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Research Article

The Impact of Capital Expenditure on Ethiopian Economic Growth

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Abstract

This study investigates the effect of disaggregated capital expenditure on economic growth in Ethiopia over the period from 1981 to 2021. An autoregressive distributed lag (ARDL) model, combined with a Granger causality test, is used for the econometric analysis. The empirical results reveal that capital expenditure on economic development (CAEE), recurrent expenditure (RCE), and the inflation rate (CPI) have significant positive impacts on economic growth in both the long run and short run. However, capital expenditure on administrative and general development (CEAG) has a significant negative effect on economic growth in the long run. The Granger causality test further indicates unidirectional causality from economic growth (GNI) to capital expenditure on economic development (CAEE). Based on these findings, the study recommends that the Ministry of Finance should increase its budget allocations for capital expenditures aimed at economic development in order to further stimulate economic growth. Additionally, the government should implement stricter follow-up and monitoring mechanisms to ensure the proper management of budget allocations, particularly regarding capital expenditures on social development and administrative and general development. These measures are crucial for sustaining long-term economic growth in Ethiopia.

Keywords

Capital Expenditure, GNI, CAEE, CES, CEAG, ARDL

1. Introduction

Economic growth is one of the most important macroeconomic variables, reflecting the overall performance of a society. It results from the production of more goods and services, which requires improvements in productivity and growth in the labor supply. Productive growth involves a combination of a more educated and efficient workforce, increased private physical capital (such as plants and equipment), greater use of modern technology, expanded public infrastructure (such as roads and utilities), efficient markets for setting prices, and the rule of law to enforce contracts. To ensure well-functioning markets and stimulate economic growth, the government must expend resources to enforce contracts, maintain national security, protect against criminal activity, and provide valuable public goods [12].

A nation's economic goals typically include achieving high levels of output, full employment, price stability, fair income distribution, and strong international relations. A government uses different policy instruments to achieve the goals of a nation. Fiscal and monetary policies are the two major tools available to policymakers to change the level of economic variables [4]. This study focuses on fiscal policies, specifically government expenditure, which is the expense incurred

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by a government for the maintenance of itself as well as the provision of goods and services to promote economic growth and improve the welfare of the people in society. Through the provision of social amenities, the government reaches out to its citizens, enabling them to make a living and, thus, enhancing the growth of the economy [1].

Economists have different views about the role of government in economic activities. Endogenous growth models sates that only productive government expenditures will positively affect the long-run growth rate [5]. Neoclassical economists believe that reducing the role of the private sector through a crowding out effect is important because it lowers inflation; an increase in public debt raises interest rates, which lowers inflation and output. The new Keynesians present the multiplier effect in response and argue that the increase in government expenditure will increase demand and thus increase economic growth.

1.1. Statement of the Problem

The goal of ensuring sustainable development and reducing mass poverty is central to the development strategies of most developing countries. Abandoning growth as a key objective would be a tragic mistake, as it would condemn a substantial proportion of the population in developing countries to a life of poverty, even if accompanied by full employment, stable prices, and equitable income distribution. Only growth can create, if not certainty, at least the option of a more comfortable life for the masses [8].

The relationship between government expenditure and economic growth has continued to generate a series of controversies. Some researchers argue that the effect of government expenditure on economic growth is insignificant [2, 14], while others indicate that the effect is positive and significant [9, 16]. Others also concluded that government spending has no significant impact on economic growth [17, 18].

Previous research in this study area in Ethiopia was very general, which means that the researchers did not examine disaggregated capital expenditures, but government expenditure in aggregate. This study is designed to address the impact of capital expenditure (disaggregated) on economic growth in Ethiopia by examining the composition of capital expenditure on economic development, social development, and administrative and general development within the study period from 1981 to 2021.

1.2. Objectives of the Study

The main objective of the study is to investigate the impacts of capital expenditure on economic growth in Ethiopia. More specifically, the study has the following objectives to:

1. Analyze the long run impact of disaggregated capital expenditure on the Ethiopian economic growth.
2. Investigate the short run effect of disaggregated capital expenditure on the Ethiopian economic growth.
3. Investigate whether there is causality between disaggregated capital expenditure and Ethiopian economic growth.

1.3. Research Questions

To launch a valid argument and corroborate necessary facts concerning the objectives of the study, the following research questions were proposed:

1. Which category of capital expenditure significantly affects economic growth in the long run?
2. Which category of capital expenditure significantly affects economic growth in the short run?
3. Is there a causal relationship between disaggregated capital spending and economic growth?

1.4. Significance of the Study

The benefits of this study are that it incorporates the most recent data and employs more advanced econometric techniques such as autoregressive distributed lag (ARDL), bounds testing approach to co-integration, and the Granger causality test to evaluate causation with data spanning from 1981 to 2021, so it can be used as a literature review by students and academic researchers for future related area studies. This study helps the Ministry of Finance to focus on budgets that contribute to economic enhancement and to revise policies regarding government spending. It also assists financiers in determining where to invest by providing information on the government's spending priorities.

1.5. Scope of the Study

The conceptual scope of this study is to analyze the effects of disaggregated capital expenditure on the Ethiopian economy. Economic growth was treated as a dependent variable, and capital expenditure on economic development, capital expenditure on social development, capital expenditure on administrative & general development, recurrent expenditure, and inflation rate are independent variables. The period covered in this study is from 1981 to 2021. The researcher used models such as the autoregressive distributive lag (ARDL) model and the bound co-integration test to investigate long-run & short-run impact of explanatory variable on dependent variable.

1.6. Organization of the Study

The first chapter is an introduction, in which the background of the study, the statement of the problem, the objective of the study, the research questions, the significance of the study, and the scope of the study are explained. In the second chapter, related theoretical and empirical literatures are summarized. The third chapter contains data types and

sources, the methodology used in the study, and the estimation techniques used, which are described in detail. In the fourth chapter, econometric analysis and diagnostic tests are conducted. In the last chapter, conclusions and policy implications are presented.

2. Method of Data Analysis

After collecting data from various sources, the researcher employed descriptive statistics and econometric analysis to present the findings. The statistical software Eviews 9 was used to analyze the data. Autoregressive distributed lag (ARDL), the bounds testing approach to co-integration, and the Granger causality test to evaluate the causality of the dependent and independent variables were applied. An autoregressive distributed lag (ARDL) testing approach was introduced to investigate the existence of co-integration relationships among variables [13]. It has several advantages:

1. In small samples of data, the ARDL model is the more statistically significant approach to find the co-integration relationship [13].
2. It can be applied whether the regression is purely order zero I (0), purely order one I (1), or a mixture of both. The ARDL approach avoids the pretesting problems associated with standard co-integration, which requires that the variables be already classified into I (0) or (1), or mixture of both.
3. In the ARDL approach, it is possible that different variables have different optimal numbers of lags.
4. The bound testing approach also has the advantage of deciding the long run and short run parameters of the model in equations at the same time. Lastly, by applying the ARDL technique, it can obtain unbiased and efficient estimators of the model.

Model Specification

Economist Paul Douglas and mathematician Charles Cobb developed the Cobb-Douglas production function which is commonly used in both macroeconomic and microeconomic models because it has several convenient and realistic properties. The Cobb-Douglas production function with constant returns to scale was used as a starting point to build model.

$$Y = f\left(AK^{\alpha}, L^{\beta}\right), \alpha + \beta = 1 \quad (1)$$

where Y = total output, K = capital used in production, L = total number of workers involved in production, and A = a positive constant number used to show the change in output that is not caused by the main production factors, α and β are the output elasticity's of capital and labor respectively.

Capital expenditure is divided into three categories to account for the effects of capital expenditure on economic growth: capital expenditure on economic development, capital expenditure on social development, and capital expenditure on administrative & general development. In general, the variables included in the model are gross national income per capita, capital expenditure on economic development, capital expenditure on social development, capital expenditure on administration & general development, recurrent expenditure, and consumer price index. Therefore, the models to be estimated in the study are specified as follows:

$$GNI = f(Capital\ \ expenditure\ \ , Recurrent\ \ expenditure, Consumer\ \ price\ \ index) \quad (2)$$

$$GNI = f(CAEE, CES, CEAG, RCE, CPI) \quad (3)$$

The above equation is converted into regression form as follows:

$$GNI_t = \ \beta_0 + \beta_1 CAEE_t + \beta_2 CES_t + \beta_3 CEAG_t + \beta_4 RCE_t + \ \beta_5 CPI_t + \varepsilon_t \quad (4)$$

GNI stands for Gross income per capita

CAEE stands for Capital Expenditure on Economic Development

CES stands for Capital Expenditure on Social Development

CEAG stands for Capital Expenditure on Administrative & General Development

RCE stands for recurrent expenditure

CPI stands for Consumer price index

β_1, β_2, β_3, β_4, and β_5 are the slopes of the regression line concerning each variable when other variables are kept constant and ε_t is the white noise residual.

The general ARDL model is written as follows: -

$$\Delta LNGNI_t = \ \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta LNGNI_{t-1} + \ \sum_{i=1}^{n} \alpha_2 \Delta LNCAEE_{t-1} + \sum_{i=1}^{n} \alpha_3 \Delta LNCES_{t-1} + \sum_{i=1}^{n} \alpha_4 \Delta LNCEAG_{t-1} + \sum_{i=1}^{n} \alpha_5 \Delta LNRCE_{t-1} + \sum_{i=1}^{n} \alpha_6 \Delta CPI_{t-1} + \ \beta_1 LNGNI_{t-1} + \ \beta_2 LNCAEE_{t-1} + \beta_3 \mathrm{LN}CES_{t-1} + \beta_4 LNCEAG_{t-1} + \beta_5 LNRCE_{t-1} + \beta_6 CPI_{t-1} + \varepsilon_t \quad (5)$$

Where, Δ denotes the first difference operator for short run, ε_t is the white noise residual, t is a linear trend or time. The left-hand side of the equation is the gross national income per capita and the first six coefficients ($\alpha_1 - \ \alpha_6$) on the right-hand side correspond to coefficients of variables on the short run. The remaining coefficients ($\beta_1 - \ \beta_6$) corresponds to coefficients of variables in the long run.

All variables are in natural logarithm form except consumer price index (CPI). Log transformation can help with heteroscedasticity by compressing the scale on which they are

measured, reducing a tenfold difference in two values to a twofold difference [7]. It is worth noting that the model is multiplicative, with all parameter coefficients corresponding to constant elasticity.

The ECM is used to estimate both short-run and long-run effects of one time series on other variables and to know at what percentage the disequilibrium in the short run will be corrected in the long run. The equation for ECM is as follows:

$$\Delta LNGNI_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta LNGNI_{t-1} + \sum_{i=1}^{n} \alpha_2 \Delta LNCAEE_{t-1} + \sum_{i=1}^{n} \alpha_3 \Delta LNCES_{t-1} + \sum_{i=1}^{n} \alpha_4 \Delta LNCEAG_{t-1} + \sum_{i=1}^{n} \alpha_5 \Delta LNRCE_{t-1} + \sum_{i=1}^{n} \alpha_6 \Delta CPI_{t-1} + \theta ECM_{t-1} + \varepsilon_t \quad (6)$$

Where; Δ is the first difference operator, ε_t is the white noise residual, and θ is the coefficients of error correction model (ECM); which measure the speed of adjustment to the long-run equilibrium after any convulsion in the short run.

3. Empirical Results and Interpretation

3.1. Unit Root

A stationary series can be defined as one with a constant mean, constant variance, and constant auto covariance for each given lag, and the value of the covariance between the two time periods depends only on the distance or lag between the two time periods, not on the time at which the covariance is calculated [7]. Otherwise, it is a non-stationary time series variable. An integrated of order d time series is a non-stationary time series that must be differed d times to become stationary. The order of integration refers to the number of unit roots in the series or the number of differencing operations it takes to make a variable stationary.

If the dependent variable is a function of non-stationary variables, the regression will produce spurious results (a nonsense regression) [6]. Even though the trending variables are completely unrelated, it is likely that significant t-ratios were obtained. Thus, to avoid the problem of spurious regression, it is necessary to test for stationary time series variables before running any sort of regression analysis. There are several tests for stationarity, including the Dickey-Fuller (DF) and Phillips-Perron (PPT) tests, as well as the augmented Dickey-Fuller (ADF) used in this paper.

The hypothesis used to test the unit root was stated as follows:

H0 = There is a unit root (non-stationary)

H1 = No unit root exists (stationary)

If the calculated statistic (in absolute terms) is less than the MacKinnon (1991, 1996) critical values, the null hypothesis is accepted and there is a unit root in the series. In other words, it means the time series is not stationary. The opposite is true when the calculated statistic is greater than the MacKinnon critical value.

The unit root test performed under ADF tests shows that the variables are stationary at different levels of stationarity. For example, variable LNGNI, LNCAEE, LNCES LNRCE, and CPI are stationary at 1st difference with 5 percent significance level, while LNCEAG is stationary at level with 5 percent significance level.

3.2. Lag Length Selection Criteria

Prior to the co-integration test, the maximum lag length k was chosen by the unrestricted VAR model to decide the optimal lag length that should be included in the model. The optimal lag length is found with the sequential modified Likelihood Ratio test statistics (LR), the Akaiki information criteria (AIC), Schwarz information criteria (SIC), Bayesian information criteria (BIC), the final prediction error (FPE), and the Hannan-Quinn information criteria (HQ). Based on the test result, Akaiki Information Criteria (AIC) at a 5% significance level was chosen, with the model having a maximum lag length of two.

3.3. Co-Integration Test

Time series variables that are not stationary may have some linear combination of them that is stationary. In such a case, the variables are said to be co-integrated. This implies that there is a long-run relationship among the non-stationary variables. If the tests for stationarity reveal that some of the variables are not stationary, there is a need to conduct a co-integration test. The presence of long-run correlations among the variables is investigated using the Pesaran approach [13]. The F-test was used to do bound test. The F-test compares the existence or absence of co-integration among the variables to the hypothesis of no co-integration among the variables. The Wald-test (F-statistic) is the foundation of the ARDL bound test. The lower bound critical values assumed the explanatory variables were integrated of order zero, or I (0), while the upper bound critical values assumed they were integrated of order one, or I (1) [13]. Therefore, if the computed F-statistic is greater than the upper critical bounds, the null hypothesis should be rejected, shows that there is a long-run relationship between the selected variables. If the calculated F-statistic is below the lower critical bounds, the null hypothesis cannot be rejected, and there is no long-run relationship between them. On the other hand, if the computed F-statistic falls inside the critical value bounds, the test is inconclusive unless it is unknown the order of integration of the underlying variables. Subsequently performing the bound test, if the existence of a long-run relationship among the variables in the model is confirmed, then, with the error terms obtained from the long-run equation, the short-run equation among the variables is estimated through the ARDL method developed by [13]. The hypothesis of the bound test is stated

as follows.

HO: No long run relationship

H1: Ho is not true

Decision rule: Reject HO, if F-statistic > I (1)

According to the bounds test result, the calculated F-statistic which is 10.242955 above the upper critical bound values (higher than at 90%, 95%, 97.5% and 99% upper bounds), which means that; the model rejects the null hypothesis of "No Long run relationship" and this implies that there is co-integration between the variables.

3.4. Long-run Estimation Coefficients

The long run estimation output reveals that capital expenditure on economic development (CAEE) has a positive significant effect on economic growth (GNI) at the 5 percent significance level. This complies with the prior expectation; a positive relationship was expected between the two variables. It proves that increasing capital expenditure for economic development by one percent; increases economic growth by 47 percent. Capital expenditure on administrative & general development (CEAG) has a negative and significant contribution to economic growth as excepted. It implies that when capital expenditure on administrative & general development increases by one percent; economic growth decreases by 15 percent, at ceteris paribus.

Recurrent expenditure (RCE) also has a positive & statistically substantial impact on economic growth; thus, when recurrent expenditure increases by 1 percent, economic growth increases by 27.7 percent. This is in line with Kryeziu et al. result [11]. They examined the impact of government expenditure on Nigeria's and Ghana's economic growth respectively, and they both confirmed that recurrent expenditure had a positive impact on their respective country's economic growth. The result also shows that inflation rate has a positive and significant contribution to economic growth as expected and which is supported by previous researchers [10, 15].

Adjusted R-squared is 0.998593, meaning that a total of 99% of economic growth is explained by the explanatory variables, while the remaining 1% is explained by variables outside the model. F-statistics test the overall significance of the model under study. F-calculated is compared with F-tabulated; when F-Cal is greater than F-tab, reject the null hypothesis (H_0) and conclude that the variable is statistically significant in explaining the dependent variable. According to the table, F-statistics is 3954.858 and Prob (F-statistic) is 0.000000. In this case reject the null hypothesis and accept the alternative hypothesis. This is because it is greater than the critical value or the tabulated value. Thus, it implies that the model is statistically significant. In other words, the explanatory variables considered together play a significant role in explaining variation in the dependent variable.

Durbin–Watson statistic is used to test the presence of autocorrelation (a relationship between values separated from each other by a given time lag), which shows whether there is serial correlation in the model. If there is serial correlation in the model, it therefore implies that the model has lost its predictive power. The value of DW always lies between 0 and 4. If $d = 2$ indicates no autocorrelation, $d < 2$ indicates positive serial correlation, $d > 2$ indicates negative serial correlation in general, if d is less than 1.5 or greater than 2.5 then there is potentially a serious autocorrelation problem. Otherwise, if d is between 1.5 and 2.5 then autocorrelation is likely not a cause for concern. The DW statistic is given as 2.083371 and shows that the model is free from autocorrelation.

Table 1. *Long-run estimation coefficients.*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCAEE	0.4692	0.0882	5.3189	0.0000**
LNCES	-0.0497	0.0893	-0.5563	0.5821
LNCEAG	-0.1512	0.0710	-2.1282	0.0416*
LNRCE	0.2775	0.1211	2.2915	0.0291*
CPI	0.6884	0.1155	5.9560	0.0000**
Constant	-7.6110	1.6237	-4.6872	0.0001**

R-squared	0.9988	Mean dependent var	7.5543
Adjusted R-squared	0.9985	S.D. dependent var	1.4093
S.E. of regression	0.0528	Akaike info criterion	-2.8651
Sum squared resid	0.0894	Schwarz criterion	-2.5273
Log likelihood	65.303	Hannan-Quinn criter.	-2.7430

F-statistic	3954.8	Durbin-Watson stat	2.0833
Prob(F-statistic)	0.0000		

Source: Author's Computation using EViews 9 software

3.5. Short-run Estimation Coefficients

The goal of running the error correction model is to estimate both short-term and long-term effects of one time series variable on other variables and to know at what percentage the disequilibrium in the short run will be corrected in the long run. The coefficient of the short run error correction model, denoted by CointEq (-1) in the short run estimation result, is -0.467260, which is negative, less than one, and significant at the selected level of significance, as expected. If ECM is negative and statistically significant, the variables are co-integrated in the long run [3]. This indicates that 46.7 percent of the previous year's disequilibrium is adjusted in the current year (Table 2). Short-run disequilibrium and inconsistencies are adjusted and corrected in the long run at a rate of 46.7 percent.

The shot-run estimation result reveals that capital expenditure on economic development (CAEE) has a positive and notable influence on economic growth at a 5% significance level. Increasing one percent of capital expenditure on economic development increases economic growth at 21.9 percent in short run. Increasing one percent in recurrent expenditure increases economic growth at 13 percent. It also reveals that one unit increment in annual inflation rate increases economic growth at 32 percent. The other two variables (capital expenditure on social development, capital expenditure on administrative and general development) have a negative but non-significant effect on economic growth.

Table 2. *Short-run estimation coefficients.*

Cointegrating Form				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(LNCAEE)	0.2192	0.0566	3.8692	0.0005
D(LNCES)	-0.0232	0.0436	-0.5320	0.5986
D(LNCEAG)	-0.0236	0.0200	-1.1797	0.2474
D(LNCEAG(-1))	0.0306	0.0194	1.5717	0.1265
D(LNRCE)	0.1296	0.0622	2.0847	0.0457
D(CPI)	0.3216	0.0674	4.7715	0.0000
CointEq(-1)	-0.4672	0.0767	-6.0878	0.0000
Cointeq = LNGNI - (0.4693*LNCAEE - 0.0497*LNCES - 0.1512*LNCEAG + 0.2775*LNRCE + 0.6885*CPI - 7.6110)				

Source: Author's Computation using EViews 9 software

4. Conclusion and Policy Implication

4.1. Conclusion

This study investigates the impact of disaggregated capital expenditure on Ethiopian economic growth, using the auto regressive distributed lag (ARDL) model for data covered over the period 1981-2021. Thus, the long-run and short-run estimation coefficients as well as the associated per-and post-diagnostic tests are conducted. Specifically, the long-run empirical estimation results show that capital expenditure on economic development has a significant positive effect on economic growth. It proves that increasing by 1 percent capital expenditure on economic development increases economic growth by 47 percent. However, capital expenditure on administration & general development has a negative and significant contribution to economic growth. Regarding, the short run estimation, capital expenditure on economic development has a positive and substantial impact on economic growth. The result also reveals that recurrent expenditure and

inflation rate has a positive and notable influence on economic growth. Recurrent expenditure also has a positive statistically notable influence on economic growth. In addition, capital expenditure on social development has a negative and insignificant effect on economic growth. Lastly, inflation rate has a positive and statistically notable influence on economic growth. To achieve economic growth; a nation has to create more jobs by investing new technologies or expanding their operations. They hire more workers to operate those technologies, which leads to more people having money to spend & brings inflation. Expansionary fiscal and monetary policies that government take to bring a healthy economic level, which is needed during the contractionary phase of the business cycle leads to inflation in short-run.

Last but not least, the pairwise Granger causality test was taken, and it shows that economic growth causes capital expenditure in economic development. Capital expenditure on social development causes capital expenditure on economic development and capital expenditure on administrative & general development. Capital expenditure on economic development granger causes capital expenditure on administrative & general development.

4.2. Policy Implication

The findings of the study reveal that capital expenditure on economic development, recurrent expenditure and inflation rate has a positive and significant contribution to economic growth in both long run and short run. Capital expenditure on administrative & general development has a negative and notable influence in long run. Thus, on these bases, the following recommendations are forwarded to concerned bodies:

The minister of finance is recommended to increase the budget for capital expenditure, especially capital expenditure on economic development, which boosts economic growth.
The Ethiopian government spends billions of birr on capital expenditure for social development and capital expenditure on administration and general development. However, it did not make a satisfactory contribution to economic growth. Therefore, it needs continuous monitoring to ensure that the allocated budget is used for its intended purpose.

Abbreviations

ADF	Augmented Dickey-Fuller
ARDL	Auto Regressive Distributed Lag
CAEE	Capital Expenditure on Economic Development
CES	Capital Expenditure on Social Development
CEAG	Capital Expenditure on Administrative & General Development
COVID-19	Corona Vires Disease Which Spread Since End of 2019
ECM	Error Correction Model
EPRDF	Ethiopian People's Revolutionary Democratic Front
FDI	Foreign Direct Investment
FDRE	Federal Democratic Republic of Ethiopia
GDP	Gross Domestic Product
GNI	Gross National Income
LR	Long Run
MOFEC	Ministry of Finance and Economic Cooperation
NBE	National Bank of Ethiopia
RGDP	Real Gross Domestic Product
SR	Short Run
VECM	Vector Error Correction Model

Author Contributions

Wondimu Mekonnen is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The author declares no conflicts of Interest.

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