The moderating effect of financial leakages on the relationship between Capital Expenditure (CAPEX) and economic growth in Zimbabwe

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Abstract

This paper assesses the moderating effect of financial leakages (corruption) on the relationship between capital expenditure (CAPEX) and economic growth. Corruption is an exogenous factor with negative effects on the efficiency and effectiveness of CAPEX use in the public sector. This paper empirically examines the moderating effect of corruption on the relationship between CAPEX and economic growth. Autoregressive distributed lag model was used to determine the moderating effect as the model tests both shot run and long run effects. The model also accepts regression of variables co-integrated at different levels. The results show that CAPEX has positive effects on economic growth. However, corruption is cancerous on the allocation and use of the CAPEX, both in the short and long run. Financial leakages were found to have a negative moderating effect on the relationship between CAPEX and economic growth both in the short and long term. The moderation is stronger in the long term as compared to the short term. Government should tackle financial leakages (corruption) head on to reduce financial haemorrhage in Zimbabwe's infrastructure projects.

Key Words: Capital Expenditure (CAPEX), Economic Growth and Financial Leakages.

Introduction

CAPEX for the government of Zimbabwe for the year 2023 was ZWL3,96 trillion, about 3.3% of the country's GDP. In 2024 it was forecast to increase to ZWL12,4 trillion, being 4.2% of GDP. The numbers show a deliberate increase in CAPEX, seen as an engine for economic growth. Zimbabwe has witnessed extensive development in CAPEX at Robert Gabriel Mugabe International Airport, Victoria Falls Airport and Joshua Mqabuko Nkomo Airport. The Harare to Beitbridge highway of 586km and major roads in Harare have been rehabilitated. However, according to Transparency International, corruption in Zimbabwe remains high. In Transparency International's 2023 Corruption Perceptions Index (CPI), Zimbabwe scored 24 on a scale from 0 (highly corrupt) to 100 (very clean). When ranked by score, Zimbabwe ranked 149th among the 180 countries in the index. In 2020, the country CPI was 24, ranking 149th out of 180 countries. The results for 2022 and 2021 were near identical, with CPI of 23. This paper examines the relationship between CAPEX and economic growth amid financial leakages in the short and long run.

Literature Review

According to the Keynesian theory of public expenditure (Keynes, 1936), the government must intervene in the economy through taxation and government spending to foster output, growth and employment. This theory is founded on the belief that government expenditure stimulates businesses to provide goods and services. Adolph Wagner (1835–1917) contended that redistribution of wealth and income is a provision in the collective need for less economic inequality as the government makes decisions in the general interest. Adam Smith, in the book *The Wealth of Nations,* identified the main drivers and causal processes of growth to formulate and promote policies that could achieve the objective of 'universal opulence.' Smith (1976) asserts that the driving force of growth is *saving*, what he referred to as 'parsimony,' and that saving will lead to and be matched by equal levels of investment, involving the employment of stock as capital in production which is necessary for capital accumulation.

Financial leakages (Corruption)

Corruption is the abuse of entrusted power for private gain, a diversion of funds from iterative processes. It is the abuse of public power for private gain, and a violation of formed rules governing the allocation of resources by officials in response to offers of financial gain (Wickberg, 2021). Financial leakages are prevalent in both developed and emerging countries, and have increased with financial globalisation (Gossel, 2018). It is rent seeking and dishonest behaviour by those in positions of power and leads to erosion of institutional capacity of governments as procedures are disregarded and resources siphoned off, resulting in underfunding of critical processes and programmes (Wickberg, 2021).

Research Methodology

The aim of this study is to assess the moderating effect of financial leakages (corruption) on the relationship between CAPEX and economic growth. The study used existing secondary data from the World Bank. Attempting to empirically uncover long-run equilibrium relationships is tantamount to separating them from the overlaid short-run dynamics, as contended by Kripfganz and Schneider (2023). This study employs the Autoregressive Distributed Lag (ARDL) model and the Error Correction Model (ECM) for cointegration to investigate the long-run and short-run relationship between economic growth and CAPEX and its determinants, as contended by Rasool et al. (2022). To implement the bounds testing procedure, the conditional ARDL Error Correction Model (ECM) is modelled using an equation.

ARDL Bound cointegration test model.

$$\Delta EG_t = \tau + \beta_0 EG_{t-1} + \beta_1 CE_{t-1} + \beta_2 CP_{t-1} + \sum_{i=1}^{p} \alpha_{1i} \Delta EG_{t-i} + \sum_{i=0}^{p} \alpha_{2i} \Delta \mathrm{CE}_{t-i} + \sum_{i=0}^{p} \alpha_{3i} \Delta CP_{t-i}$$

ARDL Model

$$EG_t = \alpha + \sum_{i=1}^{p} \beta_1 EG_{t-i} + \sum_{i=0}^{q} \beta_2 CE_{t-i} + \sum_{i=0}^{r} \beta_3 CP_{t-i} + \varepsilon_t$$

Where?
P=optimum lag length
EG= Economic Growth
CE=Capital Expenditure
CP=Financial leakages

$$\beta_i = coefficients$$
$$\varepsilon_t = error\ term$$

The model interrogates the relationship between CAPEX and economic growth amid the independent variable corruption. Qamruzzaman and Jianguo (2018) contend that the ARDL is one of the best econometric methods compared to others in a case when the variables are stationary at I (0) or integrated order I(1).

Data Sources

The quantitative data used in this study were gathered from secondary sources. CAPEX was taken from Ministry of Finance Economic Planning and Investment Promotion. The GDP was taken from the World Bank. Financial leakages (corruption) indices were taken from the World Bank Databases. Considering the limitations of data availability, the data for the fourteen years was quarterised using the Lisman and Sandee (1964) technique.

Descriptive Statistics

The study found that the average quarterly economic growth (GDPG) in Zimbabwe ranges between 5.19% and -2.97%, as depicted by the maximum and minimum values portraying the existence of severe disparities in growth. The disparity is also reflected by the standard deviation value (1.98%) which is greater than the mean (1.35%) signalling high volatility in growth. The mean (financial leakages) level in Zimbabwe for each quarter stood at -0.33 which falls within the high-level category, as the grading ranges between -2.5 to 2.5 with lower figures indicating lower level of corruption control (high level of corruption). This is also supported by the maximum and minimum values (-0.19 and -0.57, respectively) which fall within the high level of corruption category.

Table 1: Data Descriptive

	LNGDP	**GDPG**	**LNCAP**	**CORR**
Mean	1.624	1.352	4.630	-0.333
Median	1.584	0.707	4.618	-0.311
Maxim	2.667	5.186	8.167	-0.188
Minim	0.796	-2.965	1.698	-0.568
Std. Dev	0.418	1.983	1.477	0.122
Skew	0.346	0.100	0.241	-0.683

Kurtosis	2.977	2.745	2.893	2.166
J-Bera	1.119	0.245	0.569	5.976
Prob.	0.571	0.885	0.752	0.050
Sum	90.961	75.701	259.3	-18.63
S.S Dev	9.559	216.4	115.1	0.820
Observe.	56	56	56	56

Source: Author's Computation using E-Views 13 (2024)

Table 2: Correlation Analysis

	FDI	**GDPG**	**LNCAP**	**LNGDP**	**LNTRADE**	**CORR**
GDPG	0.182	1.000				
LNCAP	-0.420	-0.272	1.000			
LNGDP	-0.026	-0.381*	0.596*	1.000		
CORR	-0.007	-0.070	-0.142	-0.126	-0.057	1.0000

Source: Author's Computation using E-Views 13 (2024)

Table 3: Augmented Dickey-Fuller (ADF) Unit Root Test Results

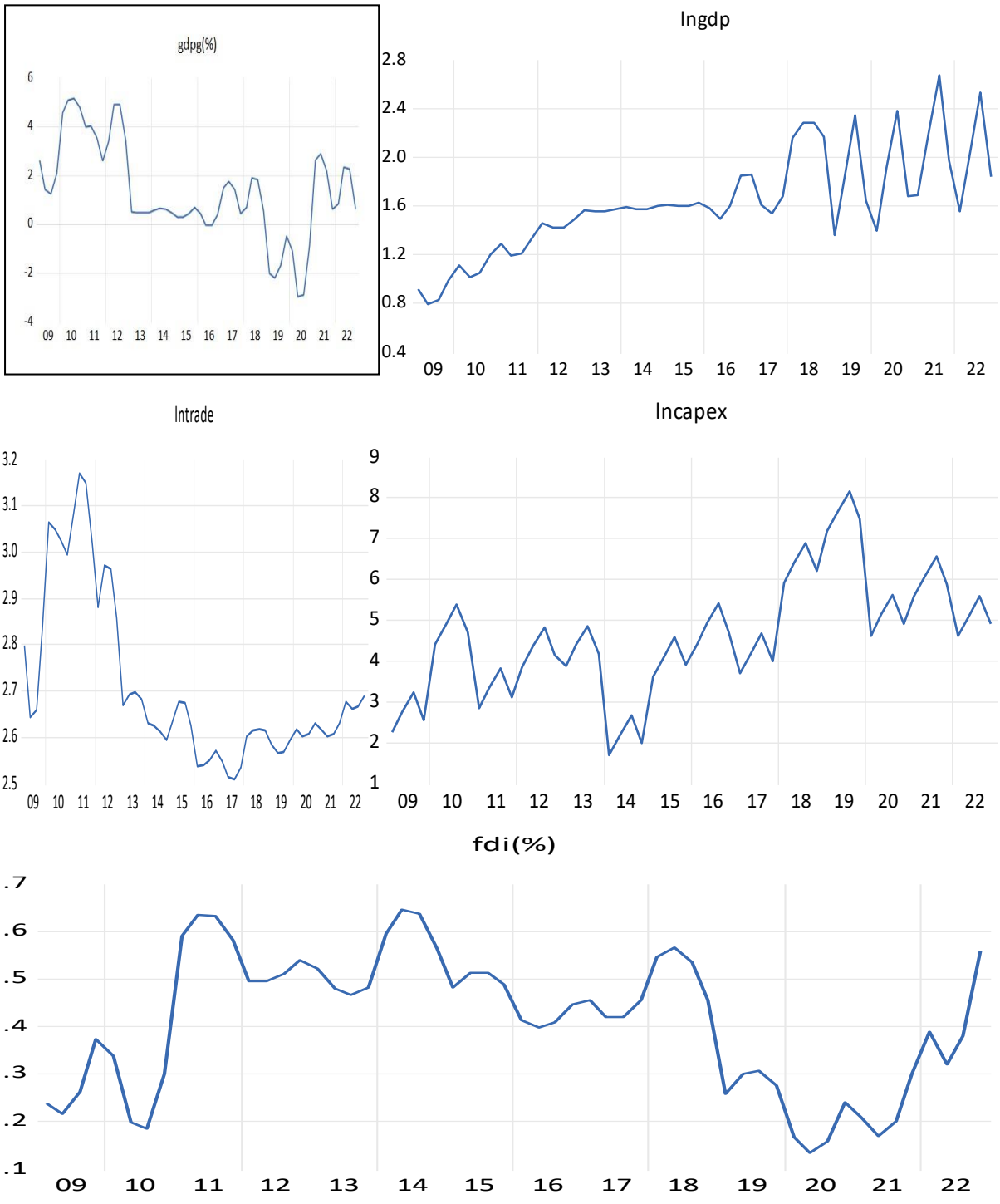
Variable	**Order**	**Intercept**	**Trend and intercept**	**Without a trend and intercept**	**Decision**
LNGDP	0	-0.2060	-3.1905	0.9545	1(1)
	1	-14.189	-14.192	-13.992	
GDPG	0	-2.106	-3.4468	-1.5298	1(1)
	1	-3.7066	-6.5071	-3.7184	
LNCAP	0	-2.7529	-3.2704	-0.1490	1(1)
	1	-8.1657	-8.2604	-8.2065	

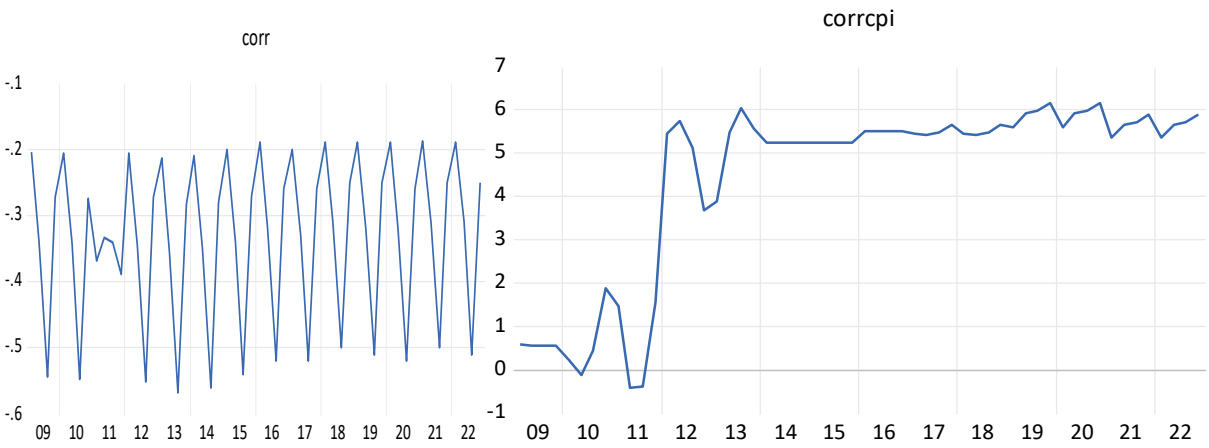
CORR	0	-3.7788***	-3.2319***	-3.7853***	1(0)
	1	-3.4997	-3.4434	-5.6669	

Note: *** denotes statistical significance at 1% level

Source: Author's Computation using E-Views 13 (2024)

Figure 1 Graphs of Time Series





Source: Author's Computation using E-Views 13 (2024)

Figure 1 demonstrates an informal way of identifying the stationarity of the variables. The variables are in levels before the application of unit root tests. The variables do not oscillate around the mean and are, therefore, not stationary in levels. The results for the ADF and PP tests are shown in Tables 3 and 4 respectively in levels and first differences, where appropriate, including an intercept, intercept with a trend as well as without a trend or intercept in the test regression. When the test statistic is more negative than the critical value, it implies that the null hypothesis that the variable contains a unit root can be rejected, whereas if the test statistic is not more negative than the critical value, then the null hypothesis cannot be rejected. The results with intercept, trend and intercept and no trend and intercept indicate that the control of corruption is stationary at levels as the null hypothesis can be rejected at the 5% significance level or higher. The test statistics for the log of real GDP, GDP growth, CAPEX and foreign direct investment indicate that the null hypothesis cannot be rejected at level terms for all specifications, meaning that the series have at least one-unit root. Turning to the Phillips-Perron test results, the findings largely confirm the conclusions from the ADF tests as both LRGDP, GDPG, and LRCAPEX, are identified to be non-stationary at level l(1). Financial leakages (corruption) are stationary in levels. The combination of I (1) and I (0) variables makes it affirmable to proceed with the ARDL model estimation. The findings from the above two-unit root tests that were applied inform that the dependent variable was I (1) whilst the independent variables were either I (1) or I(0) when examined with an intercept, or with trend and intercept, and without a trend and intercept. These conclusions thus make it suitable for the analysis to proceed using the ARDL method.

Table 4: Phillips-Perron (PP) unit root test results

Variable	Order	Intercept	Trend and intercept	Without a trend and intercept	Decision
LNGDP	0	-1.8327	-5.4956	0.3100	1(1)
	1	-11.579	-12.425	-10.078	
GDPG	0	--1.8857	-2.091	-1.5816	1(1)
	1	-4.8529	-4.5271	-4.9090	

LRCAPEX	0	-2.1077	-2.7095	-1.2758	1(1)
	1	-6.2336	-6.7659	-6.3876	
CORR	0	-10.263***	-21.570***	-1.8630***	1(0)
	1	-34.5517	-33.567	-35.0218	

Note: *** denotes statistical significance at 1% level
Source: Author's Computation using E-Views 13(2024)

Diagnostic Tests Results

Lagrangian Multiplier Test for Residual Autocorrelation

Serial autocorrelation refers to the correlation that occurs when one period residual is correlated with residuals in previous lags. According to Lütkepohl *et al.*, (2006), a null hypothesis of no serial correlation is accepted if the computed p-value exceeds 0.005 at 5% level of significance. On the other hand, a null hypothesis of no serial correlation is rejected if the computed p-value is less than 0.005 at 5% level of significance. The study employed the Breusch–Godfrey LM Test to ascertain the existence of serial correlation problems. Results in Table 5 indicate a p–value of 0.4371, which is greater than 0.005 at 5% level of significance. Therefore, the null hypothesis of no serial autocorrelation was accepted, concluding that the model does not suffer from serial correlation problems.

Table 5: Serial Correlation LM test for Autocorrelation

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	0.608311	Prob. F(2,37)	0.5496
Obs*R-squared	1.655414	Prob. Chi-Square(2)	0.4371

Source: Author's Computation using E-Views 13(2024)

Lag Selection

As mentioned in the methodology, the first step in estimating the ARDL model is the determination of the optimal lag length. Table 5 shows the results for the VAR lag length selection criterion and revealed 4 as the appropriate optimal lag. According to Kutu and Ngalawa (2016), issues of serial correlation in the residuals are resolved with the right lag length selection. More results are shown in the appendix (see Table 5).

Table 6: ARDL Lag Length Selection

VAR Lag Order Selection Criteria
Endogenous variables: LNGDP LNCAPEX CORR CORRCAP FDI LNTRADE
Exogenous variables: C
Date: 12/14/23 Time: 09:53
Sample: 2009Q1 2022Q4
Included observations: 52

Lag	LogL	LR	FPE	AIC	SC	HQ
0	25.12879	NA	1.93e-08	-0.735723	-0.510579	-0.649408
1	158.1646	230.2543	4.67e-10	-4.467870	-2.891866	-3.863667
2	244.7197	129.8326	7.06e-11	-6.412297	-3.485432	-5.290206
3	324.6490	101.4486	1.51e-11	-8.101883	-3.824156	-6.461904
4	400.7186	78.99535*	4.39e-12*	-9.643021*	-4.014434*	-7.485154*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: Author's Computation using E-Views 13

Heteroscedasticity Test

The fourth parameter to be tested is the assumption of unequal variances or heteroscedasticity. The assumption of heteroscedasticity means that different samples have the same variance even when coming from different populations. In ARDL analysis, heteroscedasticity means the residuals are not well-fitted with the predicted values. Failure to comply with this assumption could significantly affect the results or even invalidate them. Various models can be used but this study employed the Breusch-Pagan Godfrey Test. The calculated p-values are shown in Table 6. Since the calculated p-values are greater than 0.05 this signals that a null hypothesis of no serial correlation is accepted at 5% level of significance.

Table 7: Heteroscedasticity Results

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	1.668406	Prob. F(12,39)	0.1126
Obs*R-squared	17.63927	Prob. Chi-Square(12)	0.1271
Scaled explained SS	9.358025	Prob. Chi-Square(12)	0.6721

Source: Author's Computation using E-Views 13(2024)

Bound Test Results

According to Pesaran et al. (2001), when the calculated F statistic is greater than the upper bound critical value, the null hypothesis is rejected. This signals that the underlying variables

in the study are co-integrated. If the F-statistic fails to exceed the lower bound critical value, the null hypothesis is accepted, informing that there is no co-integration among the variables.

Table 8: ARDL F-Values

ARDL F-Bounds Test		
Critical Value	Lower Bound Value 1(0)	Upper Bound Value 1(1)
1%	3.06	4.15
5%	2.39	3.38
10%	2.08	3.00
F-Statistic	4.208	

Source: Author's Computation using E-Views 13(2024)

Equally, if the F-statistics fall between the upper and lower bounds, the co-integration or order of integration must be known in order to make a conclusive reference. Based on this study's results in Table 7, the calculated F statistic of 4.208 exceeds the upper bounds at 5 percent significance levels. This implies the variables have a long run relationship in line with previous studies such as Oteng-Abaiye (2011), Odihambo (2015) and Mazorodze (2018). These studies observe a cointegrating relationship between economic growth and government expenditure.

Empirical Findings Error Correction Results

The bound test co-integration results reveal that the variables are co-integrated at level 1(0) and at first difference 1(1) in the long run. Subsequently, the study established long run and short run equations together with the adjustment term. Optimal lags were automatically chosen using information criteria, AIC. The regression output is reported in Table 8 which also presents the result of the error correction model (short-run form) and long run form of the ARDL. The coefficient (-0.582) of the ECT term (speed of adjustment coefficient or error correction term) is negative and statistically significant at 5 percent level of significance, thus satisfying a convergence condition. This, therefore, suggests that LNGDP adjusts to LNCAPEX, and CORR, in the long run. About 58.2 percent of the disequilibrium in the preceding periods has fallen back to equilibrium in the current period. In other words, it takes approximately 2 years to reach the equilibrium level in this model. Therefore, long-run relationship or equilibrium has been restored among the variables. The R-Squared value of 0.79 which is the explanatory power of the model is high, and hence suggests that LRCAPEX, CORR and other control variables are good determinants or predictors of economic growth in the short-run. The remaining 21 percent account for other macroeconomic determinants of economic growth which are not accounted for in this study.

Table 9: ECM Results

Dependent Variable: D(LNGDP)
Method: ARDL
Date: 12/14/23 Time: 10:08
Sample: 2010Q1 2022Q4
Included observations: 52
Dependent lags: 4 (Automatic)
Automatic-lag linear regressors (4 max. lags): LNCAPEX CORR CORRCAP FDI___ LNTRADE
Deterministics: Restricted constant and no trend (Case 2)
Model selection method: Akaike info criterion (AIC)
Number of models evaluated: 12500
Selected model: ARDL(3,0,0,0,4,0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COINTEQ*	-0.582466	0.099906	-5.830161	0.0000
D(LNGDP(-1))	0.081588	0.081685	0.998809	0.3232
D(LNGDP(-2))	-0.496894	0.095435	-5.206604	0.0000
D(FDI___)	1.329191	0.344011	3.863802	0.0004
D(FDI___(-1))	0.188113	0.374873	0.501805	0.6183
D(FDI___(-2))	0.942212	0.378096	2.491992	0.0165
D(FDI___(-3))	0.718036	0.349799	2.052709	0.0459

R-squared	0.786309	Mean dependent var	0.016309
Adjusted R-squared	0.757817	S.D. dependent var	0.321308
S.E. of regression	0.158122	Akaike info criterion	-0.726245
Sum squared resid	1.125121	Schwarz criterion	-0.463578
Log likelihood	25.88238	Hannan-Quinn criter.	-0.625545
F-statistic	27.59748	Durbin-Watson stat	1.880585
Prob(F-statistic)	0.000000		

* p-values are incompatible with t-Bounds distribution.

Source: Author's Computation using E-Views 13(2024)

Results for Model 2: Moderating Effect of Financial Leakages (Corruption) on the Nexus between Capital Expenditure and Economic Growth

Displayed in Model 2 are the results on the moderating effect of corruption (financial leakages) on the CAPEX economic growth nexus. After introducing the interaction effect (LNCAPEX*CORR), the coefficients for both CAPEX and financial leakages were negative and significant in the short run. This supports the view that CAPEX, and control of corruption, are both essential contributors to economic growth. In the short run, a 1% increase in CAPEX and control of corruption reduces economic growth by 0.13% and 0.24% respectively. In the long run, the study reveals a significant negative effect of CAPEX on economic growth. A 1% increase in CAPEX reduces economic growth by 0.05% after including the interaction effect) and the effect is significant. The transformation in the coefficients of CAPEX from 0.08 (insignificant) to -0.05 (significant) implies that although government expenditure positively affects economic growth slightly, the level of corruption adversely affects the impact. This suggests that financial leakages in Zimbabwe is a drag and not a push factor for government CAPEX policies. The result thus provides empirical evidence of a conditional relationship between CAPEX and economic growth in Zimbabwe. The findings suggest that for economies to reap the fruits of CAPEX, governments should control or eradicate financial leakages.

Robustness of the Model Checks

Table 10: VAR Granger Causality/Block Exogeneity Wald Tests

VAR Granger Causality/Block Exogeneity Wald Tests			
Date: 12/03/23 Time: 00:06			
Sample: 1992- 2022 Included Observations: 54			
Dependent variable: LNGDP			
Excluded	Chi-Sq	Df	Prob
LNCAPEX	15.379622	2	0.0006
CORR	15.23935	2	0.0005
All	24.81808	4	0.0002
Dependent Variable: LNCAPEX			
Excluded	Chi-Sq	Df	Prob
LNGDP	22.30563	2	0.0000
CORR	15.16478	2	0.0005
All	22.40944	4	0.0002
Dependent Variable: CORR			
Excluded	Chi-Sq	Df	Prob
LNGDP	0.420667	2	0.8103
CAPEX	0.246098	2	0.8842
All	1.500382	4	0.8266

Source: Author's Computation using E-Views 13(2024)

To check for the robustness of the model results, the study conducted a Granger causality test using Block exogeneity wild tests. The result of the test is shown in Table 11. The outcomes of the Granger causality test reflect causality among capital expenditure, financial leakages and economic growth in Zimbabwe. The outcomes from the Granger causality test display a bidirectional causality relation between capital expenditure and economic growth (LNCAPEX → LNGDP) and (LNGDP → LNCAPEX). Some scholars have confirmed the causality running from government expenditure to economic growth (see for instance Mazorodze, 2018; Olugbenga & Owoye, 2007).

Table 12: FMOLS; DMOLS & CCR estimation results						
	FMOLS Results		**DMOLS Results**		**CCR Results**	
LNGDP	Coeff.	P >|Z|	Coeff.	P >|Z|	Coeff.	P >|Z|
Constant	4.1897	0.000	1.6316	0.000	1.699	0.000
LNCAPEX	0.2656	0.0793	0.1514**	0.0843	0.106*	0.003
CORR	-0.271*	0.001	-0.269*	0.002	-0.271*	0.004
CORR*LRCAPEX	-0.5714*	0.0482	-0.231***	0.001	-0.234*	0.036
R-Square	0.60751		0.95891		0.92461	
Adjusted R-Square	0.56750		0.83168		0.79154	

Note:***, **, * denotes statistical significance at 1%, 5% and 10% level, respectively
Source: Author's Computation using E-Views 13 (2024)

The study also conducted a Dynamic and Fully Modified Ordinary least squares regression (DMOLS and FMOLS), together with the Canonical Cointegrating Regression (CCR) using LNGDP and GDPG as the independent variables respectively. This would determine the moderating role of control of financial leakages on the capital expenditure-economic growth nexus in Zimbabwe. The results are shown in Tables 12 and 13. The results from all the three models (DMOLS, FMOLS and CCR) confirm that the interaction between corruption and capital expenditure derails economic growth in Zimbabwe. The results remain the same in terms of signs of the coefficients when LGDP is replaced by GDPG in Table 8. Model (3) in Table 8 also illustrates the moderating effects of financial leakages on the capex-growth nexus for robustness. GDPG was used as the independent variable and the ARDL results confirm the rest of the findings. The impulse response results in the appendix also confirm the results on all these models.

Table 13: FMOLS; DMOLS & CCR estimation results						
	FMOLS Results		DMOLS Results		CCR Results	
LRGDP	Coeff.	P >|Z|	Coeff.	P >|Z|	Coeff.	P >|Z|
Constant	1.9251	0.000	1.9251	0.000	1.9255	0.000
LRCAPEX	0.048	0.001	0.048	0.001	0.045*	0.001
CORR	-0.299	0.001	-0.298	0.002	-0.298*	0.004
CORR*LRCAPEX	-0.268	0.003	-0.268	0.003	-0.267*	0.003
R-Square	0.76923		0.76833		0.76923	
Adjusted R-Square	0.68317		0.68492		0.68317	
Durbin Watson Test	2.58619		2.57604		2.58541	
Prob (F-Statistic)	0.00000		0.00000		0.00000	

Note:***, **, * denotes statistical significance at 1%, 5% and 10% level, respectively
Source: Author's Computation using E-Views 13 (2024)

Discussion

Moderating effects of Financial Leakages

Financial leakages occur in almost every construction project, both in developing and developed countries. This severely compromises the positive image of the industry (Mejía, et al., 2020). American Society of Civil Engineers claims that corruption accounts for an estimated US$340 billion of worldwide construction cost each year (Sohail and Cavill, 2008). Similarly, according to the indexing of Transparency International, construction is one of the most corrupt industries among the various economic sectors (Owusu and Chan, 2018). When budgets allocated to procure these essential human needs are misappropriated, the net result is a socio-economic setback (Owusu, Chan, and, Ameyaw, 2019). It has hostile effects at various levels and leads to poor performance in terms of quality non-conformance, resource underutilisation and cost overruns (Bowen, Edwards, and Cattell, 2015).

Conclusion

What has emerged from the current discussion and ongoing debate on the moderating effects of financial leakages (corruption) issue is that corruption is cancerous and retards economic growth, through negative corrosive effects on capital expenditure. To be effective, measures against corruption must therefore address these underlying causes and not the symptoms. The government needs to sharpen, deepen and expand its understanding of the root causes of

financial leakages (corruption). To uproot it, corruption needs to be tackled head on and mercilessly. Corruption takes advantage of government bureaucracy and unknowledgeable officials who handle infrastructure projects with large capital outlay. Arresting corruption helps a country overcome institutional weaknesses. The judiciary should ensure transgressors receive punitive custodial sentences. This would be a strong deterrent for would be corrupt individuals and officials.

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