

# Chapter 6

## The Impact of Ebola Virus Disease on Government Expenditure in Sierra Leone



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### 6.1 Introduction

Emerging infectious disease like EVD adversely affects government tax and expenditures in many affected African countries. This has the potential to indirectly threaten the lives and livelihoods of more than 22 million people in Ebola-affected areas (ACAPS 2014). The epidemic may also have a long-term socio-economic and political implications on the affected country's development trajectory (Piot 2014). The first episode of the disease was first recorded in the Democratic Republic of Congo in 1976. The most recent outbreak occurred in Sierra Leone, Liberia, and Guinea. The origin of EVD (the primary infectious event) is yet to be known in spite of various studies that have been carried out on the epidemic. According to Nadia, (2015) an index case was identified four times and hypothesized in two other instances among the twenty-one documented outbreaks of EVD in Africa. For instance, as at 2016, there were estimated 28,639 suspected, likely, and established cases of EVD and a projected 11,316 deaths from the 2014 epidemic of EVD in West Africa (CDC 2016). More so, there were 2427 reported cases and 1597 deaths in all other outbreaks of Ebola (CDC 2016). The Ebola outbreak began slowly in Sierra Leone and quickly degenerated to an epidemic between May and June, 2014. An ex-post examination indicated that the first case recorded in Sierra Leone was a woman who was a guest at the home of the index case in Meliandou, Guinea (WHO 2015).

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The Ebola epidemic had a pronounced socio-economic impact in Guinea, Liberia, and Sierra Leone aside the devastating health effects (CDC 2016). According to a World Bank 2014 projection, “an estimated \$2.2 billion was lost in 2015 in the gross domestic product (GDP) of the three countries. The disease also resulted in lower investment and a substantial loss in private sector growth, declining agricultural production that led to concerns about food security, and a decrease in cross-border trade as restrictions on movement of goods and services increased” (CDC 2016). Sierra Leone recorded the highest number of cases with 14,124 suspected and confirmed cases and a total of 3956 confirmed deaths among all the three most affected West African countries, (CDC 2016). It equally recorded a total government budget (deficit of about 3.10% of the country’s Gross Domestic Product GDP) in 2015. Government budget in Sierra Leone averaged  $-4.46\%$  of GDP from 1999 until 2015, reaching an all-time height of  $-0.98\%$  of GDP in 2007 and a record low of about  $-9.47\%$  of GDP in 1999 (World Bank 2016).

Available literature has enumerated different views of looking into the issue of Ebola and its impact on the country’s growth and individual’s welfare. For example, Hakon et al. (2014) “noted that Ebola has strong and devastating effects on the health of the population and submitted that in addition to the direct health effects of the viral disease, the indirect effects on health service may lead to increased morbidity and mortality”. More so, factors such as patient’s fear of Ebola and death of health care staff has reportedly affected health-seeking behaviour and reduced the function of health service. Despite many studies on the Ebola-welfare transmission mechanism, decreasing government revenue resulting from the closure of most mining and food companies of the affected countries, makes investigation of the impact of the Ebola disease on the government expenditures of the affected country vital. This is because decreasing government revenue may impact negatively on the growth of the economy. This study therefore investigates the effect of Ebola outbreak on government capital expenditure of the Sierra Leonean government. The rest of this chapter is organized as follows: Sect. 6.2 reviews empirical literature on the effects of disease outbreak on government expenditures, Sect. 6.3 presents stylized facts on the effects of Ebola crisis on the Sierra Leone economy; Sect. 6.4 described the theory and method of analysis Sect. 6.5 while Sect. 6.6 presents the empirical results and discussion of results.

## 6.2 Conceptual Linkage Between Epidemic Diseases and Economic Growth

The manner of allocation of public expenditure has important impact on the development process of any nation. For example, budgetary allocations to key sectors such as health and education through its positive effects can enhance equity and reduce poverty (Gupta et al. 2001). Budgetary allocations to public sectors are classified into capital expenditure and recurrent expenditure. Capital expenditure can be

classified as a payment for non-financial assets used in the production process while recurrent expenditure is payment for non-repayable transactions within one year. Gupta et al. (1998) suggested that public spending on health and education through its positive effects on the formation of human capital can boost economic development and reduce poverty. This is achieved through reduction and eradication of diseases and improvement in the health of the populace.

The need for an instant and substantial intervention from the government given any disease outbreak especially communicable disease is likely to divert public spending from investment in development projects to health and other social spending. Foreign and domestic private investments may also decline without government support to the investors (ECA 2014a, b, c, d). For example, the 2014 Economic Commission for Africa (ECA) report on Ebola crisis in Africa showed that EVD decreased public revenue and increased expenditure in health. This creates pressure on the fiscal stability and weakened state's capacity to manage the disease or protect the economy against spill over effects of the outbreak. Fiscal imbalance due to the outbreak may also force the country to depend on external support. ECA (2014a, b, c, d) argued that health crisis due to the epidemic may lead to a large health spending to manage the disease and provide social protection as a result of the number of deaths, increase in the number of orphans and number of poor. These unfavourable changes in revenue and expenditures of government may force a reallocation of resources in favour of the new needs against productive public investment.

Economic growth is strongly connected to the increase in living standard which inevitably leads to higher economic standard. But health appears to be a decisive factor for economic growth and the increasing overall health level in the population has a strong positive effect on economic growth (Birchenall 2007). A reasonable conclusion therefore is that epidemic diseases will hinder economic growth which may further negatively affect government revenue and spending. Despite many studies on the Ebola-welfare transmission mechanism, the dwindling government revenue of the affected countries due to the outbreak of Ebola disease makes investigation of the impact of the Ebola disease on the government expenditures of the affected country vital. Studies have attempted to study the cost of the EVD on the health sector and health workers of the countries affected, as well as on individuals and households of these countries but very little or nothing has been done on the impact of the disease on government expenditure of these countries especially on the Sierra Leonean economy. This study therefore, delves into this by looking at the resulting effect from such a scenario.

### **6.2.1 Empirical Review**

There is little disagreement that the spread of EVD was aggravated by the poor health infrastructure in Sierra Leone. There are many problems facing the health sector in Sierra Leone before the outbreak of Ebola. According to "The Agenda for Prosperity" Sierra Leone health sector suffers from inadequate health infrastructure, shortage of

skilled personnel, insufficient prevalence of trained doctors and nurses and weak supervision in the health system and high burden of disease. According to WHO (2010), Sierra Leone had only 132 community health workers as at 2010 and there are more Sierra Leonean doctors working in OECD countries. Which makes Sierra Leone be one of the African countries bedevilled with brain drain in the health sector. Curtis, (2015) observed that the challenges in the Sierra Leonean health sector, as outlined in the Agenda for Prosperity, include: poor health infrastructure, inadequate health care financing resulting in catastrophic health spending. Also included in this Agenda is low coverage in the provision of water and sanitation, high burden of communicable diseases and increasing non-communicable diseases, shortage of health-care workers and weak human resource as well as poor health sector management.

Beside studies linking epidemic diseases and economic performance, other stream of literature have investigated the impact of public spending on the prevalence of diseases. Filmer and Pritchett (1999), for example, submitted that public spending on health is not significantly related to the overall health of the population and that factors such as income inequality, history of civil conflict, (female) education, ethnic and religious fragmentation and trade integration tend to be more appropriate explanation for cross-country variance in health levels than public spending on health (e.g. Castro-Leal et al. 2000; Evans et al. 2001; Ghobarah et al. 2004; Bor 2007). It was further pointed out that the effectiveness of health measures does not only rely on financial resources (i.e. public and private spending) but also on the political support or goals of the government (Cassels 1995; Hsiao and Heller 2007) and the efficient use of existing resources (institutional quality & good governance) (Walt and Gilson 1994; Evans et al. 2001; Ghobarah et al. 2004; Gauri and Lieberman 2006; McGuire 2006; Gilson and Raphaely 2008).

Thus, political and institutional features seem to play a crucial role in explaining the spread of epidemic diseases in terms of allocating funds effectively on combating infectious diseases. Also, differences in public spending patterns which can be observed between low- middle- and high-income countries may be related more to dissimilarities in health challenges as well as institutional designs of the health sector (Gerdtham et al. 1992). One major distinction between low-and high-income countries regarding health challenges, is that, while individuals in high-income countries suffer mostly from non-communicable diseases (e.g. stroke, cancer, heart attack), health systems in developing countries are used to finance the burden of communicable and infectious diseases such as Ebola and tuberculosis (Hsiao and Heller 2007).

In a study on the impact of epidemic outbreak on consumer expenditures for Middle East respiratory syndrome coronavirus (MERS) in South Korea, Hojin et al. (2016) found that the South Korean government was forced to cut the country's economic growth forecast for 2015 to 3.1%, a drop from the projected 3.8% in 2014. This was due to the government's inability to effectively control MERS. Consequently, and compared to the previous year, retail shops in South Korea faced a 3.4% decrease in sales, and department stores also experienced a 16.5% decrease in sales. The authors further asserted that the outbreak led to over 100,000 cancelled tourist visits to South Korea. As a result, a stimulus package of over \$13.5 billion and a 0.25-percentage-point cut in interest rates was offered by

the government to reduce the adverse economic effects of the outbreak. This stimulus package was a re-direction of government spending from productive sector to reduce the effects of the epidemic.

Thompson et al. (2003) on the economic costs of the foot and mouth disease (FMD) outbreak in the United Kingdom in 2001 shows that the losses to agriculture and the food chain amount to about £3.1 billion. Government incurred the majority of these costs through compensation for slaughter and disposal and clean-up costs which adversely affects government spending on productive investment. The surveys of tourism shows that tourist-related businesses lost about £2.7–3.2 billion due to reduced number of tourists. However, the overall costs to the UK economy are substantially less than the sum of these components. Much of what was gotten from tourists expenditure was moved to other sectors of the economy. According to the Thompson et al. (2003) the overall net effect of FMD was estimated to have reduced the gross domestic product in the UK by about 0.2% in 2001.

Therefore, literature, in general revealed that the overall effects of outbreak of disease such as Ebola, FMD etc. can have a depressing effect on economic growth and government expenditures and re-directs government spending away from productive sector to curtailing and eradicating disease outbreak.

### 6.3 Ebola Crisis and the Sierra Leone Economy

The 2014–2015 (EVD) outbreak in West Africa was the largest and most widespread in history. The pressures of the epidemic collapsed an already weak health system. Health workers were among the high risk group because, they were exposed to risk during routine patient care and community exposures. Piot, (2014) observed that healthcare workers were principally vulnerable to contracting the disease. This led to an increase in non-Ebola related mortality (ACAPS 2014; Piot 2014). Also, about 80% HIV/AIDS positive individuals living in the three most affected countries were unable to access treatment and pregnant women stopped giving birth in health facilities (ACAPS 2014; Glassman and Raghavan 2014). Muiderman, (2014) affirmed that the Ebola crisis had a significant negative impact on the economies of the countries it has affected and its impact can be felt in different sectors. This include loss of gross domestic output, threat to food security, and a fall in employment and decline in foreign investment (UNDP 2014).

The direct effects of EVD in Sierra Leone include over 8000 infected and 1820 deaths which include 106 health care workers. Ten out of the 124 medical doctors in the country died due to Ebola, equivalent to a risk ratio of 280 compared to the general population (Hakon et al. 2014). Many health centres and hospitals in the country were closed down due to the death or desertion of member of staff (Welthungerhilfe 2014; Glassman and Raghavan 2014). Health and burial workers also went on strike over hazard payment and in some cases no payment (ACAPS 2014). Thus, there was a general reversal of the gains made in the health sector in relation to child mortality, maternal mortality, HIV/AIDS, malaria, and other dis-

eases as a result of the closure of health services and the diversion of resources to combatting Ebola (Glassman and Raghavan 2014). The EVD epidemic also had a devastating socio-economic impact in Guinea, Liberia, and Sierra Leone beside the adverse health effects. The disease resulted in low investment and a large loss in private sector growth and declining agricultural production, and a decrease in cross-border trade due to increased restrictions on movement of goods and services. The school children lost a total of 39 productive week in Sierra Leone and children experienced a gap in vaccination schedules due to a decrease in routine immunizations by 30% (CDC 2016).

Due to disruptions in most activities such as agriculture, mining, construction, manufacturing, trade, tourism and transport in Sierra Leone as a result of the Ebola outbreak, there was a slower economic growth in the preceding years (Glassman and Raghavan 2014; UNDP 2014). There were worrying signs for future growth from the drop-in sales in the manufacturing and construction sectors (Welthungerhilfe 2014; Glassman and Raghavan 2014). In December 2014, there was a drop of  $-2.0\%$  in Sierra Leone economic growth compared to a pre-Ebola  $8.9\%$  estimated growth (World Bank 2015). The crisis culminated in increasing unemployment among the youth (GoSL et al. 2014). The government and donors agencies also diverted fund for different sectors to combat Ebola. This created a funding gap for non-Ebola related government services (Brigitte 2014). The emphasis on health versus social spending varies among the three countries. In Sierra Leone, EVD-related spending for 2014 and 2015 were about \$36 million and \$40.9 million respectively (IMF 2014a). In Liberia the authorities estimated direct EVD spending at \$79.7 million, besides \$20 million in cash transfers and \$30 million in agricultural stimulus (Government of Liberia 2014). Therefore, EVD increase fiscal deficit. The fiscal deficit in Sierra Leone was forecast to widen by 1.5% and 1.7% points in 2014 and 2015 (IMF 2014a, b).

Containing EVD led to rises in government spending and reallocation of spending earmarked for long-term growth. The balance of payments suffered because of increased food and health-related imports (Government of Sierra Leone 2014). The IMF (2014a) estimated the balance of payments shifting from a programmed surplus of \$38 million before the crisis to a deficit of \$72.4 million in 2014. The currency depreciated relative to international currencies. Other studies indicated the revenue implications of EVD on Sierra Leone and have identified transmission channels. The preliminary country estimates shows that due to the EVD, the country experienced a 14.9% decline in revenue by the end of 2014 (National Revenue Authority of Sierra Leone 2014). The EVD-related revenue loss was around \$45.7 million in 2014 and \$91.3 million in 2015, or 1% and 1.6% of non-iron GDP. In monetary terms (IMF 2014a). The negative effects of EVD in Sierra Leone include mortality of key health personnel, stretched health infrastructure and reversal of health gains as non-EVD health delivery was compromised. The education sector suffered due to school closures. Many students were forced to study via online platforms or through radio programs. Hence, EVD is a threat to social structure among vulnerable groups such as women and children. About 51% of women and 49% of men were infected including more women in agriculture and trade than men (Government of Sierra Leone 2014).

### 6.4 Theoretical Framework and Methodology

EVD like any outbreak of communicable disease puts budget under pressure due to its adverse effects on public revenue and spending thereby widening the fiscal deficit. There have been several criteria used in classifying public expenditure (Akpan 2005). Economists assumed that there should not be an absolute classification, but rather, a classification that is relative to the purpose which it intends to serve (Akpan 2005). However, the best classification of public expenditure is the economic categorization as shown below (Fig. 6.1).

Most studies carried out on the economic effects of diseases, have laid emphasis on forgone income as well as direct medical costs incurred by the population. This then results in greater morbidity and mortality of the ailment. Such costs borne by the burden of disease includes: both private and public expenditures incurred in managing the disease. All these costs are incurred or increased by the pressing need to sustain a free environment, implement better preventive measures and carry out research that can help curb the disease. (Commission on Macroeconomics and Health 2002). The immediate effect of epidemics is a negative shock on the popula-

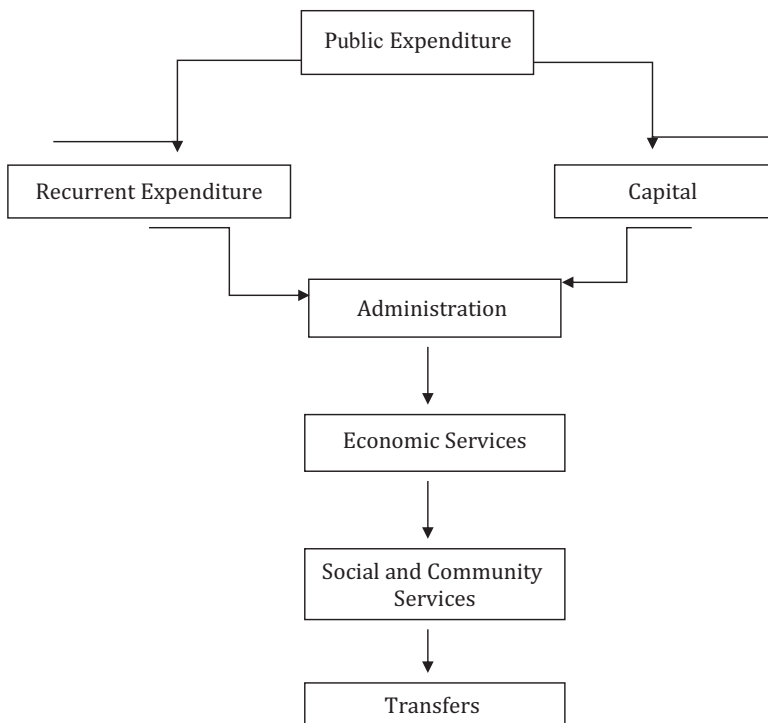


Fig. 6.1 Classification of public expenditure. (Source: Aregbeyen 2006, p 12)

tion and labour force. Lee and McKibbin, (2004) argued the destruction of human capital is another transmission mechanism through which disease outbreak adversely affects the economy's long-term growth. However, in term of private costs and public spending, the direct consequences of the Ebola epidemic are high and have detrimental effects on productive sectors. Ebola influences the Sierra Leone economy in major three ways. First, fear of Ebola leads to a considerable decline in consumer demand, especially for travel since the fast rate of contagion makes people avoid social interactions. The decrease in consumption has a more detrimental effect on regions with more service industries and higher population densities and this negatively affects not only the revenue generation capacity of the government but also compel an inevitable diversion of public expenditure from productive industry and human capital development to Ebola epidemic. Second, uncertainty concerning any future epidemics reduces confidence in the future and this effect is very important for a developing country like Sierra Leone which required foreign investment for growth and development. Third, Ebola unquestionably increases the cost of disease prevention, especially in the most affected industries, such as travel, retail and the service industries.

The Government of Sierra Leone introduced the declaration of a State of Emergency and special security powers to separate the affected areas, place restrictions on internal movement, close markets and schools and reduce public gatherings among others as measures to control the epidemic. These measures had profound effects on people. The quarantine and other restrictions of movement had a noticeable effect on economic activity, including foregone output, higher fiscal deficits, rising consumer prices, depreciation of the national currency, loss of employment and increased levels of poverty. The agricultural sector also suffered significant declines in production and disruptions in the planting cycle with far reaching effect on household food security which may take several years to recover. Other impacts include distraction of efforts aimed at improving water and sanitation and reduced social cohesion that harms vulnerable groups.

The Endogenous Growth of Public Expenditure usually provides the theoretical framework for analyzing persistent Gross National Income (GNI) growth which is determined by forces governing the production process rather than by forces outside it. The theory assumes the existence of a single sector of production or all sectors are symmetrical, existence of increasing returns to capital and that, public and private investment in human and physical capital creates economies and productivity improvements and hence impacts positively on the growth of government expenditure which subsequently sustain long-term growth. Mathematically, endogenous growth theories can be expressed as:

$$Y = AK \tag{6.1}$$

where: Y represents gross national income or output

A represents any factor that affects technology while K represents both physical and human capital



The theory assumed that for income to grow, there must be continuous accumulation of factor of production. The implication is that government can influence long-run economics growth through its investment expenditure, education (human capital) and research and development (R&D) expenditure. But given an outbreak of a deadly communicable disease, all these expenditures may be absent. The exposition of work on endogenous growth has generated a number of models linking public spending with economic growth. A particular simple version is Barro's (1990), which takes government expenditure to be complementary with production. This framework assumes that all components of public expenditure are productive. This study considers a modification of simple model of endogenous growth assuming that the government imposes a proportional income tax rate and instead of using the public budget to furnish both households with public consumption and firms with productive investments, uses public budget to contain disease outbreak.

## 6.5 Methodology

Given the modification of the endogenous growth model, the functional form of the model for this study is expressed as follows:

$$GCE = f(EVD) \quad (6.2)$$

Equation (6.2) states that government capital expenditure is a function of Ebola disease outbreak. This means that EVD influences government capital expenditure. If EVD positively affects government capital expenditure, it implies the growth of government capital expenditure during the outbreak and hence, the growth of the economy. On the other hand, if EVD negatively impacts government capital expenditure, it indicates a dampening effect on the growth of the economy during the crises. Other variables that can impact positively on government capital expenditure include the quality of human capital measure by population growth, life expectancy, net migration, health expenditure per capita and GDP growth. Causes of death by communicable diseases were employed as a measure of EVD. Therefore, Eq. (6.2) can be modified as

$$GCE = f(EVD, PG, LE, NM, HEP, GDP) \quad (6.3)$$

Where: GCE represents Government Capital Expenditure,  
 EVD represents Ebola Virus Disease,  
 PG represents Population Growth,  
 LE represents Life Expectancy,  
 NM represents Net Migration,  
 HEP represents Health Expenditure Per capita and  
 GDP represents Gross Domestic Product

Equation (6.3) can be stated in explicit form as:

$$GCE_t = \beta_0 + \beta_1 EVD + \beta_2 PG + \beta_3 LE + \beta_4 NM + \beta_5 HEP + \beta_6 GDP + \mu_t \quad (6.4)$$

Equation (6.4) measures the impact of EVD and other variables as defined above on government capital expenditure in Sierra Leone. The a priori expectations in the above equation are:  $\beta_1 < 0$ ;  $\beta_2 > 0$ ;  $\beta_3 > 0$ ;  $\beta_4 > 0$ ;  $\beta_5 > 0$  and  $\beta_6 > 0$ . That is an outbreak of disease such as EVD will reduce government capital expenditure and hence growth. An increase in life expectancy, population growth, net migration, health expenditure per capita, growth rate of GDP will increase government capital expenditure and thereby increase economic growth and a decrease in all these variables will have a dampening effect on the economy.

### 6.5.1 Data and Estimation Technique

The relevant data for the study covered the period 2006–2014. The data employed were obtained from the World Bank Data repository (World Bank 2017). The causes of death by communicable disease was from World Bank data bank including other variables like population growth, life expectancy, net migration, health expenditure per capita and GDP growth (World Bank 2017). Unit root test (Brown et al. 1975) was employed to test for the stationarity of the variables and also the use of the co-integration and error correction model (ECM) to test for both short-run and long-run effect of EVD on government capital expenditure.

## 6.6 Presentation and Discussion of Results

The Augmented Dickey Fuller test (ADF) was employed to test for the stationarity of the variables used in the analysis. In this analysis, three models were considered and they are with constant, linear trend and none (with no constant and trend). The null hypothesis in both the ADF is that there is the presence of unit root. Table 6.1 below reports the ADF results.

**Table 6.1** Augmented dickey fuller tests

Variables	Levels			First difference		
	Model 1 (constant)	Model 2 (linear trend)	Model 3 (no constant and trend)	Model 1 (constant)	Model 2 (linear trend)	Model 3 (no constant and trend)
GCE	-2.627490***	-2.582746	-1.48377***	-4.746538*	-4.635601*	-4.853823*
EVD	-3.979727*	4.455449*	-0.151322	-5.935387*	-5.935387*	-6.030935*

Lag length on ADF chosen by Akaike Criterion; \*, \*\* and \*\*\* significant at 1%, 5% and 10%. Source: Authors Computation

The results of the ADF tests reported in Table 6.1 show the behaviour of the variables in their levels and first difference form respectively. Model 1 includes a constant; model 2 includes a constant and a linear trend while model 3 includes none in the test regression as exogenous. The lags were selected based on the Schwartz Information Criterion for all the variables to ensure that the residual was white noise (i.e. it has zero mean and a constant variance). The result shows that GCE was stationary at levels for model 1 and model 3 and non-stationary at model 2 while it was stationary at the first difference in the three models. Also, EVD was stationary at levels for both models 1 and models 2 and also at first difference for the three models. Therefore, we can say that GCE and EVD are both integrated of order 0 and order 1 at different models. These results indicate that the series are  $I(0)$  variables. Hence, we can conduct co-integration tests on the variables. Tables 6.2 and 6.3 show the estimated results of the Engle-Granger co-integration test and the results of the residual-based test. It is clear from the results that we cannot reject co-integration (i.e. long-run relationship) between GCE and EVD.

Unit root test performed on the residuals in Table 6.3 shows the test statistic ( $-3.649$ ) is less than the critical ( $t$  tau) value ( $-3.082$ ) at 5% significance level. Therefore, the null hypothesis of no co-integration was rejected in favour of the alternative. This indicates evidence of long-term relationship between GCE and EVD in Sierra Leone. However, the speed of this pre-shock adjustment depends on ECM result.

Table 6.4 shows the ECM estimates for the short-run and long-run movements and the speed of adjustment. From the table, EVD has negative effect on GCE in the short-run and this is statistically significant at 5% level. This suggests that EVD negatively affects GCE in the short-term in Sierra Leone. Table 6.4 further shows the long-run relationship between GCE and EVD. The equilibrium adjustment coefficient ( $-0.8044$ ) shows the correct sign (negative). This suggests that GCE and EVD converge to long-run equilibrium and deviations from this equilibrium relationship as a result of shocks will be corrected over time. It can also be observed that  $\alpha_2$  tends to one, indicating that the speed of adjustment to equilibrium is fast. It follows that about 80% of the deviation from equilibrium path is corrected

**Table 6.2** Estimation of the long run relationship ( $GCE = \alpha_0 + \alpha_1 EVD + \mu_1$ )

Variables	Co-efficient	Std error	Significance	D.W Stat
Constant	0.8106	0.573	0.051	1.956
EVD	-0.7665	0.487	0.097	

Source: (Author's Computation)

**Table 6.3** Residual based unit root test ( $\Delta\mu_t = \alpha\mu_{t-1} + \epsilon_t$ )

Variables	Critical value 10%	Critical value 5%	Critical value 1%	Test statistic
Residuals ( $\mu_t$ )	-2.68288	-3.08179	-3.963	-3.649**

Lag length on ADF chosen by Akaike Criterion. Source: (Author's Computation)

\*, \*\*, \*\*\* indicates significance at 1%, 5% and 10% significance level

**Table 6.4** Error correction mechanism ( $\Delta GCE = \alpha_1 + \alpha_2 \Delta EVD + \epsilon_{t-1}$ )

Variable	Co-efficient	Std error	t-Stat	Significance level
$\alpha$	-0.175728	0.26558	0.66168	0.5217
$\alpha_1$	-0.043532	0.495276	0.8789	0.03**
$\alpha_2$	-0.8044	0.3440	-3.5885	0.01*
$R^2 = 0.54192$				
Adjusted $R^2 = 0.45865$				
DW = 1.975				

Lag length on ADF chosen by Akaike Criterion. \*, \*\*, \*\*\* indicates significance at 1%, 5% and 10% significance level. Source: (Author's Computation)

**Table 6.5** The regression result of the impact of Ebola on government capital expenditure

Government capital expenditure	Coeff <sup>a</sup>	SE <sup>b</sup>
EVD (Ebola Virus Disease)	-0.87***	0.49
PG (Population Growth)	4.36*	1.20
LE (Life Expectancy)	4.25*	1.15
NM (Net Migration)	2.47	5.53
HEP (Health Expenditure Per capita)	0.89	0.69
GDP (Gross Domestic Product)	0.12	0.45
Constant	0.43***	0.23
$R^2 = 0.991702$ ;		
Durbin Watson (DW) = 1.550248;		
F-statistics = 866.4929; P-value = 0.0000		

<sup>a</sup>Estimated Parameters \*, \*\*, \*\*\*, Significant at 1%, 5% and 10%, <sup>b</sup> Robust Standard Errors

per annum. The ECM results therefore show a long-run relationship between GCE and EVD.

The result of the Ordinary Least Square result is presented in Table 6.5 further shows that the coefficient of EVD conforms to our apriori expectation. It shows that EVD impacted negatively on government capital expenditure and hence on growth. The transmission mechanism involves the redirection of government capital expenditures which are supposed to be spent on investment and infrastructural facilities to containing the spread of the disease and treating the infected individuals. More so, much of the foreign assistance to the country will also be targeted at attacking the epidemic rather than economic growth and development. These will conspicuously have a dampening effect on growth in Sierra Leone. Therefore, EVD or outbreak of any communicable disease will affect government capital expenditure negatively and by implication dampen the economic growth of any affected country. Also, population growth and life expectancy are directly related to government capital expenditure. This also implies that both can aid growth of the economy with an increase in capital expenditure. Both results are also significant at 1% level. Net migration, health expenditure per capita and GDP are also positively related to government capital expenditure but not significant. The non-significance of net migra-

tion, health expenditure per capita and GDP may be as a result of the outbreak of the disease during this period.

The F-statistic result shows that Ebola disease (EVD), population growth (PG), life expectancy (LE), net migration (NM), health expenditure per capita (HEP), and GDP are jointly statistically related to government capital expenditure and the Durbin-Watson statistics shows absence of autocorrelation. The result of the  $R^2$  implies that about 99% of the variation in the government capital expenditure in Sierra Leone can be explained by EVD and other covariates.

## 6.7 Conclusion

The occurrence of the Ebola Virus Disease between 2013 and 2015 has so far had far reaching and devastating socio- economic and political effects on the general population of Sierra Leone. As highlighted earlier, the disease did not only infected and killed people in this country, but had the greater impact of affecting the economic situation of the country leading to a deficit in government budget of about 3.1%. This study examined the impact of EVD on government capital expenditure in Sierra Leone. This is important for the implication of disease outbreak on economic growth. The study shows that EVD impacted negatively on government capital expenditure, hence economic growth. EVD impacted negatively on growth due to diversion of government spending on curtailing the spread of the disease, treating the affected individuals and caring for the orphans and widows who lost their parents and husbands due to the outbreak of the disease. Equally, the restriction of movement of people to and from affected zones also led to many more people not being able to work and thus leading to a decline in productivity and growth. Minimizing the impact of communicable diseases vs reducing their occurrence is to prioritize investment in human capital development through e.g. education for all, water and sanitation for all, settings approaches (healthy cities, Health promoting schools, health promoting hospitals, health promoting working places and markets), etc. Emergency funds also needs to be created to spend on possible future occurrence of this nature, so as to prevent spending funds meant for growth on containing outbreak of diseases. Finally, since economic growth and development are the main objectives of public expenditure, issues of growth policy should emphasize quality and adequate levels of investment in social and economic infrastructure.

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