial markets relied sources of financing deficit. To make monetary policy more effective, the functioning of the financial sector should be improved. Above all, it requires a strong arrangement to

be made for Ethiopian National Bank to be independence with complete autonomy.

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