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Indonesia's Capital Expenditure and Economic Growth 1990-2020: Role of Accountability

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ABSTRACT

This study examines the empirical relationship between capital expenditures and economic growth. It examines whether capital expenditures and accountability complement each other to encourage Indonesia's economic growth throughout 1990-2020. Using the autoregressive distributed lag (ARDL) bounds test, this study finds a cointegrated relationship between capital expenditure and economic growth in Indonesia during this period. In particular, capital expenditures have a negative impact on long-term growth. However, it is interesting that government capital expenditure with accountability shows a positive and significant effect on long-term growth. This demonstrates the importance of government accountability in managing government capital expenditures. This study implies that the government needs to increase accountability for the capital expenditures that have been realized to provide optimal benefits for Indonesia's economy in the long term.

KEYWORDS:
Capital expenditure; economic growth; accountability; ARDL; long-term growth

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INTRODUCTION

The neoclassical economic growth literature (Solow, 1956) and the endogenous growth literature as pioneered by (Lucas, 1988; Romer, 1986) emphasize the importance of investment as the main driver of a country's economic growth. Theories that emphasize the importance of investment in economic development are known collectively as "capital fundamentalism" (King & Levine, 1994). King and Levine (1994) characterize capital fundamentalism as the belief that the rate of accumulation of physical capital is an important determinant of economic growth.

In previous studies, discussions on the impact of investment on a country's economic growth have generally focused on the role of private investment. However, recently, policymakers have increasingly viewed the importance of public investment as one of the drivers of long-term economic growth. According to Miyamoto, Baum, Gueorguiev, Honda, and Walker (2020), public investment stimulates economic activity through short-term effects on aggregate demand, raising the productivity of existing private capital. Public investment also encourages new private investment to take advantage of the higher productivity it creates. Public investment increases economic growth through two main channels: (1) efficiency, which is how much a given amount of public investment provides physical infrastructure, and (2) productivity, which is how the created physical infrastructure affects the economy. In the context of microeconomics, the availability of infrastructure services affects the reduction of production costs (Gie, 2002).

Furthermore, according to Gie (2002), the contribution of infrastructure in improving the quality of life can be seen from the creation of amenities in the physical environment and an increase in welfare (increased consumption value, labor productivity, access employment, and prosperity). Milbourne, Otto, and Voss (2003) state that public investment projects provide final goods or services that are not directly productive. However, most public investment – generally in the form of infrastructure will provide services for private production. Therefore the two are complementary. In general financial management practices, public investment is materialized by government capital expenditures, both at the central and regional levels.

In Indonesia, the infrastructure sector has become one of the main focuses under President Joko Widodo. Infrastructure development aims to improve connectivity and stimulate economic growth in various regions and is part of realizing justice for the entire community. The government allocates public investment in the form of capital expenditures, including the construction of road infrastructures, bridges, dams, and the provision of other public facilities in the education and health sectors. As shown in Figure 1, government capital expenditure increased significantly, starting in 2011, although it decreased slightly in 2014. Capital expenditure realization peaked in 2015 under President Joko Widodo's administration.

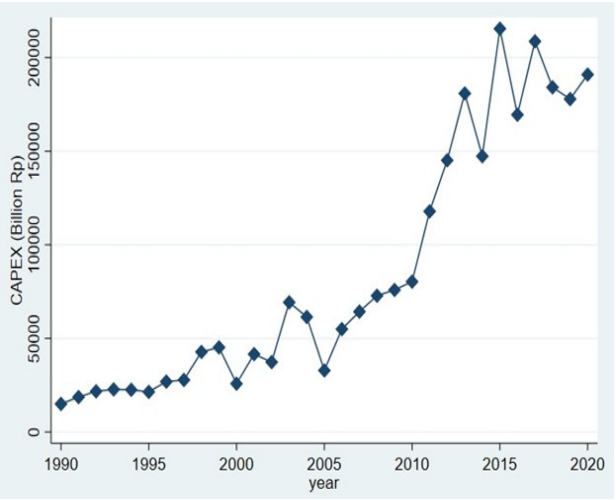

Figure 1. Capital Expenditure, 1990-2020
***Source**: Bank Indonesia (2020)*

Over the past thirty years, it appears that the increase in capital expenditure is in line with the growth of GDP per capita, as shown in Figure 2. However, it is still too early for the scatter diagram to conclude that capital expenditure will necessarily increase economic growth, bearing in mind that economic growth is influenced by other factors derived in the model in this study.

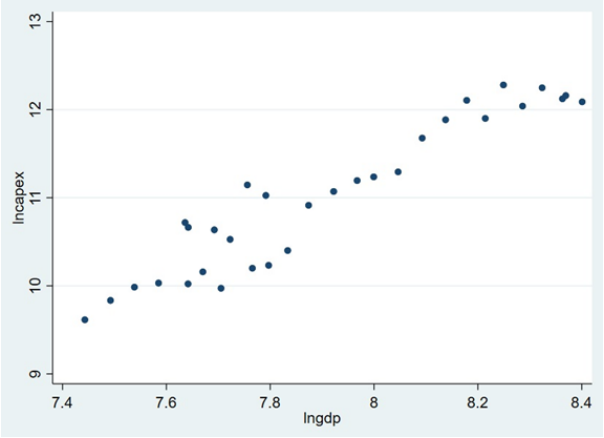

Figure 2. Capital Expenditure and GDP, 1990-2020
Source: *World Bank (2020a), Bank Indonesia (2020)*

The government's commitment to developing and advancing the region is emphasized in the second priority agenda (NAWACITA), notably building clean, effective, democratic, and reliable governance. This is quite interesting as the development strategy in physical investment must also correspond with good governance. Thus, development can run effectively and complement each other to encourage economic growth. This remains a challenge. As we can see in Figure 3, the voice and accountability of the government as one of the six dimensions of governance, experienced a positive trend starting in 2005 with an average score of 0.52 in the last three. The achievement, however, is still low.

To this extent, empirical studies that analyze public investment on economic growth have provided contradictory evidence. In cross-country studies, Barro (1991), throughout 1960-1980, found that public investment has no significant effect on growth rates. Easterly and Rebelo (1993), using public investment measures at various levels of disaggregation, found a strong relationship between public investment in transport and communications and economic growth. Empirical findings from Bose, Haque, and Osborn (2007) and Baldacci, Clements, Gupta, and Cui (2008) have established a significant positive impact of public capital expenditures on some developing economies' growth within a disaggregated analysis framework. For low-income developing countries, Furceri and Li (2017) found a positive effect of public investment on the short to medium-term output. In contrast, Warner (2014) found "very little" evidence supporting the idea that public capital can promote growth beyond the short-term demand effect.

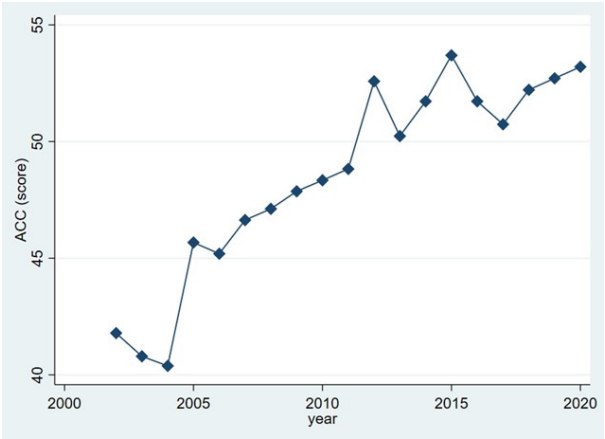

Figure 3. Voice and Accountability, 2002-2020
Source*: World Bank (2020b)*

Nevertheless, cross-country regression results remain problematic. As Temple (1999) reported, one of the immediate problems is the quality of data for developing countries. Many essential variables, such as population growth and school enrollment, are often interpolated from just three or four census years. The second difficulty is the limited period of the available data; even when there are sufficient observations available, including the lag of the independent variable in the model impacts the problem of degrees of freedom. One way to overcome the limitations of cross-country data is the time series model. The selection of time series analysis from country-specific data is also considered

more insightful than cross-country growth studies. It allows for unique economic structures and solves the problem of heterogeneity. Recently, Onifade, Çevik, Erdoğan, Asongu, and Bekun (2020) examined the impact of government expenditure on Nigeria's economic growth from 1981-2017. Using the ARDL model, Onifade et al. (2020) found that recurrent government expenditures had a negative impact on economic growth, while the positive impact of public capital expenditures was not significant on economic growth.

It is interesting to note that other essential variables, namely governance, also influence the impact of capital expenditure on a country's growth. IMF (2015) points out that countries with stronger infrastructure governance institutions tend to have lower average incremental public-capital-to-output ratios and therefore receive more growth "bang" for their investment "buck." It also found that countries with higher public investment efficiency receive more significant output dividends from public investment. According to Samarasinghe (2018), governance influence the country's economic growth in two ways. First, better governance creates a set of important institutions that increase human and physical capital productivity and attract investment for developing human and physical capital. Second, following the social infrastructure theory, better governance improves the country's key institutions and creates good government policies for economic growth. In this regard, this study relates public spending with one of the governance indicators, namely voice and accountability, which have been disregarded thus far. No studies examine the relationship between public investment and accountability on Indonesia's economic growth. From the perspective of this study, accountability is believed to be one of the crucial factors to make capital expenditure more efficient and effective, which can encourage long-term growth. Thus, the purpose of this study is to analyze the empirical relationship of capital expenditure on economic growth and to examine whether capital expenditure and accountability are complementary to encourage Indonesia's economic growth from 1990 to 2020. This study builds a hypothesis that capital expenditure and accountability complement each other to encourage economic growth.

RESEARCH METHOD

The basic framework of this study is the extension of the neoclassical growth model proposed by Mankiw, Romer, and Weil (1992), in which human capital and physical capital provide an excellent picture of per capita income across countries. In this study, the author separate private capital (INV) and public capital (CAPEX) in Equation 1 as follows:

This study adds accountability (ACC) as well

$$GDP_t = \beta_0 + \beta_1 INV_t + \beta_2 SEC_t + \beta_3 CAPEX_t + \mu_t$$

as the interaction of capital expenditure and accountability (CAPEX x ACC) on per capita growth, as the Equation 2:

Whereas GDP is GDP per capita (constant

$$GDP_t = \beta_0 + \beta_1 INV_t + \beta_2 SEC_t + \beta_3 CAPEX_t + \beta_4 ACC_t + \beta_5 (CAPEX_t x\ ACC_t) + \mu_t$$

2010 US$), SEC is human capital represented by secondary school enrollment (percent), INV proxied by gross fixed capital formation (constant 2010 US$), CAPEX is total government capital expenditure (billion Rupiah), and ACC is proxied by voice and accountability index. There is a limitation of ACC data that only 21 observations are available and SEC data in the last two years is not yet available. To meet the range of data required in this study, author interpolated linear data using STATA software. Voice and Accountability capture perceptions of the extent to

which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and free media. Percentile rank indicates the country's rank among all countries covered by the aggregate indicator, corresponding to lowest rank and 100 to highest rank. GDP, SEC, INV, and ACC were sourced from World Bank. CAPEX was obtained from Indonesia's Economic and Financial Statistics of Bank Indonesia. This study uses yearly data throughout 1990-2020. GDP, INV, and CAPEX are in natural logarithms. The following Table 1 summarizes the descriptive statistics of the raw variables used.

To answer the research questions, the author used the autoregressive distributed lag (ARDL) bound test developed by Pesaran, Shin, and Smith (2001) also Pesaran and Shin (1997). The author chooses the ARDL bound test approach with the following considerations: (1) The Bounds co-integration approach can also be used to test for the existence of long-run equilibrium regardless of whether the underlying variables are I(0), I (1), or fractionally integrated; (2) It involves just a single-equation set-up, making it simple to implement and interpret; (3) more efficient in limited sample studies; (4) correctly defined lag structure, not only controlling for serial correlation but also minimizing potential endogeneity in the model (Pesaran, Shin & Smith, 2001).

ARDL is a model that includes lag values of the dependent variable as regressors (autoregressive) and distributed lag (regression also includes some lag from additional predictors). Pesaran, Shin, and Smith (2001) also Pesaran and Shin (1997) developed the ARDL Bound Test to investigate the cointegration relationship of variables in models with a degree of stationarity at I (0) and I (1) or a combination of both. The ARDL model is shown in Equation 3.

Whereas Δ denotes the first difference. In Equation (5), the short-run coefficient is shown by ϕ_1 to ϕ_6, the long-run coefficient is shown by ψ_1 to ψ_6, and ε_t is the error term which represents residual values that are not serial correlation, homoscedastic, and normally distributed. Author tested the stability of the parameters using the Sb CUSUM test and RAMSAY RESET for specified model test. Given our relatively small sample size, author applied the Akaike Information Criterion (AIC) to select the optimal lag structure in the model (Lütkepohl, 2005).

Table 1. Descriptive Statistics

	GDP	INV	SEC	CAPEX	ACC
Mean	2,830.843	206,180.058	64.154	84,476.32	45.212
Median	2,524.222	170,779.547	60.154	61,450	47.867
Maximum	4,450.641	395,763.766	88.910	215,434.2	53.695
Minimum	1,707.818	95,769.567	43.729	14,986	17.413
Std Deviation	836.694	95,890.594	15.168	67,027.82	9.617
Skewness	0.568	0.641	0.229	0.733	-1.964
Kurtosis	2.001	2.032	1.630	1.982	6.079
JB Normality	0.228	0.189	0.284	0.128	1.9e-05
Obs	31	31	29	31	21

Equation 3

$$\Delta GDP_t = \psi_1 GDP_{t-1} + \psi_2 INV_{t-1} + \psi_3 SEC_{t-1} + \psi_4 CAPEX_{t-1} + \psi_5 ACC_{t-1} + \psi_6 CAPEX\ x\ ACC_{t-1} + \sum_{i=1}^{p} \phi_1 \Delta GDP_{t-i} + \sum_{j=0}^{q} \phi_2 \Delta INV_{t-j} + \sum_{k=0}^{r} \phi_3 \Delta SEC_{t-k} + \sum_{l=0}^{s} \phi_4 \Delta CAPEX_{t-l} + \sum_{m=0}^{s} \phi_5 \Delta ACC_{t-m} + \sum_{m=0}^{s} \phi_6 \Delta CAPEX\ x\ ACC_{t-m} + \varepsilon_t$$

Essentially, the ARDL Bound Test involves testing the null hypothesis (Ho) of no cointegrated relationship. In Equation (2) author test $H_0: \psi_1 = \cdots = \psi_6 = 0$ against the alternative hypothesis of cointegrated relationship $H_1: \psi_1 \neq \cdots \neq \psi_6 \neq 0$.

Since these hypothesis tests effectively test the joint significance of coefficients, the author computes the F-statistic and compares it with the critical values of upper and lower sample-limited and asymptotic limits provided by Kripfganz and Schneider (2018). Referring to Kripfganz and Schneider (2018), their critical value increases and substantially extends the critical value set by Pesaran, Shin, and Smith (2001) also Narayan (2005). The author rejects Ho if the F-statistic exceeds the upper bound critical value, and Ho cannot be rejected if the F-statistic is below the lower bound critical value. However, the test becomes inconclusive if the F-statistic lies within the lower and upper bound range. It is worth mentioning that the suitability and adequacy of the statistical estimation ARDL models rely on the coefficient Error Correction Term (ECT_{t-1}) which indicates the speed of a short-run adjustment coefficient to the long-run equilibrium (Kripfganz & Schneider, 2018). The coefficient γ_1 < 0 and is significant to ensure convergence towards equilibrium, (Kripfganz & Schneider, 2018).

RESULT AND DISCUSSION

ARDL bound test can be performed if the variables in the model are integrated at the level [I(0)] or first difference [I(1)], and there are no integrated variables in the second-order [I(2)]. Suppose a variable is integrated at I(2). In that case, the F-statistic calculation for cointegration becomes inconclusive since the critical bonds are based on the assumption that all variables are stationary at I(0) or I(1) (Pesaran, Shin, & Smith, 2001). Thus, the author performed the classical stationary techniques Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP). As presented in Table 2, the ADF and PP tests results conclude that all variables are stationary in I(1). Hence, the author concludes that the use of the ARDL bound test is appropriate.

However, to ensure these results, the author also performed a DF-GLS test, which is a more robust "second generation" unit root test when compared to "first-generation" tests such as Augmented Dickey-Fuller and Phillip-Perron (Baum, 2005). As shown in Table 3, the results of the DF-GLS test confirm the author's conclusion that none of the variables are cointegrated in the second order.

Upon confirming that all of our variables were not integrated at I(2) or more, the author then performed an ARDL Bound Test. First, this study applies the basic model in Eq.(1), which is then reduced to Eq.(2) by adding the variable of accountability and the interaction of capital expenditure with accountability. As presented in Table 4, the F-statistical value in Eq.(1) and Eq.(2) is above the critical value provided by Kripfganz and Schneider (2018). Precisely, Eq.(1) at the 5%

Table 2. ADF & PP Stationary Test Results

Variable	Level		First Difference		Conclusion
	ADF	PP	ADF	PP	
GDP	-0.400	-0.449	-3.828***	-3.741***	I(1)
INV	-0.535	-0.579	-3.805***	-3.643***	I(1)
SEC	0.655	0.779	-6.062***	-6.171***	I(1)
CAPEX	-1.173	-1.009	-7.873***	-9.524***	I(1)
ACC	-0.711	-0.830	-3.823***	-3.710***	I(1)
CAPEX*ACC	-0.796	-0.695	-7.439***	-7.588***	I(1)

Source: *Author's calculation using Stata*
*Noted: The *, **, and *** signs indicate statistical significance at the 10%, 5%, and 1% levels, respectively*

Table 3. DF-GLS Stationary Test Results

Variable	Level		First Difference		Conclusion
	No trend	Trend	No trend	Trend	
GDP	-0.047	-2.231	-3.475***	-3.374**	I (1)
INV	-0.462	-2.735	-4.590***	-4.545***	I (1)
SEC	0.539	-1.968	-2.673***	-3.562**	I (1)
CAPEX	0.014	-3.248	-3.562***	-5.371***	I (1)
ACC	-1.028	-2.758	-3.856***	-4.012***	I (1)
CAPEX*ACC	0.195	-2.288	-4.390***	-4.440***	I (1)

Source*: Author's calculation using Stata*
*Noted: The ** and *** signs indicate statistical significance at the 5% and 1% levels, respectively*

significance level and Eq.(2) at all significance levels. Thus, the authors reject the null hypothesis and conclude a cointegrated relationship between capital expenditures and economic growth during the period 1990-2020.

Evidence of a long-run relationship is also indicated from the coefficients reported in Table 6. The coefficient in both equations is negative and statistically significant, which validates convergence to long-run equilibrium between Capital Expenditure on GDP during the sample period. In Eq.(2), the convergence speed is 0,42, which implies that around 42% deviations from long-run equilibrium are adjusted every year and the remaining 58% in the subsequent year. It also means that it will take more than one year to adjust to equilibrium once disequilibrium happens. The author can also benefit from short-term and long-term effects in the ECM model without losing any important information. However, the short-term analysis requires additional lag, reducing the degree of freedom in a limited sample. Ultimately, this is not the aim of this study.

As presented in Table 5, our results were validated by a set of diagnostic tests against serial correlation (Breusch-Godfrey LM test), heteroscedasticity test including the White Test, and normality using Jarque-Bera test. There is also much evidence sup-

porting Ramsey's RESET test, which suggests that the estimated models are well specified. The results of the Sb CUSUM test for the estimated model indicate that the parameters of the models are highly stable over the sample period. This is indicated by the statistical test value being within the critical limit at the 5% confidence interval (see Appendix).

As presented in Table 6, the ARDL results in Eq.(1) demonstrate that private investment (INV) has a positive and significant effect on long-term growth. When we reduce it to Eq. (2), the result remains consistent. In Eq.(2), the long-run coefficient of INV is 0.89, which indicates that when all other factors are held constant, an increase in INV of 1% will increase GDP by 0.89%. These results confirm the theoretical basis and empirical evidence that private investment is one of the main drivers of economic growth. Investment can fill the savings gap in the economy. Physical investment in the form of factories and equipment will increase the economy's productive capacity, with other effects on increasing employment, tax revenues, and exports (Moosa, 2002).

ARDL shows that human capital (SEC) has a negative correlation with growth and is statistically significant. These results indicate that human capital has not been a driver of economic growth in Indonesia. A possible explanation is that secondary school enrollment rates may not reflect the quality of human resources. This can be shown from the low number of the Human Development In-

Table 4. ARDL Bound Test

Significance Level	Dependent variable: ln GDP			
	Model (1) ARDL (2, 2, 2, 0)		Model (2) ARDL (1, 0, 1, 0, 1, 0)	
	F Statisctics = 5.503		F Statisctics = 116.790	
	Critical Value			
	Lower bound I(0)	Upper bound I 1)	Lower bound I(0)	Upper bound I(1)
1%	5.616	7.721	4.632	6.667
5%	3.736	5.293	3.180	4.718
10%	2.993	4.325	2.597	3.930

Table 5. Diagnostic Test

Diagnostic Test	Dependent variable: ln GDP		Conclusion
	Model (1) ARDL (2, 2, 2, 0)	Model (2) ARDL (1, 0, 1, 0, 1, 0)	
	Prob > chi2	Prob > chi2	
Breusch-Godfrey LM test	0.839	0.531	No serial correlation
White Test	0.487	0.568	Homoskedastic
Ramsay RESET	0.411	0.186	No misspecification
J-Bera	0.592	0.981	Normally distributed
Sb CUSUM	0.359	0.494	Stable

dex in Indonesia. UNDP (2020) reveals that Indonesia's Human Development Index in 2018 is 0.491 or ranked 111th in the world. Indonesia is lagging far behind Singapore (0.649) and still lower than Brunei Darussalam (0.587), Malaysia (0.558), Thailand (0.531), and the Philippines (0.494). Furthermore, as depicted in Wößmann and Hanushek (2007), the population's cognitive skills are closely related to individual income, income distribution, and economic growth instead of increasing school achievement. This result is in line with the study of Mendy and Widodo (2018).

As the next step, the authors then analyze the role of capital expenditure (CAPEX) and accountability (ACC) on Indonesia's economic growth. As shown in Table 6, in Eq.(1), capital expenditure does not significantly impact long -term growth. Even in Eq.(2), capital expenditure has a negative and significant impact on economic growth. In general, these results are in line with those of Onifade et al. (2020) in Nigeria. Likewise, the governance-accountability variable has a negative correlation with economic growth. This result supports Gani (2011), which finds that voice and accountability have a significant and negative effect on economic growth. Similar to Samarasinghe (2018), using 145 countries over the period 2002-2014 found that the voice and accountability indicators did not become statistically significant on economic growth.

In the last discussion, this study examines whether capital expenditure and accountability can complement each other to promote economic growth. Governance variables also influence, suppositionally, the effectiveness of capital expenditure. In this case, the author uses an accountability proxy. Therefore, the variable of interest in this study is the role of accountability in capital expenditure on economic growth, as indicated by the interaction of variables. As in table 6 Eq.(2), the interaction of capital expenditure and accountability shows positive and statistical significance at the 1% significance level. If all factors are held constant, a 1% increase in capital expenditure and accountability will increase GDP by 1.5%.

This result is interesting, how the creation of good governance must also support capital

Table 6. Results of the ARDL model

Explanatory variable	Dependent variable: ln GDP			
	Model (1) ARDL (2, 2, 2, 0)		Model (2) ARDL (1, 0, 1, 0, 1, 0)	
	Adjusted R Square: 0,92		Adjusted R Square: 0,96	
	Coefficient	p-value	Coefficient	p-value
INV	0.487***	0.000	0.889***	0.000
SEC	0.002	0.484	-0.009**	0.015
CAPEX	0.052	0.162	-1.448***	0.000
ACC	N/A	N/A	-0.043***	0.000
CAPEX*ACC	N/A	N/A	1.514***	0.000
Cons	-2.184***	0.001	-7.921***	0.000
ECT	-0.407***	0.002	-0.416***	0.000

Noted: *The ** and *** signs indicate statistical significance at the 5% and 1% levels, respectively*

expenditure. The better the governance, the more effectual government capital expenditure will be to encourage long-term growth. A possible explanation is that improved institutions and better government policies make an attractive environment for high investment in human and physical capital development, thereby achieving economic growth. As stated by Miyamoto et al. (2020), the strength of infrastructure governance plays a critical role in determining the macroeconomic effects of public investment. Countries with more robust governance achieve a more substantial public investment output impact than countries with weaker governance. More robust infrastructure governance helps public investment yield a higher growth dividend by improving investment efficiency and productivity, stimulating private sector investment. As pointed out by the IMF (2015), countries with higher public investment efficiency receive greater output dividends from public investment.

CONCLUSION

This study analyzes whether capital expenditures and accountability complement each other to encourage Indonesia's economic growth from 1990-2020. Applying the autoregressive distributed lag (ARDL) bounds test, this study finds a cointegrated relationship between capital expenditure and economic growth in Indonesia during the study period. In particular, capital expenditures have a negative impact on long-term growth. However, interestingly, the interaction of government capital expenditure with governance variables shows a positive and significant impact on long-term growth. If all factors are held constant, a 1% increase in capital expenditure and accountability will increase GDP by 1.5%. The results indicate that capital expenditure and accountability are complementary to drive economic growth.

This study implies that the government needs more robust infrastructure governance that helps public investment yield a higher growth dividend by improving investment efficiency and productivity, stimulating private sector investment. Hence, the capital expenditures that have been realized can provide optimal benefits for Indonesia's economy in the long run. In addition, the role of accountability is crucial to creating an attractive environment for high investment in human and physical capital development.

Finally, it is necessary to point out the limitations of this study. First, because this study only limits capital expenditure to the central government, further research can assess how capital expenditure at the local government level affects regional per capita growth. Second, accountability proxies need to be sharpened not just links with the country's political system, but more specifically, accountability related to the management of government capital expenditures that must be reported to the stakeholders. This may provide a clearer picture of the role of government governance and public investment in economic growth.

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APPENDIX

Appendix 1. The results of the Sb CUSUM test for the estimation of Eq.(1) and Eq.(2)