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Impact of Foreign Aid on Economic Growth in Sierra Leone

Empirical Analysis

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Abstract

This paper examines the impact of foreign aid on economic growth in Sierra Leone, a country where an empirical econometric study on aid effectiveness is yet to exist. Using a triangulation of approaches involving the ARDL bounds test approach and the Johansen maximum likelihood approach to cointegration for the period 1970-2007, we find that foreign aid has a significant contribution in promoting economic growth in the country. This finding is found to be robust across approaches and specifications. Whilst aid may have been associated with improvement in economic growth in the country, its impact during the period of war is found to be either weak or non-existent. Further, aid during the pre-war period is found to be marginally more effective than aid during the post-war period. The latter results suggest that the impact of aid may change with time.

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Acronyms

AIC	Akaike information criteria
ARDL	autoregressive distributed lag
ECM	error correction mechanism
HIPCs	heavily indebted poor countries
ICRG	World Bank's international country risk guide database
ODA	official development assistance
SIC	Schwartz/Bayesian information criteria
SSA	sub-Saharan Africa

1   Introduction

It is no secret that developing countries are characterized by resource starved economies, with crucial constituents of these resources being capital-related. This much needed capital to boost economic growth and welfare is largely inadequate domestically, which consequently warrants the need for external capital. And as most of low-income countries lack the necessary impetus to attract substantial foreign direct investment, the only external capital readily available to support development undertakings has to come from foreign aid. Foreign aid, and in general external capital, has been postulated by prominent scholars of development economics to be a vital input to supplement low savings and hence support development in low-income countries. However, in as much as theory is largely in conformity with regards the role of foreign aid in promoting development in underdeveloped countries, the empirical evidence has rather remained in disagreement. Some studies show that aid impacts positively on economic growth, whilst others either find the relationship to be insignificant or even negating growth, or that the impact of aid is conditional only on policy, governance and the environment.

This paper attempts to contribute to the empirics of aid effectiveness in three ways. First, it contributes to this literature by focusing our investigation on a unique country case study for Sierra Leone. This country study is unique in the sense that not only has there been no empirical study on impact of foreign aid in the country, but also that it combines crucial attributes of being a largely aid-dependent country, and a country that has experienced drawn out political instability and characterized by dismal development statistics. Appendix Table A1 provides a table of an overall period average and 5-year averages from 1970-2007 of per capita growth performance for Sierra Leone compared to developmental sub-groups comprising of heavily indebted poor countries (HIPCs), low-income countries, developing countries (low income and middle income), Africa and sub-Saharan Africa (SSA). Trends in GDP per capita growth for Sierra Leone have been fluctuating since the 1970s just as it does for the other developmental groups. Generally, there has been an increase in Sierra Leone's GDP per capita from 1.85 per cent during1970-74 to 3.61 per cent during 2005-07. Improvements in GDP per capita growth were seen particularly during 1970-74, 1980-84 and in the post-war periods of 2000-04 and 2005-07. Besides growth in the later years (2000-07), the positive growth figures in the pre-war era are even seen to be somewhat low to sufficiently improve the standard of living in the country. In fact, the trend shows that there were lengthy periods of unimpressive GDP per capita growth for the country; typically during 1975-79 and from 1985-99, with the highest fall in GDP growth per capita being evident during the peak of the civil conflict in 1995-99, with a decline in GDP per capita growth of 6.28 per cent. The picture is even more glaring when we compare overall period averages of GDP per capita for the country against those of the developmental groups (Appendix Table A1). Besides the group of HIPC countries, Sierra Leone shows the weakest average GDP per capita growth for the entire period of 1970-2007 with an average growth rate of only 0.36 per cent. Possibly, the periods of decline in GDP per capita growth evident from 1985-89 right through the conflict periods from 1990-99 may have had some damaging effect on overall economic performance of the country to the extent it lags far behind most developmental groups on average.

Not only have growth figures been dismal for Sierra Leone, this has also been a country well known for unimpressive poverty statistics. For instance, since the commencement

of the United Nations Development Programme's human development reports, Sierra Leone has remained within the bottommost end of the human development index, and further happens to be one of the countries with the highest infant mortality rates in the world. Appendix Table A2 presents a table that compares the welfare/poverty statistics for Sierra Leone as compared with SSA and Africa. The table shows that on average from 1980-2007, the human development index and infant mortality rate for Sierra Leone remains considerably worse off as compared to SSA and Africa as a whole, even though both happen to be the world's worst performing region and continent.

Amidst these damning poverty statistics, Sierra Leone has been a recipient of substantive donor aid, which surged further following the end of the 11-year civil conflict. Hence, the country has remained highly aid-dependent with disbursed volumes of aid higher than even the average for the most aid-dependent subregion, SSA. Appendix Figure A1 presents a simple bar chart showing foreign aid disbursed to Sierra Leone for the period 1970-2007 compared with SSA and Africa, the most aided sub-region and continent respectively. As can be seen from the chart, total donor aid disbursed to Sierra Leone stands at an average of 14.2 per cent of GDP for the period 1970-2007, which is far above the average for SSA of 4.8 per cent and that for Africa at 3.7 per cent for the same period. This implies despite the fact that Africa happens to be the most aided continent yet Sierra Leone, a constituent state of this continent is by far a higher recipient of foreign aid.

Hence, it is evident that despite notable donor intervention in the country's economy, growth and poverty remain inherent. But in spite of this paradoxical scenario, research had not captured the attention of assessing the effectiveness of aid in such a country in order to find out whether aid has been effective, or whether, in fact, the persistent poverty in such an aid-dependent country is not the result of the ineffectiveness of aid. Hence, this paper makes a contribution into this limited aid-growth empirics at the country level (which do not suffer from the effect of country heterogeneity typical of cross-country regressions). The paper not only provides evidence on aid effectiveness for a country for which no such study had existed to date, but also provides a case study on a country that is characterized by high aid dependency, unimpressive economic performance, as well as one that has faced prolonged and severe political instability.

Further to contributing to the less researched country empirics on aid effectiveness, this study makes a second contribution to this literature by probing into the possible differential impact of aid with time, focusing on its effect on the country's post-conflict period. Whilst Collier and Hoeffler's (2002) study on the impact of post-conflict aid focuses only at the cross-country level, this study analyses this relationship at the country level for Sierra Leone, a country that has witnessed a brutal 11 years of civil conflict. Lastly, this paper contributes to the aid-growth empirics at the country level by employing a triangulation of approaches to assessing aid impact on growth instead of relying on a single technique of estimation, as is common in the limited country literature. Typically, in the pluralistic analytical framework, this paper employs two timeseries econometric techniques involving the autoregressive distributed lag (ARDL) approach to cointegration and the Johansen maximum likelihood cointegration approach for the period 1970-2007. By using a pluralistic methodological approach of the more advanced timeseries econometric techniques, it is hoped that this paper will provide more robust results for the aid-growth relationship at the country level.

Further, methodological contribution is enhanced by the fact that both approaches used to estimate the impact of aid effectively account for problems of endogeneity. Foreign aid has been largely argued in the literature to be endogenous. Boone (1996), Franco-Rodriguez, McGillivray and Morrissey (1998), Burnside and Dollar (2000) and Feeny (2005) for instance consider the problem of simultaneity bias as due to the possible endogeneity of foreign aid. The main reason suggested for this in the aid-growth regressions is that it is difficult to perceive aid as a lump-sum transfer that does not take into consideration the level of income of the recipient country. Donors may tend to allocate less or more aid to countries that do not tend to do well in terms of their economic performance. If aid depends on the level of income, it cannot therefore be exogenous with regards to growth, as has been traditionally assumed. Therefore, not accounting for possible endogeneity of aid may possibly bias the results. In this regard, we use not only the ARDL estimation approach that provides consistent estimates even in the presence of endogenous variables, but also complement it with the Johansen approach that accounts for simultaneity bias as we treat aid and other possible endogenous regressors as endogenous in the cointegration estimation. The use of ARDL approach alone to account for endogeneity has been argued by some researchers as not being quite sufficient to eliminate the problem of endogeneity of the regressors. According to Feeny (2005), although the ARDL model is able to provide consistent estimates in the presence of endogeneity, the parameters may still be biased as a result of endogeneity. Hence, to minimize this problem, we complement the ARDL estimation with the Johansen maximum likelihood estimation which corrects for simultaneity bias. Hence, with country specificity in mind, we argue in favour of the supplemental theorists that foreign aid promotes economic growth, but also that the impact and marginal effectiveness of aid varies with time and the form of the political environment.

The remainder of this paper is organized as follows: The next section presents highlights of the theoretical and empirical literature on aid effectiveness. The second section then presents the empirical model for estimation of the aid-growth relationship. This is followed by an overview of the estimation strategy and unit roots test. We then present the empirical results on the examination of the relationship between foreign aid and economic growth for both estimation methodologies employed. This is followed by a further analysis of the aid-growth relationship by investigating the impact of aid during the post-conflict period. We conclude in the final section.

2   Brief review of the literature

2.1 The aid-growth relationship: What does theory suggest?

Theory suggests that foreign aid promotes economic growth by supplementing limited domestic savings as well as foreign exchange constraints of recipient developing countries. The work by Chenery and Strout (1966) which itself has its basis on the Harrod-Domar model of economic growth, has been important in this respect in the early literature. The three elements of the Harrod-Domar model are income (growth), investment (savings) and capital-output ratio (ICOR) related in the form:

$g = I/ICOR$

The incremental capital-out ratio (ICOR) represents ratio of additional investment to additional output; 'g' is the growth rate of the economy; and 'I' represents investment (which is equated to savings).Hence, with the ICOR remaining constant, the rate of economic growth will be directly determined by the rate of investment. With investment assumed to be equal to savings, this implies that a poor country, with low savings, will have low investment and therefore low growth. It is thus expected that a supplementation of domestic savings by foreign aid will resort to an increase in investment, and hence economic growth (White 1974: 114). Chenery and Strout (1966) base the first step of this two-gap analysis on the case where resource limits on skills and savings are important, and describe this scenario as 'investment limited growth' (ibid: 683), where the Harrod-Domar model is taken as the limiting case of no foreign assistance. In the second step, they consider the possibility for attaining self-sustaining growth when the balance-of-payments limit is effective and hence describe this situation as 'trade limited growth' (ibid: 683). Calculation of the savings gap is made possible from the Harrod-Domar equations. A savings gap occurs, when the quantum of domestic savings available is less than the amount of investment required to attain the target growth rate, and hence this gap can be filled with foreign aid. Similarly, a foreign exchange gap arises when the net receipts of a county's exports fall short of the foreign exchange requirements; the resulting gap being filled by foreign aid (Jhingan 2004: 472). Hence, the dual-gap analysis makes an important contribution to development theory by emphasising not only the traditional domestic savings gap but also the foreign exchange gap, which in itself stresses the importance of imports and foreign exchange in the growth process.

Eventually, further growth theories emerged contesting portions of the postulations of the Harrod-Domar model; and such have been the models largely employed in the assessment of the impact of aid on economic growth. The crucial ones have been the emergence of the neoclassical growth theory and the new endogenous growth theories. The neoclassical model, which is largely inspired by the Solow model of long-run growth, was constructed as an alternative to the Harrod-Domar growth analysis and hence was devoid that of the latter's critical assumptions of fixed proportions in production. This implies Solow's neoclassical growth model assumes a continuous production function relating output to the inputs of capital and labour which (as opposed to the Harrod-Domar model) are substitutable and exhibit diminishing returns to scale. The assumption of diminishing returns, as is proposed by Solow, implies for each unit of additional capital (part of which constitutes foreign aid) invested in the economy, it produces smaller returns unto the point when no more profits are accrued from additional capital.

The endogenous growth theory was constructed from the shortcomings of the neoclassical model of economic growth, with Arrow (1962), Romer (1986) and Lucas (1988) being the key contributors. This new growth theory acknowledges the importance of endogeneity of capital in the growth process. Assumption of increasing returns as opposed to constant returns of capital typical in the neoclassical growth theory was another differencing attribute. This theory also emphasized the importance of human capital in the growth process, and hence the assessment of foreign aid on economic growth fits into this new growth theory since aid in the form of technical assistance can be an important attribute in influencing capacity building and hence human capital in most aid-recipient countries. Lucas, for instance, assumes that investment in education leads to production of human capital which is the crucial determinant of the growth process. Issues of research and development and learning by

doing or by investment became important in the new growth theory (Jhingan 2004). The implication of this theory for developing countries is that such countries stand to benefit more from trade with developed countries by drawing on the new knowledge in research and development and new technologies and hence the need to encourage trade openness. The new growth theory in particular recognizes the importance of public policy to economic growth and this justified the inclusion of policy variables in empirical aid-growth regressions. Further, the assumption of increasing returns to capital of the new growth model implies that foreign aid will improve growth well into the long run.

Consistent in all these growth models is the importance of capital in determining economic growth. Whilst the additional determinants of growth may differ in some respect, capital is commonly postulated as an important determinant of growth. But whether these capital sources are empirically proven to determine growth in cross-country and in-country regressions has remained a debate. Further, even though capital is postulated to determine economic growth, it is important to empirically prove whether it is all types of capital that determine economic growth in developing countries. In this respect, even though we model other types of capital in this study, we prioritize foreign aid as a key source of capital in determining economic growth in Sierra Leone. In the next section, we review the literature on the empirical evidence on the impact of foreign aid on economic growth both at the cross-country and country levels.

2.2 The empirical evidence

Following the aforementioned growth theories, a considerable number of empirical studies have been conducted to ascertain the theoretical construct of the aid-growth relationship both at the cross-country as well as the country level. Cognizant of the enormous existence of empirical studies on aid effectiveness, this paper limits the review to the presentation of the aid effectiveness findings from meta studies, which are qualitative and/or quantitative studies on a comprehensive review of the aid effectiveness literature. The paper further provides an analysis of the literature in terms of its methodological limitations. Two meta studies on the aid effectiveness literature have in particular been drawn upon not only because of limitation of space, but also because these are comprehensive and contemporary with regards to the coverage of aid empirics. These include the studies by Tsikata (1998) and Doucouliagos and Paldam (2008). Other meta studies mentioned are those by Hansen and Tarp (2000) and McGillivray et al. (2006), also comprehensive and contemporary in their review of the aid literature.

Tsikata's (1998) analysis reveals that aid's impact on growth still generally remains debatable and insignificant relationships still persist on the basis of the prevalent evidence from empirical literature. The study finds some evidence that aid has had a positively significant impact on economic growth under policy conditions conducive to growth. It should be observed that Tsikata's (1998) meta analysis follows the publication of the World Bank' report (1998) *Assessing Aid*, and could not have foreseen the criticism following the findings' by Burnside and Dollar (1997, 2000) and some of their World Bank colleagues that aid is effective in contributing to economic growth only under conditions of good policies. In terms of aid's impact on growth via channels of domestic savings and investment, Tsikata (1998) finds that the results were

mixed, with some pointing to a significant relationship in countries that succeeded in sustaining the adjustment effort.

Doucouliagos and Paldam (2008) conduct the first full quantitative meta-analysis on the impact of foreign aid on economic growth, which involves quantitatively investigating the direct impact of foreign aid on economic growth on the basis of the aid-growth regressions conducted over 40 years of aid effectiveness research. Up to the time of their writing, 68 such studies existed in the literature and these contained a total of 543 direct estimates of the aid-growth impact and hence formed the bulk of their study dataset. Generally, the results of their analysis do not support the optimism found by McGillivray et al. (2006) that the debate on aid impacts on economic growth is settled following an upward twist in the evidence since the late 1990s towards a positive and significant relationship; neither do the results support the positive conclusion that Hansen and Tarp (2000) establish. Doucouliagos and Paldam (2008) argue that even after 2006 there is increasing evidence to show that aid does not promote economic growth. They further show that the reported aid-growth relationship was weaker in the 1970s and 1980s, but improved in the 1990s and 2000s; an improvement, which however, does not imply that there was no recent evidence of an insignificant relationship of recent as McGillivray et al. (2006) suggest, but does imply an improvement in the reported aid–growth associations during this period compared to the early literature.

Whilst the aforementioned meta analysis of the aid literature may have reviewed only the evidence and hence largely presents a picture of inconclusiveness of the aid effectiveness literature, a further analysis of this literature shows that not only is the evidence contentious, which should warrant further investigation, but which is also limited in terms of the robustness of methodologies employed. Methodological limitations in particular clearly emerged in several of the studies at both cross-country and country regressions. However, some notable studies (e.g., those by Papanek 1973 and Karras 2006) made critical innovations to estimating the relationship, yet used limited number of variables as determinants of growth, justifying their variable limitation on the grounds of merely wanting to focus on the effect between foreign resources and growth. The effect is omitted variable bias, with the likelihood of the coefficients becoming significant even though they may not have. Further evident in the methodological limitation of some of the aid effectiveness studies, is that the outcome of the results seems to be influenced by the analytical methodology employed. Studies (for example, Levy 1988; Karras 2006) that compared the effect of aid across both cross-section and panel data, proved the advantage of time effect in the panel data estimation in terms of robustness of the results. There are also several studies that do not account for endogeneity of the aid variable, which is all but clearly existent in developing countries. Whilst the sophistication of the methodology used may guarantee more realistic results, it does not guarantee that the results are necessarily positive. For instance, Mosley's (1980) study, being the first to correct for the endogeneity of the explanatory variables obtains results that show aid as not having a positively contributing impact on economic growth. However, accounting for endogeneity of the explanatory variables, particularly the aid variable, points to more realistic results.

Perhaps even more importantly, cross-country studies in particular have the problem that countries are heterogeneous, with such heterogeneity of individual country circumstances not necessarily guaranteeing the applicability of the cross-country findings to in-country studies. This criticism is supported by the meta analysis of

Doucouliagos and Paldam (2008) that aid-growth results are associated with regional differences, particularly the inclusion of Asian economies in the cross-country regression sample, as it tends to lead to a more positive and significant impact. Thus, this makes it relevant to conduct a country study whose result will be much more reflective of the country's performance and not be buoyed by the inclusion of rather good performing Asian economies in a cross-country analysis; hence the relevance of our research's focus on Sierra Leone as a country case study.

The above limitations are not only restricted to the cross-country studies but are also evident in the country regressions. Weaknesses in country studies have ranged from the use of short timeseries, crude methodologies, and weak proxies. The early country studies by Islam (1992) (with 17-year series), Mbaku (1993) (with 20 years) and Murthy, Ukpolo and Mbaku (1994) (20-year series) are especially evident with quite short timeseries, making their aid findings only acceptable with caution. A further problem with the reliability of these studies is their use of the variables, foreign capital and foreign aid; with the former being different from the latter as it includes foreign direct investment or other non-aid foreign capital inflows. In fact, these early studies, although paving the way for the timeseries estimation of the impact of foreign aid on economic growth, yet were so plagued with methodological and other weaknesses that prompted Bring (1994) to stage a strong critique particularly for Mbaku's (1993) study but also that of Islam (1992). Bring's (1994) critique was mostly based on methodological grounds and to some extent on the purpose for which aid is given. In his applied economic letter, 'how not to find a relationship between foreign aid and economic growth', Bring (1994) argues that the methodologies of these studies were below standard and violated the assumptions of OLS to the extent that findings emerging from them should not be relied upon.

Eventual studies that used fairly longer timeseries and standard econometric timeseries techniques are as well inundated with weaknesses that pose a challenge to their findings.For instance, most of the existing country studies have been plagued with problems of using weak proxies thus limiting comparisons and interpretations of findings. The study by Lloyd, Morrissey and Osei (2001) on Ghana is an example that used the growth of private consumption to represent economic growth, which is simply not a comprehensive and better proxy for economic growth. Usually government consumption in low-income countries like Ghana is considerably substantial to be ignored and hence use growth in private consumption solely as representing growth in the economy. Growth in GDP (which constitutes both private consumption and government consumption) is the most reliable and closest proxy for economic growth. Hence, their study is useful in establishing the impact of aid on private consumption, but with limited contribution to the literature on the impact of foreign aid on economic growth. Thus, issues of comparisons of their results with others remain questionable. Likewise, the study by M'Amanja and Morrissey (2005) uses 'loans' as proxy for foreign aid, which is unacceptable. Loans are just one component of foreign aid; grants also constitute a significant portion of foreign aid received by a country, particularly in low-income and fragile states. Hence, despite the fact that there has only been a limited number of country studies that have investigated the impact of aid on growth using the timeseries approach, a good number of these also exhibit certain limitations that render their findings acceptable only with caution.Hence further research in other country case studies on the impact of foreign aid on economic growth, as is done in this paper, remains relevant.

This review concludes that the empirical evidence on the aid-growth relationship has been not only inconclusive from both the cross-country and country regression, but also confronted with notable methodologically related limitations that should welcome further research into the effectiveness of foreign aid that particularly accounts for these limitations.

3 The empirical model

Following from the earlier highlights of economic growth theories typical of the Harrod-Domar, neoclassical and endogenous growth theories, it is apparent that all postulate capital to be an important determinant of economic growth. Our empirical model specification for estimating the impact of foreign aid on economic growth specifies capital and other key determinants of economic growth as commonly suggested in the growth literature. Therefore, in deriving our empirical model for estimating the aid-growth relationship for Sierra Leone, we posit that:

$$Y = f(X, Z)$$

Y denotes output (i.e.,real GDP), X is a vector of capital sources, and Z is a vector of other growth-determining variables as found in the empirical literature and which are crucial for technological productivity. The endogenous growth model in particular emphasizes in general the importance of capital (both physical and human) and policy for promoting economic growth. On this basis, the above theoretical model motivates the general empirical growth model for the timeseries growth regression, which is specified as follows:

$$RGDP_t = \alpha + \beta X_t + \gamma Z_t + \mu_t \tag{2}$$

where RGDP is real gross domestic product being a proxy for economic output, and X and Z are as previously defined. μ_t is the error term, while subscript t, denotes time.

Critical capital sources[1] for economic growth of developing countries comprise foreign aid and private investment.

$$\text{Hence, } X = f(Aid, PI) \tag{3}$$

Where 'aid' denotes foreign aid, which is net official development assistance (ODA) as a share of GDP, PI denotes private investment as a share of GDP. This assumes that PI, which constitutes private domestic capital sources (such as domestic credit to the private sector) and foreign direct investment, is a critical source of capital in addition to foreign aid that can augment economic growth. Herzer and Morrissey (2011), in their cross-country study of foreign aid effectiveness present capital as the single most important factor that influences domestic output. Of this capita stock, they specify foreign aid and

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[1] Capital sources are largely physical capital sources, as data for human capital for Sierra Leone are virtually unavailable. However, as some form of aid is disbursed for technical assistancewhich could account, to some extent, forhuman capital in the model (as is justified by Bhattarai 2009).

private investment in addition to domestic taxes in the production function as the critical components of capital that determine domestic output.

As found in the literature, other growth determinants:

$$Z = f(Policy, IQ1) \tag{4}$$

where 'policy' denotes macroeconomic policy index, accounting for fiscal, monetary and trade policies. Fiscal policy is proxied by government final consumption expenditure (Easterly and Rebelo 1993). Monetary policy is proxied by inflation (Fischer 1993; Burnside and Dollar 1997, 2000). Trade policy is proxied by trade openness measure, which is (imports + exports)/GDP (Burnside and Dollar 1997; Feeny 2005; Javid and Qayyum 2011). These policy measures are found to affect growth of the economy.

The variable, IQ1 denotes property rights score, whose component variables follow Knack and Keefer's (1995) component variables in their construction of an index of property rights/institutional quality. The literature on property rights seems to be in agreement that secure property rights contribute positively to economic growth through the promotion of investment (Przeworski and Limongi 1993; Knack and Keefer 1995). As economic theory and empirical evidence generally find investment to be a critical determinant of economic growth, the protection of property rights, which in itself provides insurance for investment, will ultimately contribute to economic growth. In addition, North and Thomas (1973) and North (1990) argue that secure property rights are important for economic growth.

Thus, substituting (3) and (4) in (2), gives our detailed empirical growth model as:

$$RGDP_t = \alpha + \beta(Aid, PI)_t + \gamma(Policy, IQ1)_t + \mu_t \tag{5}$$

Simplifying, this gives us the empirical model for estimation as:

$$RGDP_t = \beta_0 + \beta_a Aid_t + \beta_i PI_t + \beta_p Policy_t + \beta_{iq} IQ1_t + \mu_t \tag{6}$$

To capture economic growth using RGDP, we use log of RGDP (as has been used by Kargbo and Adamu 2010; Adhikary 2011; Herzer and Morrissey 2011), as log difference of RGDP implies economic growth. Correspondingly, all the regressors are expressed in logarithms with the exception of the policy index which has some negative observations. Thus the model as used in the empirical analysis is specified as:

$$LRGDP_t = \beta_0 + \beta_a LAid_t + \beta_i LPI_t + \beta_p Policy_t + \beta_{iq} LIQ1_t + \mu_t \tag{7}$$

A positive and statistically significant coefficient of the aid variable is interpreted as aid having an impact in promoting economic growth in the country.

4   The estimation procedure

The timeseries analysis of the impact of foreign aid on economic growth in Sierra Leone follows the technique of cointegration, which is employed to estimate the long-

runimpact of aid on economic growth; accompanied by an error correction model representation which provides estimates for the short-run and the adjustment term once cointegration is found to exist. The timeseries period covers the years from 1970 to 2007, which is a relatively long series with the advantage of obtaining adequate degrees of freedom as well as having the capacity to incorporate more growth determinants into the model and hence to yieldless unbiased estimates that could have been made biased as a result of omitted variables. We introduce a triangulation approach involving a combination of different techniques of cointegration to establish the impact of foreign aid on economic growth.

As most macroeconomic variables are found to be non-stationary or integrated of order 1 over time, econometric practice had previously involved the differencing of any non-stationary variables before doing the necessary estimations. The cost to such a practice had involved the loss of long-run information on the variables, and hence had been criticized as being non-standard. Therefore, to deal with the problem of non-stationarity, later studies have increasingly used the standard technique of cointegration and error correction mechanism (ECM) to estimate time-series relationships. Generally, cointegration establishes the existence of long-run relationship among the variables. As our study involves the use of economic variables which are largely seen to be non-stationary, in order to obtain long-run information, there is the need to establish the existence of cointegrating relationship between economic growth and its determinants including foreign aid, which is our variable of interest.

Three main methods of cointegration are commonly used inthe literature: the Engle-Granger two-step procedure, the Johansen likelihood approach and the more recent autoregressive distributed lag (ARDL) bounds test approach to cointegration modified by Pesaran and Shin (1999). The Engle and Granger (1987) approach, which involves a two-step procedure, is limited to a bivariate model and hence cannot be applied in our study in which the models constitute more than two variables. Thus, we employ the other two approaches (the autoregressive distributed lag bounds test approach and the Johansen maximum likelihood technique tocointegration) to estimate the aid-growth relationship, with both approaches being applicable in a multivariate regression situation. Although we use and triangulate findings from both approaches in this study, we consider the ARDL approach as our main technique of estimation; which implies should there be any contradicting results between these two techniques, we prioritize those estimates from the ARDL approach. Our prioritization of this approach is based on the unique power of its estimates being found to be more efficient and reliable in small samples than those from counterpart estimators such as the Johansen technique (Inder 1993; Banerjee et al. 1993).

The choice of the ARDL methodology for approaching our investigation is premised on several considerations. First, as opposed to the Johansen likelihood approach to cointegration analysis, the ARDL approach avoids the problem of order of integration. The cointegration approach by Johansen (1991) and Johansen-Juselius (1990) requires that variables be of the same order of integration (i.e., I(1)). Hence, the ARDL approach is observed to have the advantage of flexibility in that it can be applied irrespective of whether the variables are of different order of integration (Pesaran and Pesaran 1997). Second, Inder (1993) shows that estimates from ARDL approaches are much reliable than their counterparts even if the dynamic structure is over-specified; and also that sizes of the t-tests from an estimator that uses an ARDL approach is much more reliable. Third, Banerjee et al. (1993) show that the ARDL approach to cointegration is

especially attractive when carrying out cointegration in small samples, and that it is also more efficient than other VAR methods. This is also confirmed by Pesaran and Shin (1999) and Pesaran, Shin and Smith (2001) who show that the ARDL model outperforms alternative approaches like the Phillip and Hansen's fully modified OLS when the sample size is small. Finally, Pesaran and Shin (1999) show that by appropriately modifying the orders of the ARDL model is adequate to simultaneously correct for residual serial correlation and the problem of endogenous regressors, thus giving ARDL an advantage over other approaches to cointegration. This is also justified by Harris and Sollis (2003), and Constant and Yue (2010). The inclusion of dynamics is shown by Inder (1993) and Pesaran and Pesaran (1997) to help correct for endogeneity bias. As foreign aid has been largely argued to be endogenous, this makes the use of this methodology all but appropriate for the estimation of the aid-growth relationship.

The modified approach by Pesaran and Shin (1999) uses the error correction version of the ARDL model and takes the following form:

$$\Delta y_t = \alpha_0 + \alpha_1 t + \sum_{i=1}^{m-1} \varphi_i \Delta y_{t-I} + \sum_{i=0}^{m-1} \pi_i^{'} \Delta x_{t-I} + d_1 y_{t-1} + d_2 x_{t-1} + \eta_t$$

where d_1 and d_2 are parameters of the long-run relationship variables.

Φ and π are matrices of parameters;

y_t is a vector of endogenous variables; and

x_t is a vector of explanatory variables;

α is a vector of constants and t is a deterministic trend;

$m = \max (q, s+1)$.

Embedding (7) into the error correction form of the ARDL model, the conditional VECM becomes:

$$\Delta LRGDP_t = \beta_0 + \delta_1 LRGDP_{t-1} + \delta_2 LAID_{t-1} + \delta_3 LPI_{t-1} + \delta_4 LIQ1_{t-1} + \delta_5 Policy_{t-1} + \sum_{i=1}^{p}$$

$$\varphi_i \Delta LRGDP_{t-I} + \sum_{j=1}^{q} \omega_j \Delta LAID_{t-j} + \sum_{l=1}^{q} \Omega_l \Delta LPI_{t-l} + \sum_{m=1}^{q} \gamma_m \Delta LIQ1_{t-m} + \sum_{p=1}^{q} \eta_p \Delta Policy_{t-p} + \varepsilon_t$$

where δ_i are the long-run multipliers, β_0 is the drift and ε_t are white noise errors. p and q are the appropriate ARDL model orders. This becomes the base equation.

The ARDL approach uses the F-test to establish the existence of a cointegrating relationship. The test however has a non-standard distribution, which implies that the critical values differ from those in the standard distribution. Pesaran and Pesaran (1997) generate separate critical values that tabulate two sets of values. The first value (upper critical bound) of the F-test assumes that all the variables are I(1) and the second (the lower critical bound) that they are I(0). If the calculated F-statistic appears above the upper value of this band, the null hypothesis is rejected, suggesting the existence of

cointegration between the variables irrespective of whether they are I(1) or I(0). If the F-statistic falls below the lower critical bound, the null hypothesis of no cointegration cannot be rejected; while a value within the bounds (i.e., within the lower critical bound and the upper critical bound) implies an inconclusive test. In this paper, critical values are used for all three sets of level of significance, i.e., at the one per cent, five per cent and ten per cent levels of significance. However, the critical values used by Pesaran and Pesaran (1997) are generated for samples from 500 observations. As this paper uses a sample of 38 years, we therefore use the critical values generated by Narayan (2004), which are available for samples of 30 observations to 80 observations.

Considering our aid-growth base model, the hypothesis is specified as follows:

H_o: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$

Against

H_A: $\delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq 0$

Once cointegration is established, in the second step, the conditional ARDL (p, q_1, q_2, q_3, q_4) long-run model for $LRGDP_t$ can be estimated. This involves selecting the optimal orders of ARDL model in the variables (p, q_1, q_2, q_3, q_4) which is done using either Akaike information criteria, AIC or the Schwartz/Bayesian information criteria, SIC (or SBC). The model selection criteria according to Shrestha and Chowdhury (2005) are a function of the residual sums of squares and are equivalent asymptotically. In this paper, we use the SIC to select the orders of the ARDL specifications, which in the context of our study has a comparative advantage over the AIC. Pesaran and Shin (1999), in a comparison of the AIC and SIC in the Monte Carlo experiments they ran, show that though the ARDL-AIC and ARDL-SIC have quite similar small-sample properties, the ARDL-SIC performs slightly better in the majority of the experiments. They suggest that this may be due to the fact that the Schwartz criterion is a consistent model-selection criterion whereas the Akaike is not. Hence, the SIC can be described as being more parsimonious with the lag length selection and is a consistent model selection criteria (Pesaran and Shin 1999)

In the third and final step, we obtain the short-run dynamic parameters by estimating an error correction model associated with the long-run estimates. The adjustment term, which indicates the speed of adjustment to disequilibrium, is also estimated at this stage.

To ascertain the goodness of fit and/or model adequacy, diagnostic and stability tests are further conducted in the ARDL approach. The diagnostic tests, which are automatically derived by Microfit on estimation of the ARDL model, examine serial correlation (or autocorrelation), functional form of the model, normality, and heteroscedasticity associated with the models. This is because the ARDL is OLS and so the need to satisfy the classical assumptions of least squares is obvious if the model is to be considered adequate and the estimates considered reliable for inference. The stability test of the regression parameters is conducted using the technique of stability testing by Brown, Durbin and Evans (1975), namely the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of the recursive residuals (CUSUMSQ). It tests for structural stability of the parameters within the 5 per cent critical bounds.

The second methodology used in our enquiry is the Johansen ML approach to cointegration. In 1988, Johansen developed a technique of cointegration suited to the case of multivariate models and with the possibility of simultaneity in the variable relationships. The approach has several advantages that warrant its utilization to estimate the aid-growth relationship. First, variables of the study's base model for examining the impact of foreign aid on economic growth are all I(1) which is a requirement for the application of the Johansen ML approach to obtain the long-run estimatesof the aid-growth relationship. De Boef (2000) and Villavicencio and Bara (2008), for instance, argue that using the Johansen approach in a model with a mixture of I(1) and I(0) variables produces biased results. Second, the Johansen approach accounts for the possibility of endogenous regressors in the model for which foreign aid has been argued to be endogenous (Boone 1996; Franco-Rodriguez, McGillivray and Morrissey 1998; Burnside and Dollar 2000; and Feeny 2005). Third, using the Johansen procedure allows for a comparison with some portion of the existent country aid-growth literature for which this technique has also been used (e.g., M'Amanja and Morrissey 2005; Bhattarai 2009). Finally, our use of the Johansen approach arises from the need to complement the findings of the ARDL approach with the aim of triangulating the findings and strengthening reliability of the results.

The Johansen cointegration analysis in microfit crucially depends on whether the VECM contains intercepts and/or time trends, and also whether the intercept or trend coefficients are restricted (Pesaran and Pesaran 1997). In this study, we choose the option where allowance is made for an intercept in the cointegrating vector but no trend. A visual observation of the plots of the variables (see Appendix Figure A3) does not show an obvious trend in the variables nor do we expect a trend in the cointegration of economic growth and its determinants, including foreign aid with time. Therefore, we do not include a trend in our analysis.

The Johansen ML cointegration test uses two sets of statistics to test for the presence of cointegration: the Maximal Eigenvalue statistic and the Trace statistic. Microfit further computes model selection criteria for AIC, SIC and HQC for different values of r, the rank of the long-run matrix. For the sake of consistency with the ARDL and for its advantage of being a parsimonious model selection criterion, we use the SIC here to further confirm our choice of the r number of cointegrating relationships. Hence, where there is conflict in the choice of r between the Trace and Maximal Eigenvalue tests, we complement with the r chosen by SIC. But before the test for cointegration is made, the Johansen technique requires the specification of the order of the var, which implies the need to test for the order of the var of the model before doing the cointegration tests. Using SIC for similar reasons as mentioned previously, all the models in this study choose 1 as the order of the var. Further, Pesaran and Pesaran (1997) recommend that a confirmation of the non-existence of serial correlation is necessary at this stage before conducting the cointegration test. In all the specifications run in this study, there is no evidence of serial correlation and we had cause to proceed with the use of the chosen lag order of 1 in our cointegration tests.

For both techniques of cointegration analysis, the study employs Microfit 4.0 regression package to conduct the cointegration tests, diagnostic test and to run the regressions, as this econometric software is more suited to running time-series regressions.

4.1 Unit roots tests and results

Before cointegration analyses are deemed to be carried out, unit roots test must first be conducted. Unit roots test is a test conducted to ascertain the stationarity of the variables. Generally, cointegration requires that the variables to be estimated are integrated of order 1. This is a particular requirement for the Johansen method in its estimation of the long-run impact of foreign aid on economic growth. It is only when all the variables indicate the presence of a unit root that there will exist a long-run relationship in the case of the Johansen technique. In the ARDL approach, Pesaran and Shin (1999) argue that the approach is such that it does not require pre-testing for stationarity before estimation of the model. However, as the F-test for cointegration is such that the critical values used to ascertain the existence of a cointegrating relationship lie with the bounds of I(0) and I(1), it implies that the variables used in the estimation must be either I(0) or I(1)and hence needs a unit roots test to ensure that none of the variables go beyond I(1); otherwise the ARDL technique cannot be used to carry out the estimation. Further, it is necessary that the dependent variable be integrated of order 1 (as is also argued by Afzal et al. 2010:45) in as much as the regressors can remain a mixture of I(0) and I(1). The regression with an I(0) dependent variable created coefficients of the ECM term beyond the theoretical bounds of 0 to -1. The need to conduct a unit roots test for the ARDL model is also suggested by Ouattara (2004), who argues that the approach collapses in the presence of I(2) variables. Therefore, both cointegration techniques require the need to conduct unit roots tests.Employing the commonly used Augmented Dickey Fuller (ADF) approach, Table 1 below provides the unit roots test result for the variables used across the models. The test shows that all the variables used in our base model are I(1) which allows our use of both the ARDL and Johansen approaches to cointegration in the estimation of the base model.

Table 1
ADF unit roots test results, including constant but without trend, 1970-2007

Variables		Levels		1st Difference		I(d)
		SIC Lag	ADF t-stat.	SIC Lag	ADF t-stat.	
LRGDP		2	-1.790406	0	-4.472844	I(1)
LAID		0	-1.736667	0	-7.227074	I(1)
LPI		0	-2.445824	0	-6.924393	I(1)
LIQ1		0	-1.835226	0	-6.090586	I(1)
POLICY		1	-2.174771	0	-4.762549	I(1)
Additional Variables						
CRISIS/WAR		0	-1.555815	0	-5.830952	I(1)
POLIT		0	-2.175246	0	-5.804381	I(1)
LIQU		0	-1.267710	0	-6.167158	I(1)
INF		0	-2.950797			I(0)
LTOPEN		0	-3.286945			I(0)
LGEX		0	-2.110433	0	-8.711782	I(1)
Critical value	1%	2	-3.632900	0	-3.626784	
	5%		-2.948404		-2.945842	
Critical value	1%	1	-3.626784			
	5%		-2.945842			
Critical value	1%	0	-3.621023			
	5%		-2.943427			

Source: See text.

5   The empirical results

5.1 The ARDL estimation results

In this section, we apply the ARDL cointegration approach to present the cointegration test results, the long-run as well as the short-run estimates for the impact of foreign aid on economic growth in Sierra Leone and the tests of model adequacy.

Cointegration test

As the test for stationarity of the regression variables using the ADF unit roots test (Table 1) showed that all the variables in the base regression (Table 2 below) are I(1), with none being I(2), it implies that we can proceed with the use of the ARDL technique to cointegration, which is applicable when the regressors used in the model are either I(0) or I(1) or a mixture of both. The cointegration test (Table 2) for the existence of a long-run relationship between economic growth and its regressors including the foreign aid variable of interest reveals the existence of cointegration at the 5 per cent level of significance when the F-statistic for cointegration is compared with the special F-test critical values. With the confirmation of long-run relationship between economic growth and its determinant in Sierra Leone, we can proceed with the estimation of the long-run and short-run dynamics to determine the impact of foreign aid on economic growth in the country.

Table 2
Impact of foreign aid on economic growth
ARDL long-run estimates and diagnostic tests

Dependent variable is logreal GDP	Model A Base model	Model B Disaggregated policy variables
Foreign aid	0.379** (2.193)	0.351** (2.276)
Private investment	0.293** (2.600)	0.261** (2.388)
Property rights	1.861* (1.673)	2.292* (1.797)
Macro policy	0.134 (1.003)	–
Government expenditure	–	0.658 (1.142)
Inflation	–	0.002 (1.243)
Trade openness	–	0.578 (1.370)
Constant	16.536*** (7.890)	12.219** (2.617)
F-Test for cointegration	4.773**	4.265**
Serial correlation	3.75	4.88**
Functional form	0.01	0.01
Normality	0.02	0.57
Heteroscedasticity	2.16	5.27**

Note: * significant at 10%, ** significant at 5%, and *** significant at 1% level of significance. T-statistic in parenthesis.

Source: See text.

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The long-run empirical estimates

The ARDL estimates presented in Table 2 show foreign aid to have a positive and significant impact on economic growth in Sierra Leone. For any one percent increase in aid/GDP ratio, economic output will increase by 0.4 per cent. The control variables all emerged with the expected signs with intuition. Private investment is found to have a significant impact in promoting economic growth in the country. For any 1 per cent increase in private investment, economic output will increase by 0.3 per cent. The quality of institutions (otherwise referred to as property rights) shows some indication of determining economic growth in the country as it moderately impacts on economic growth at the 10 per cent level of significance. Macroeconomic policy index (comprising fiscal, trade and monetary policy) has not proved to be impressive for economic growth in Sierra Leone. Even when attempt is made (model B in Table 2) to disaggregate the policy variables to its individual components (note, however, that this model fails the test for serial correlation and heteroscedasticity), the individual policy variables also emerge as insignificant in determining long-run economic growth in the country.

The short-run estimates

The short-run estimates are also of relevance in the estimation of the aid-growth relationship. According to De Boef (2000: 82), the short-run change is necessary to maintain the long-run relationship. Krause (1997), in fact, chooses not to present the long-run estimates of the relationship between economic expectation and economic

Table 3
Error correction representation of the chosen ARDL models (short-run estimates)

Dependent variable is log real GDP (dLRGDP)

Regressors	Model A Base model	Model B With disaggregated policy variable
dLRGDP1	-0.458** (2.620)	-0.578*** (3.403)
Foreignaid	0.065*** (4.417)	0.058*** (3.687)
Private investment	0.051** (2.371)	0.043** (2.180)
Property rights	0.321*** (4.488)	0.378*** (5.487)
Macro policy	0.023* (1.703)	–
Government expenditure	–	0.108* (0.750)
Inflation	–	0.003 (1.272)
Trade openness	–	0.095** (2.12)
Constant	2.850 (1.585)	2.013 (1.167)
ECM(-1)	-0.172* (1.960)	-0.165** (2.065)
R^2	0.65	0.73
Adjusted R^2	0.58	0.65

Note: * significant at 10%, ** significant at 5%, and *** significant at 1% level of significance.
T-statistic in parentheses.

Source: See text.

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conditions, but reports only the short-run estimates because these are unaffected by the limitations in the use of long-run estimates. However, in the case of foreign aid, there is expected to be a long-run and short-run relationship with economic performance as aid is given mostly to boost investment, but also to augment recurrent expenditure and short-term shocks in macroeconomic stability. Table 3 presents the dynamic short-run estimates of the aid-growth relationship.

The short-run estimates (Table 3) are very much in consonance with the long-run estimates as foreign aid is found to impact on economic growth at a high level of significance in the short run. However, the proportion of aid's contribution to economic growth is comparatively lower in the short-run than in the long-run. In the short run, the estimates show that for a 1 per cent increase in aid, economic output will increase by an approximate proportion of only 0.1 per cent. However, in the short run, all the control variables emerge to contribute significantly to economic growth in the country. Private investment significantly determines economic growth at the 5 per cent level of significance, while property rights impact at the 1 per cent level. Macroeconomic policy index, though at only 10 per cent level, emerges to contribute to economic growth in the short-run. This may not be surprising as the usual aim of macroeconomic policy is largely to stabilise the economy following shocks from inflation and balance of payment deficit. In the disaggregated policy variable model (Model B of Table 2.1), the short run estimates show that significance of the macro policy index is attributed largely to trade policy and government expenditure.
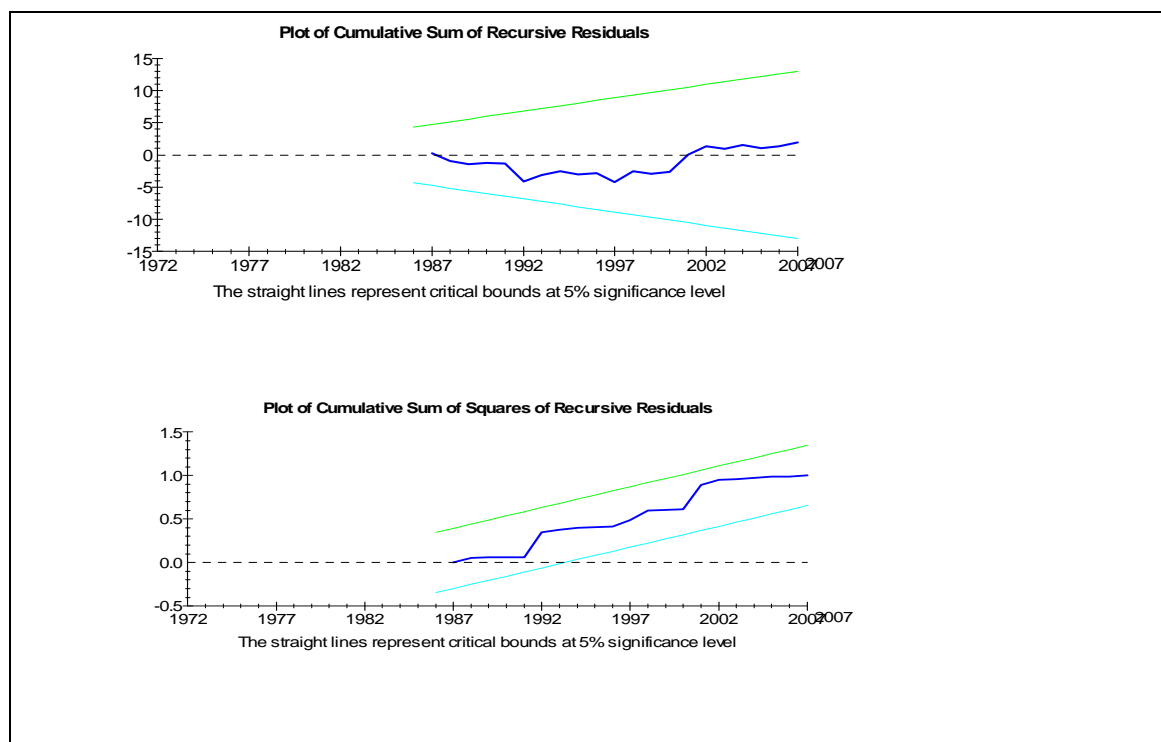
The error correction mechanism tells us the degree to which the equilibrium behaviour drives the short-run dynamics (De Boef: 82). Thus the ECM term is of importance in cointegration analysis. The coefficient of the ECM term which signifies the speed of adjustment of the model to equilibrium in the event of shocks, shows that 17.2 per cent of disequilibrium errors are corrected. The ECM term is also found to be negative and significant further confirming the existence of a long-run relationship between foreign aid and economic growth in Sierra Leone.

Diagnostic test

The diagnostic tests indicate the adequacy of the model in terms of the reliability of its estimates for inference. The model passes all the diagnostic tests for serial correlation, functional form, normality and heteroscedasticity associated with the model at the 5 per cent level of significance.

CUSUM and CUSUMSQ plotted against the critical bounds at the 5 per cent level of significance show that the coefficients of the model are stable over time. Therefore, our model estimates are sufficiently reliable for inference. In Model B where the components of the policy index are individually added into the model, the diagnostic test are not quite strong, because even though the model passes the tests for functional form of the model and normality of the residuals, it fails the tests for serial correlation and heteroscedasticity; the latter probably due to the fact there is a mix of I(1) and I(0) variables in the estimated ARDL model since the trade openness and inflation variables are I(0) (see Shrestha and Chowdhury 2005; Kargbo and Adamu 2010: 53). Hence, our analysis and inference are focused more on the base model where we use the composite policy index.

Plots of the stability tests (CUSUM and CUSUMSQ) for the base model are given below:

Plot of Cumulative Sum of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Source: See text.

Further robustness specifications

A further robustness check specification where we add the war dummy to capture the impact of the 11 yearsof political crises in the country was estimated to ascertain the impact of foreign aid on economic growth in Sierra Leone (Appendix Tables A3 and A4). This model clearly shows the existence of cointegration between economic growth and its determinants including foreign aid, thus enabling us to conduct long-run estimates. The model estimates are highlyconsistent with our main estimation model as foreign aid is noted to have a positive and significant impact on economic growth. The short-run estimates of this robustness check model (Appendix Table A4) merely mirror the long-run estimates and further confirm the robustness of aid's impact on economic growth in both the long and short run.The ECM term emerges to be negative and significant as expected to further confirm the existence of cointegration among the variables of the model and also to ensure that any disequilibrium in the model is corrected for at a certain proportion. The model passes the stability tests for CUSUM and CUSUMSQ at the 5 per cent critical bounds, ensuring that the estimates are stable over the study period. It also passes the diagnostic tests for functional form, normality and heteroscedasticity associated with the model. However, it fails the test for serial correlation. But as the estimates of the ARDL model are robust in the presence of serial correlation (Pesaran and Shin 1999: 372; Laurenceson and Chai 2003: 30), it implies that even the estimates from that model are largely reliable to provide a robustness check for the impact of aid on economic growth as is estimated by our main model. As a whole, the ARDL estimates of the relationship between foreign aid and economic growth find aid to be a positive determinant of economic growth in Sierra Leone, and this result is noted to be robust with the change of specification.

5.2 The Johansen ML estimation results

From the Johansen cointegration test results, the hypothesis that no cointegrating relationship exists, is rejected by both the Maximal and Trace statistic at the 90 per cent confidence interval. This, therefore, implies that there is at least one cointegrating relationship. The test that there is more than one cointegrating relationship is, however, rejected by both test statistics, thus confirming the existence of only one cointegrating relationship among the variables. Therefore, we choose one cointegrating relationship in our estimation of the long-run relationship. Once cointegration is confirmed, we are at liberty to conduct long-run estimates.

Table 4 presents the long-run estimates of the aid-growth relationship for Sierra Leone using the Johansen ML approach. We present two models for the same variables. In Model A, we use the base model variables and add an intercept in the cointegrating vector (restricted intercept, but no trend option in Microfit). Normalizing with the dependent variable, LRGDP, the long-run estimates show that foreign aid has a highly significant impact on economic growth in the country with one percent increase in aid/GDP ratio leading to a 0.2 per cent increase in economic growth. Private investment also emerges as having a highly significant impact on economic growth in the country, whileproperty rights have a moderately significant impact. Macroeconomic policy does not appear to impact significantly on economic growth.

In Model A.1, we use the same variables but employ instead an unrestricted intercept (unrestricted intercept and no trend). The results do not significantly change from those with the restricted intercept. Foreign aid still emerges as having highly significant

Table 4
Impact of foreign aid on economic growth
Johansen long-run estimates

Dependent variable is log of real GDP

	Model A with restricted intercept	Model A.1 with unrestricted intercept
Foreign aid	0.191*** (0.0484)	0.189*** (0.0476)
Private investment	0.236*** (0.0509)	0.240*** (0.050)
Property rights	0.575* (0.3329)	0.544* (0.322)
Macro policy	0.0085 (0.039)	-0.0022 (0.0377)
Constant	18.938*** (0.5659)	5.374*** (1.487)
Var order (SIC)	1	1
Cointegration test		
R (Maximal Eigen)	1*	1*
R (Trace)	1*	1*
R (used in regression)	1	1
Short-run results		
ECM	-0.292*** (0.0745)	-0.283*** (0.078)

Note: * significant at 10%, ** significant at 5%, and *** significant at 1% level of significance.
          Standard errors in parentheses.

Source: See text.

impact on economic growth with 1 per cent increase in aid related to a 0.2 per cent increase on economic output. Private investment also shows having a highly significant influence in promoting economic growth; and property rights have a moderate impact. As in the original regression (Model A), macroeconomic policy did not appear to influence economic growth in the country.

The ECM term which indicates the speed of adjustment of the model to equilibrium is negative and highly significant thus further confirming the existence of cointegration among the variables of the model. The coefficient of the ECM shows that should there be shocks that will cause disequilibrium in the economy, 29.2 per cent of the errors emerging from such disequilibrium will be corrected.

Further robustness specifications

To ascertain our finding following the Johansen cointegration procedure that foreign aid is a positive long-run determinant of economic growth in Sierra Leone, we further check for the robustness of such results by altering the base specification similarly as with the ARDL estimations to see whether foreign aid, with a change of specification, remains significant on economic growth as was noted in the base model. Appendix Table A5– Model A presents the estimates of this robustness specification which involves the addition of the crisis/war dummy to the base model to capture the impact of political crises, as was done in the ARDL analysis. One cointegrating relationship is found to exist among the variables. In this specification, foreign aid still continues to have a significant long-run impact on economic growth at the 5 per cent level of significance. The ECM term emerges as negative and significant in accordance with theory. This therefore further confirms the existence of a long-run relationship among the variables in the model, and that any proportion of errors arising from the disequilibrium of the model is corrected. Thus, the Johansen estimates only support that our finding of aid being a positive determinant of long-run economic growth in Sierra Leone is robust across approaches and specifications.

5.3 Discussions and conclusion on the impact of foreign aid on economic growth

The aforementioned analysis of the aid-growth relationship in Sierra Leone has shown that using a triangulation of approaches and specifications, foreign aid is observed to significantly promote economic growth in Sierra Leone within the period 1970-2007. Both the estimates of the ARDL bounds test and the Johansen approaches to cointegration are in agreement that foreign aid is a positive determinant of economic growth.Changes to the aid-growth specification in both approaches also confirm that foreign aid significantly impacts on economic growth in Sierra Leone. The agreement of this finding across approaches and specifications only provides support for reliability and validity of the findings and conclusions reached on the impact of foreign aid on economic growth.

Our finding that foreign aid has a positive and significant impact on growth is consistent with the greater portion of the aid-growth literature. The finding is supportive of the supplemental aid-growth theory, which postulates that aid contributes to economic growth in recipient countries. As evident in the Harrod-Domar model and as explained by Chenery and Strout (1966), foreign aid flows into a country are expected to positively contribute to the economic growth of that country. Chenery and Strout (1966)

see foreign aid as filling the savings and trade/foreign exchange gap typical in less developed countries like Sierra Leone, and in effect should contribute to fostering economic growth in such countries. Our finding, therefore, is a dismissal of the displacement theorists (like Griffin 1970; Griffin and Enos 1970) who argue that foreign aid negates economic growth.

Moving away from the theoretical literature, the empirical literature has been inconclusive on the impact of aid on economic growth. However, our finding through the ARDL and Johansen estimation methods is supportive to that portion of the empirical literature, which shows foreign aid to have a significant and positive effect on economic growth. Emerging from a timeseries analysis, this result supports the empirical finding ofMurthy, Ukpolo and Mbaku (1994); Gounder (2001);Lloyd, Morrissey and Osei (2001); Mavrotas (2002); and Bhattarai (2009) who also usetimeseries analyses in different country studies to show that foreign aid has a significant and positive impact in determining economic growth. The study by Lloyd, Morrissey and Osei(2001), for instance, use the ARDL approach to cointegration (the main approach employed also in this study) to investigate the impact of aid on economic growth at the country level for Ghana. The findings of our study—with more approaches and specifications to provide robustness checksfor a case study in a country (Sierra Leone) where government expenditures are vastly aid-dependent—further confirm the conclusions of these authors that aid impacts positively on economic growth. However, Lloyd, Morrissey and Osei's (2001) study uses a rather less representative proxy for economic growth: growth in private consumption, and hence their finding that foreign aid impacts on economic growth could only be accepted with caution. The study by Gounder (2001) also uses the ARDL model by Pesaran and Shin (1999) for the period 1968–96 to show that foreign aid to Fiji has had a significant impact in promoting economic growth in the country. Murthy, Ukpolo and Mbaku (1994) and Bhattarai (2009) both use the Johansen ML approach and find aid to contribute significantly to economic growth in Cameroon and Nepal, respectively. However, our results could not provide support for the studies by Islam (1992), Mbaku (1994), Fenny (2005) and Javid and Qayyum (2011) who could not find foreign aid to contribute significantly to economic growth in Bangladesh, Cameroon, Papua New Guinea and Pakistan, respectively. Fenny (2005) uses the ARDL methodology but could not find foreign aid to significant contribute to economic growth in Papua New. Likewise, Javid and Qayyum (2011) also use the same ARDL approach to examine the impact of aid on economic growth for Pakistan but could not establish a significant impact of aid, unless when aid is interacted with macroeconomic policy index.

Commentators may be interested in learning why foreign aid could be effective in directly contributing to growth in Sierra Leone versus the contractor findings from some other case studies. Whilethis contraction may remain an area for further investigation, some explanation can be suggested. First, whilst methodological differences cannot be ruled out entirely for deferring aid effectiveness results, the studies by Feeny (2005) and Javid and Qayyum (2011) also use the ARDL approach but with different aid effects. One possibility may be the differing purposes of foreign aid to recipient countries. Aid to Sierra Leone may be less politically-oriented compared to the case of Pakistan. While the promotion of democracy may be a crucial reason for donors to grant aid to Sierra Leone, poverty reduction and, indeed, economic growth (a conduit to poverty reduction) may be a more centralaim of granting aid to the country. In fact, Sierra Leone received significant proportions of aid even during non-democratic periods. As the introductory section of this paper reveals, Sierra Leone is one of the poorest countries in the world

and the granting of aid to such a recipient may be more oriented towards growth and poverty than otherwise. This is further reflected in the donor disbursement of more grants than loans to the country (aid disaggregation is not covered in this paper). As Sierra Leone is largely a poor and capital-starved economy, it is expected that foreign aid disbursed to such a country will supplement savings and subsequentlyboost economic growth. Further, as Sierra Leone is a non-industrialized country, intermediate inputs required for production in the few available domestic factories and industries have to be imported from overseas. Similarly, as a largely mineral-producing country, nearly all mining equipment has to be imported. Evidently imports are even more prominently seen in the trading sector where vast proportions of domestically traded commodities are imports. With earnings from exports likely to be lower than the import requirements of the country, a foreign exchange gap becomes inevitable. What this implies is that large inflows of foreign assistance from donors fill the gap (as explained by Chenery and Strout 1966) and ultimately promote economic growth.

Finally, while the period of the civil conflict may have adversely affected the impact of aid, it may also be that the aid enhancing environment in the case of Sierra Leone has not been sufficiently appalling to ensure that aid becomes ineffective on growth. Sierra Leone has had a history of corruption in public institutions, which may imply that the misappropriation of donor assistance may not be an exception. However, past and present political regimes have been associated with certain informal donors; China and Libya, for instance, have been close friends to some past and present political regimes in the country, with a proportion of their aid being unofficial. As such informal aid may be given on personal grounds and does not enter the official conduits, the implication is that such aid could be used to secure neopatrimonial networks by politicians without necessarily affecting the development effectiveness of official aid. Hence, while there could be some evidence of official aid being misused by the bureaucracy, aid corruption by politicians may largely affect non-official aid whose purpose may be personal.

In conclusion, in terms of the economic growth criterion, the study provides evidence to show that foreign aid disbursement to Sierra Leone is positively associated with economic growth. Hence, if poverty remains evident in the country amidst the aid inflows, it does not necessarily mean that foreign aid has been ineffective in promoting economic growth,but that either growth may not have been pro-poor or that aid has not directly reduced poverty. Thus, if the purpose of donor aid to Sierra Leone is to promote economic growth, then our findings that aid fosters economic growth is an inspiration for donors to continue to give aid, as it yields the desired results. However, it should also be noted that even though growth has been found to respond to aid disbursement, the economic significance in terms of the magnitude of the response is not that high. Elasticity of 0.4 (as the ARDL aid estimates show) would imply that the response is relatively weak despite being statistically significant. Therefore, for enhanced growth effort in the country, other factors such as private investment and the quality of institutions, which have also been found to induce growth response, should be strengthened in addition to aid effort.

6 Impact of post-war aid on economic growth

In the preceding analysis, foreign aid is found to have a positive and significant effect on economic growth in Sierra Leone following both ARDL and Johansen

timeseriesanalysis covering the period 1970-2007. However, it is important to single out the post-war period of 2002-07 to find out if aid remains positively significant on economic growth during this period. Several reasons can be proposed for examining the impact of foreign aid during this post-conflict period:

First, following the end of its 11-year civil conflict, Sierra Leone has had substantial inflows of foreign aid (see Appendix Figure A1) from diverse range of donors mostly on the premise of being sympathetic of the destruction of human resources, and social and physical infrastructure of the country. Large sums of aid either in the forms of financial flows or material support had been flowing in the country with the target of reviving the economy and ultimately promoting economic development.

Second, there has been a strengthening of the country's policies and institutions following the post-war period in the hope that any disbursed development assistance wouldhave a positive impact on its development amidst these supporting policies and institutions. Public financial management institutions such as the Anti-Corruption Commission, audit institutions (including the Auditor General's Department, parliamentary oversight, the media, and civil society pressure groups and monitors), procurement institutions, and as well as macroeconomic stability polices were strengthened during this period and continue to be strengthened to date.

Third, there have been considerable reports and attacks on the government as well as the donor community for their misuse of foreign aid flows particularly after the civil conflict.[2] If aid has been significantly misused by public bureaucrats, politicians and donor agencies alike, then is it to be expected that post-war aid may not be significant in promoting economic growth and may even negate growth. Further, it may emerge that post-war aid is effective in terms of determining growth, but if the magnitude of the effect (elasticity) is low relative to pre-war periods, it may also imply that misuse may have partly reduced the expected impact of aid.

For these reasons, the study finds it relevant to further investigate the contributing impact of post-war aid on economic growth despite our finding that aid generally is effective in promoting economic growth in the country. It is the hope of this study that the findings emerging from this extended analysis will be useful for the direction and reform of policies and institutions that directly or indirectly relate to aid effectiveness in post-conflict countries.

Hence, intuitively, the impact of post-war aid on economic growth can be either positive or negative. Given the destruction of human resources, and of social and physical infrastructure following civil conflict, aid flows to such an economy are expected to boost economic growth that may have been unimpressive during conflict. Moving from such a low or even negative economic growth to an economy possibly bolstered by substantial aid flows meant to stimulate economic activity as well as recovery of primary, industry and services sectors, economic growth is thus expected to be positive and meaningful. Further, as Collier and Hoeffler (2002) suggest, post-conflict countries are usually subject to strong donor support for country policy and institutional reforms following the achievement of peace, and such support should indirectly contribute to

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[2] For example, Sorious Samura's documentary on the misuse of aid resources in Sierra Leone on BBC1 Panorama (2008)

economic growth. On the other hand, post-war aid could have an insignificant or even negatively impact on economic growth in situations where corruption and weak institutions inherited from the war period are carried over to the post-conflict era. In particular, this could become evident because even though the political leadership may change after the end of the war, bureaucrats (civil servants) managing foreign aid and the economy may continue to remain in office. In such situations, it would not be surprising to find post-war aid to be insignificant, or at best with lesser than expected economic effect on growth in a post-war economy.

When we examine the impact of post-war aid on economic growth, the aid variable is disaggregated into aid in the post-war period, during the civil war and prior to the civil war. This implies the extended form of the aid-growth base model is specified as:

$$LRGDP_t = \beta_0 + \beta_{abw}LABWD_t + \beta_{awr}LAWAR_t + \beta_{apw}LAPW_t + \beta_i LPI_t + \beta_{iq}LIQ1_t + \beta_p POLICY_t + \mu_t \ldots\ldots.(11)$$

where LABWD denotes aid disbursed to the country before the war and is computed by interacting the total aid variable with a dummy for the pre-war period, 1970-90. LAWAR denotes aid disbursed to the country during the periods of the war and is computed by interacting the total aid variable with the war dummy spanning the years 1991-2001. LAPW denotes aid disbursed in the post-war period from 2002-07. This variable is computed by interacting the total aid variable with a post-war dummy, which takes the value of 1 for the post-war years (2002-07) and 0 otherwise. The combination of pre-war aid, aid during the war and post-war aid is equivalent to the total aid variable for the entire period of 1970-2007. Hence, once these subperiods of aid interactions are added to the model, adding the total aid variable itself will resort to double counting and perfect collinearity. Thus, we drop the total variable in this regression. Similarly, adding all three period dummies will resort to perfect collinearity, which the Microfit software will not estimate, and we drop the period dummies in the specification as well.

This analysis will not only investigate the significance of post-war aid in Sierra Leone, but will also investigate further the relative effectiveness of aid with time; i.e., before the war, during the war and the post-war period.

6.1 Impact of post-war aid on economic growth: the ARDL estimation results

Table 5-Model B presents the long-run estimates and cointegration test for the model under review.

Test for cointegration

The test for cointegration using the ARDL approach by Pesaran and Shin (1999) and Pesaran, Shin and Smith (2001) reveals the existence of a long-run relationship between economic growth and its regressors. A comparison of the F-statistics of 4.636 against the critical values by Narayan (2004) reveals that cointegration occurs at the 5 per cent level of significance. Therefore, we can proceed with the long-run estimation of the parameters of the model as is provided in the following.

The empirical estimates

The long-run model estimates as presented in Model B show that post-war aid has contributed positively to promoting economic growth in Sierra Leone. The post-war aid variable is positive and highly significant, signifying that foreign aid flows during the post-war period of 2002-07 have been impressive for economic growth in the country during this period. This implies that our general finding that foreign aid has a significant impact on economic growth in the country is evident even in the post-war period. Hence, in tune with the supposed influx of substantial aid flows and donor support to strengthen its policy and institutional frameworks in the aftermath of the civil conflict, such intervention has been found to be pro-developmental, as aid during this period significantly contributed to promoting economic growth in Sierra Leone.

A comparison of the three disaggregated aid periods shows that pre-war aid—although highly significant in determining growth in the long run similarly as with the post-war aid—is marginally more effective on Sierra Leone's long-run growth than aid in the post-war period. The magnitude of the coefficient of the aid-before-war variable is larger than that for the post-war aid variable. Aid during war, though moderately significant, is not comparatively impressive in promoting long-run growth. The control variable, private investment, maintains its significant impact on economic growth while property rights and macroeconomic policies are rather insignificant.

This model is found to be largely adequate to qualify the reliability of its estimates and validity of the emerging conclusions. We find no evidence of problems of serial correlation, functional form, normality of the residuals and heteroscedasticity, which are the most important diagnostic tests in order for the model to be declared of good fit and reliable for inference.

Table 5
Long-run impact of post-war aid on economic growth with ARDL cointegration approach

	Model A Base model		Model B Post-war aid
Dependent variable is log real GDP		Dependent variable is log real GDP	
Foreign aid	0.379** (2.193)	Pre-war aid	0.214*** (3.735)
		Aid during war	0.105* (2.007)
		Post-war aid	0.200*** (5.225)
Private investment	0.293** (2.600)	Private investment	0.197*** (5.469)
Property rights	1.861* (1.673)	Property rights	0.229 (0.788)
Macro policy	0.134 (1.003)	Macro policy	0.048 (1.118)
Constant	16.536*** (7.890)	Constant	19.582*** (35.219)
F-Test for cointegration	4.773**	F-Test for cointegration	4.636**
Serial correlation	3.75	Serial correlation	0.19
Functional form	0.01	Functional form	0.92
Normality	0.02	Normality	0.33
Heteroscedasticity	2.16	Heteroscedasticity	0.12

Note: * significant at 10%, ** significant at 5%, and *** significant at 1% level of significance.

Source: See text.

Even when the analysis is further restricted to the comparison of only pre-war and post-war aid (Appendix Table A6), the results appear consistent. The aggregate value of the coefficient of pre-war aid (0.217) is slightly higher than that for post-war aid (0.203), further confirming the marginal effectiveness of pre-war aid being slighter higher than that for post-war aid. In fact, these values are almost identical with those from the main post-war aid model.

Model B in Table 6 below presents the short-run estimates for the impact of post-war aid on economic growth in Sierra Leone.Likewise, post-war aid has a positive impact on economic growth in the short run, which is consistent with the findings of the long-run estimation. However, in the short run, in as much as post-war aid emerges to be impressive on economic growth, pre-war aid does not. Rather, aid during war shows as having a short-run impact on economic growth. The author is unable to clarify the reasons for expecting short-run aid disbursement during conflict periods to have a significant impact. It may be that aid disbursed during emergency periods may have had some impact, especially when Freetown, the capital city (and the government's seat of power) was relatively stable while most of the provincial areas were not (as in the case of Sierra Leone). Freetown is also the main hub of commercial activity with the rest of the world. Hence, with more stability in the city, some level of aid effect in the short term may be expected. It should, however, be noted that this short-run economic impact of aid during the conflict era is quite low (elasticity of only 0.05) despite showing statistical significance. The ECM term is negative and significant as expected, thus further confirming the existence of a long-run relationship between the regressors and economic growth. The coefficient of the ECM shows that in the occurrence of disequilibrium, 50.0 per cent of the errors will be corrected.

Table 6
Short-run impact of post-war aid on economic growth using ARDL cointegration approach

Dependent variable is LOG REAL GDP (dLRGDP)

Regressors	Model A	Regressors	Model B Post-war aid
dLRGDP1	-0.458** (2.620)	dLRGDP1	-0.421*** (2.822)
Foreign aid	0.065*** (4.417)	Pre-war aid	0.016 (0.825)
		Aid during war	0.052** (2.688)
		Post-war aid	0.100*** (6.515)
Private investment	0.051** (2.371)	Private investment	0.057*** (3.302)
Property rights	0.321*** (4.488)	Property rights	0.115 (0.936)
Macro policy	0.023* (1.703)	Macro policy	0.024 (1.417)
Constant	2.850 (1.585)	Constant	9.789*** (3.415)
ECM(-1)	-0.172* (1.960)	ECM(-1)	-0.500*** (3.706)
R^2	0.65	R^2	0.85
Adjusted R^2	0.58	Adjusted R^2	0.78

Note: * significant at 10%, ** significant at 5%, and *** significant at 1% level of significance.
T-statistic in parentheses.

Source: See text.

Appendix Table A7 gives the results for an extended form of the analysis (as is done in the long-run analysis) where the analysis is restricted to comparing only the pre-war and post-war aid marginal effectiveness. The results also show (in conformity with the main post-war aid model) that in the short-run, post-war aid (0.101) seems to be rather more effective than pre-war aid, as the latter could not prove any positive short-run impact.

6.2 The impact of post-war aid: the Johansen ML estimation results

To complement the findings of the ARDL approach presented above on the impact of post-war aid, this section presents the empirical estimates using the Johansen ML cointegration approach. With a model var order of 1 selected by SIC, the maximal eigenvalue result reveals the existence of cointegration among the variables at r=1 (i.e. one cointegrating relationship). The trace statistic test also reveals the presence of cointegration as well at r=1. We therefore use r=1 in the estimation of the long-run relationship.

The long-run estimates using the Johansen approach as presented in Model B Table 7, are largely in agreement with the ARDL estimates. The results show that aid flows to Sierra Leone during the post-war period had positive and significant impacts on economic growth. As with the ARDL estimates, the Johansen estimates also show that

Table 7
Long-run impact of post-war aid on economic growth using Johansen cointegration approach

Dependent variable is log real GDP (LRGDP)

Regressors	Model A Base model	Regressors	Model B Impact of post-war aid:with restricted intercept
Foreign aid	0.191*** (0.048)	Pre-war aid	0.104** (0.044)
		Aid during war	-0.055 (0.039)
		Post-war aid	0.123*** (0.017)
Private investment	0.236** (0.051)	Private investment	0.126*** (0.030)
Property rights	0.575* (0.3329)	Property rights	-0.626*** (0.191)
Macro policy	0.009 (0.039)	Macro policy	-0.024 (0.036)
Constant	18.938*** (0.566)	Constant	21.248*** (0.355)
Var order (SIC)	1	Var order (SIC)	1
F-Test for cointegration		F-Test for cointegration	
R (Maximal Eigen)	1*	R (Maximal Eigen)	1**
R (Trace)	1*	R (Trace)	1**
R (used in regression)	1	R (used in regression)	1
ECM	-0.292*** (0.075)	ECM	-0.312* (1.983)

Note: * significant at 10%, ** significant at 5%, and *** significant at 1% level of significance.
Standard errors in parentheses.

Source: See text.

aid flows during the post-war periods tend to significantly improve economic growth. However, as opposed to the ARDL finding that the long-run marginal effectiveness of post-war aid is smaller than in pre-war aid, it is the reverse in this estimation. In as much as both pre-war and post-war aid both significantly improve economic growth in Sierra Leone, post-war aid has tended to have a marginally higher impact on growth than pre-war aid. Here, aid during the war is found to be insignificant in determining long-run growth in the country, with the direction of this relationship tending to be even negative. However, what is consistent with the ARDL estimates is that aid during the post-war period does seems to be impressive in promoting growth, while aid during war is not that impressive. The ECM term, showing the speed of adjustment to disequilibrium in the short-run, is negative and significant as expected, further confirming the presence of cointegration among the variables. The coefficient of this adjustment term shows that about 31.2 per cent of errors resulting from any disequilibrium in the previous period are corrected for in the current period.

6.3 Discussion of post-war aid results

Our finding that post-war aid has had a positive impact on economic growth in Sierra Leone does seem to provide partial support for the findings from the widely-cited study on post-war aid by Collier and Hoeffler (2002) who conduct a cross-country analysis of 27 post-conflict countries and find post-conflict foreign aid to have a positive impact on economic growth in those countries. Hence, even in a country analysis, there is further evidence that the impact of post-war aid is positively significant in terms of influencing economic growth. In consonance with our earlier finding that foreign aid is generally found to be significant in promoting economic growth over the entire period of our study, aid in the post-war period remains significant in improving growth in the country. In some way, this may not be surprising, given the substantial influx of aid to Sierra Leone during this period, and with the reformof its institutions (destroyed during the civil conflict) to standards surpassing the pre-war levels. However, this study does not seem to clearly support the conclusion by Collier and Hoeffler (2002) that aid is more effective in post-conflict scenarios. In as much as the Johansen results and the short-run ARDL estimates do provide evidence in their support, the long-run ARDL estimates do not.

Another unsurprising result is that after disaggregation of the aid periods, the long-run impact of aid during civil conflicts is found to be unimpressive. This is not surprising because institutions during conflicts are either damaged or less effective (Murshed 2002; Addison and Murshed 2005) to the extent that misuse of aid can be expected. Addison and Murshed (2005) point out that conflicts and civil wars are among the major causes of development and growth failures in present-day developing countries, and Sierra Leone is no exception. Because political and economic institutions are either damaged or disrupted during civil conflicts, their usefulness to support effective utilization of aid is thwarted. Therefore, the granting of aid during civil conflicts may only target short-run economic stability (as the short-run results show for Sierra Leone) but cannot target long-run impact on growth. This conforms with the suggestion made by Demekas, McHugh and Kosma (2002).

However, what is surprising is that the marginal effectiveness of aid during the post-war period is weaker than that in the pre-war period (as is shown by the study's main ARDL

estimation technique) despite growth statistics being more inspiring in the post-war than in the pre-war periods. Several reasons may be associated with this finding.

First, although the study does not assess the performance of other growth-determining factors during the post-war period, it may be that post-war growth may have been substantiallyinfluenced by other factors in addition to foreign aid. Such impressive post-war economic growth may have been largely determined by private sector performance, particularly in areas of service sector (as is shown in Appendix Figure A2). Whilst sectoral trends tend to show pre-war growth inthe primary sector (i.e., agricultural sector),which can largely be aid-funded, its growth-rate trend in the post-war period is showing somewhat of a decline. Instead, the entire growth of the economy seems to have been inspired by the increase in the services sector during the post-war period. Appendix Figure A2 shows that the services sector trend tends to be increasing at a higher rate than either the agricultural or the industry sector during the post-war. When this is the case, we can expect to get high economic growth but with lower than expected effect of foreign aid on such growth, because the sector with the strongest influence on economic growth is the less aid-funded. This is particularly true because the services sector includes trade, hotels and restaurants, transport, communication, financing and insurance, real estate and business services, i.e., those with little or no aid-funding.

The second reason that may be suggested for finding post-war aid to be marginally less effective than pre-war aid is that the adverse effect of damaged institutions may have been carried over into the post-war period. This may imply that some level of aid mismanagement during civil conflict may have extended into the post-war period, particularly when most of the relevant bureaucrats prominent in the conflict period have continued in their posts in the post-war era. In fact, Addison and Murshed (2005) further argue that even though the creation (or reform) of democratic institutions may restore the credibility of fiscal transfer (which largely includes foreign aid in aid-dependent countries), these institutional reforms take time. This is no different in the case of Sierra Leone.Despite evidence of democratic reforms in the immediate post-war period, their effects may take some time to develop, particularly as the effect of damaged institutions may be carried over into the post-war period. Therefore, in spite of the supposed increased flow of aid during post-war periods as was evident in Sierra Leone, as well as donor targeting of institutional and policyimprovements during the post-war, aid, though effective, did not turn out to be more effective than during pre-war periods. Although not entirely supporting the assumption that foreign aid may have been misused during the post-war period in Sierra Leone (our third reason for assessing the effectiveness of post-war aid), the findingthat post-war aid impact does not match pre-war levels in terms of economic effectiveness does provide some support. It provides, to some extent, empirical support for the BBC Panorama programme (BBC 2008) that foreign aid was misused in Sierra Leone during the period that coincides with its post-war period. Further, public expenditure tracking surveys (PETS) conducted in the post-war years as well as service delivery surveys for 2006-07 all show evidence of gross misuse of public funds and resources, most of which was foreign aid.

However, it should be noted that this problem of the ineffectiveness of the Sierra Leonean institutions has not accelerated to an extent that aid fails to deliver on economic growth; it merely shows that the potential scope of aid in improving economic growth can be hampered by ineffective institutions. Further, though the ARDL estimates are more reliable than those of other cointegration techniques (Inder

1993; Banerjee et al. 1993), the fact that the finding of less marginal effectiveness of post-war aid relative to pre-war aid is not robust to the use of the Johansen approach, should call for further empirical research in other case studies to consolidate the evidence.

7   Overall conclusion

Foreign aid remains an important source of public expenditure in most developing countries, including Sierra Leone. Its impact on development andeconomic growth in particular has been debated following the empirical literature. In a country where aid effectiveness was yet to be examined, this study serves only to fill this gap by providing the empirical evidence as a basis for policy consideration and further research. Using the ARDL bounds test approach and the Johansen maximum likelihood estimation technique for the period 1970-2007, we obtained estimates for the impact on economic growth of foreign aid and post-conflict aid.

The study finds that aid is significant in promoting economic growth in Sierra Leone. In considering the entire study period, the analysis further reveals that even though aid may have generally had an impact to spurring growth, it did not contribute substantially to economic growth during the civil war period. Further, even though aid was significant in the pre-war as well as the post-war eras, its marginal effectiveness in the post-war period was weaker than in the pre-war period,as indicated by the results from the study's main estimation method.

The evidence in the case of Sierra Leone has provided support only for the supplemental theories that foreign aid is vital in the promotion of a country's economic development. Donor intervention in Sierra Leone does not seem to have been in vain, but has proved to be largely useful instead. It implies that Sierra Leone's persistent poverty characterization amidst notable donor presence and participation in the country's economy has little to do with the fact that foreign aid has been ineffective in promoting economic growth, but rather that the magnitude of the effect has not been sufficiently strong to eradicate poverty completely. Aid supporting institutions and policies require much strengthening in order to increase the magnitude of its impact. Further, if aid's impact on the country's growth is to be maintained or its magnitude even to be improved, it is recommended that efforts towards a politically stable state and the promotion of democratization be pursued:these are the crucial elements if aid is to have an impact in promoting economic growth in the country.It is also evident that the promotion of private investment is almost as important as the disbursement of foreign aid with respect to promoting economic growth. But generally, as the analysis finds aid to contribute significantly to economic growth, this implies thatthere is need to further probe aid's impact on pro-poor growth as well as its direct impact on human development in further research into the country's weak poverty standing amidst increased donor aid effort.

A point of caution to donors, however, is that based on the results of our analysis, in as much as aid has been found to be useful in spurring economic development in the country, it has not been significantly important in all periods. The finding that foreign aid during political instability was not quite impressive on long-run growth, may imply that donors should be much hesitant with respect to the quantum of development

assistance disbursed during conflicts, as institutions relevant for guiding the effectiveness of aid may be weak and these weaknesses may not be entirely eliminated even in the post-war periods. However, the fact that aid has been generally effective for a country's economic growth should encourage donors to continue in their effort to provide aid to capital-starved nations. Whilst the study may be attributable to the case of Sierra Leone, the applicability of its findings may not be limited to only one country, but generally to any typical aid-dependent poor nation with a history of prolonged political instability.

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Appendix: Tables and figures

Appendix Table A1
Comparative growth in GDP per capita, 1970-2007

	HIPCs	Low- income countries	Developing countries	SSA	Sierra Leone
1970-74	1.10	-0.10	3.70	2.87	1.85
1975-79	0.25	-0.61	2.68	-0.34	-0.48
1980-84	-1.52	-0.69	1.06	-1.22	0.76
1985-89	-0.72	0.58	1.71	-0.25	-3.17
1990-94	-2.74	-1.23	1.15	-2.05	-2.67
1995-99	1.63	1.86	2.43	0.72	-6.28
2000-04	1.44	2.07	3.65	1.52	9.28
2005-07	3.18	3.99	6.62	3.53	3.61
Overall period average	0.33	0.73	2.87	0.60	0.36

Source: World Bank's World Development Indicators (on line).

Appendix Table A2
Sierra Leone versus Africa: average human wellbeing statistics, 1980-2007

	HDI	IMR
Sierra Leone	0.25	177.0
Sub-Saharan Africa	0.42	97.4
Africa	0.44	91.7

Source: Compiled from UNDP's Human Development Reports (various) and the World Bank's World Development Indicators (on line).

Appendix Table A3
Impact of aid on economic growth—Robustness specification
ARDL long run estimates and diagnostic tests

Dependent variable is log real GDP

Regressors	Model C	
Foreign aid	0.290**	(2.222)
Private investment	0.200*	(1.928)
Property rights	0.886	(0.951)
Macro policy	0.079	(0.840)
Constant	18.424***	(10.316)
Crisis	-0.270	(1.136)
F-Test for cointegration	6.202***	
R^2	0.93	
Adjusted R^2	0.92	
Serial correlation	4.24**	
Functional form	0.004	
Normality	0.90	
Heteroscedasticity	1.82	

Note: * significant at 10%, ** significant at 5%, and *** significant at 1% level of significance.
T-statistic in parentheses.

Source: See text.

Appendix Table A4
Error correction representation of the chosen ARDL models (short-run estimates)
Robustness check specification

Dependent variable is log real GDP (dLRGDP)

Regressors	Model C	
dLRGDP1	-0.379*	(1.889)
Foreign aid	0.068***	(4.083)
Private investment	0.047**	(2.061)
Property rights	0.206	(1.441)
Macro policy	0.018	(1.229)
Constant	4.291*	(1.767)
War/crisis	-0.063	(-0.937)
ECM(-1)	-0.233**	(2.076)
R^2	0.67	
Adjusted R^2	0.58	

Note: * significant at 10%, ** significant at 5%, and *** significant at 1% level of significance.
T-statistic in parentheses.

Source: See text.

Appendix Table A5
Impact of foreign aid on economic growth—Robustness specifications
Johansen long-run estimates and diagnostic tests

Dependent variable is log of real GDP

Regressors	Model A	
Foreign aid	0.112**	(0.050)
Private investment	1.000	(none)
Polity		
Governance		
Property rights	-1.181**	(0.571)
Macro policy	0.010	(0.037)
Constant	22.419***	(0.990)
Crisis	-0.137***	(0.042)
Var Order (SBC)	1	
F-Test for cointegration		
R (Maximal Eigen)	2**	
R (Trace)	2**	
R (used in regression)	2	
ECM	-0.403***	
	(0.084)	

Note: * Significant at 10%, ** significant at 5%, and *** significant at 1% level of significance.
Standard errors in parentheses.

Source: See text.

Appendix Table A6
Impact of post-war aid on economic growth—Robustness check
ARDL long-run estimates and diagnostic tests

Dependent variable is log real GDP (LRGDP)

Regressors	Impact of post-war aid		Pre-war vs post-war aid (coefficients)
Foreign aid	0.109**	(2.128)	
Pre-war aid	0.108***	(2.744)	0.217
Post-war aid	0.094***	(3.250)	0.203
Private investment	0.199***	(5.609)	
Property rights	0.239	(0.830)	
Macro policy	0.047	(1.127)	
Constant	19.557***	(35.640)	
F-Test for cointegration	4.636**		
Adjusted R^2	0.96		
Serial correlation	0.02		
Functional form	0.001		
Normality	0.38		
Heteroscedasticity	0.08		

Note: * significant at 10%, ** significant at 5%, and *** significant at 1% level of significance.
          T-statistic in parentheses.
Source: See text.

Appendix Table A7
Error correction representation of the chosen ARDL models (short-run estimates)
Robustness check

Dependent variable is log real GDP (dLRGDP)

Regressors	Impact of post-war aid	
dLRGDP1	-0.423***	(2.901)
Foreign aid	0.054***	(2.903)
Pre-war aid	-0.037*	(1.832)
Post-war aid	0.047**	(2.318)
Private investment	0.057***	(3.388)
Property rights	0.119	(0.993)
Macro policy	0.024	(1.428)
Constant	9.717***	(3.466)
ECM(-1)	-0.497***	(3.764)

Note: * significant at 10%, ** significant at 5%, and *** significant at 1% level of significance.
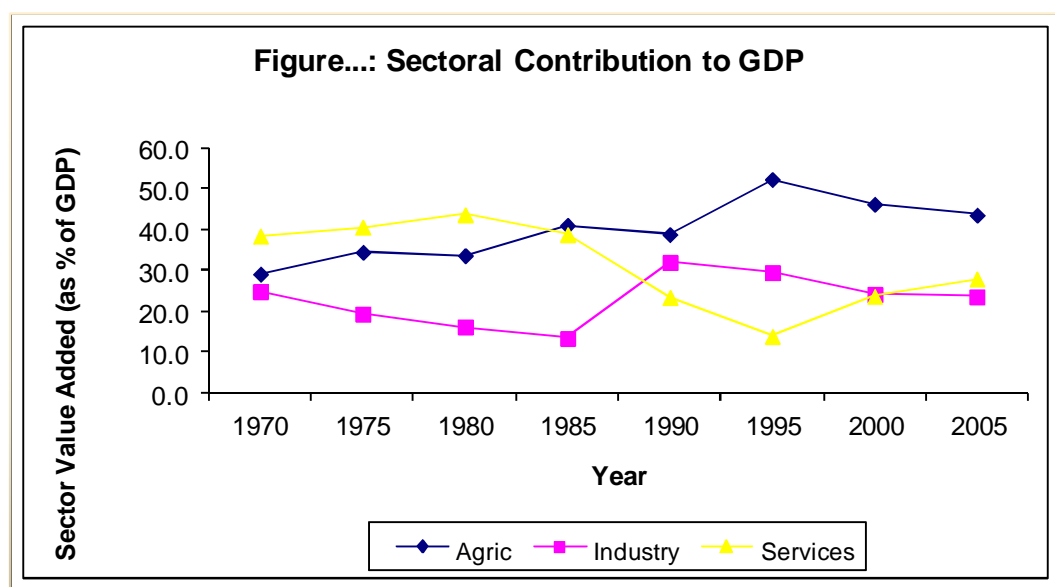   T-statistic in parentheses.
Source: See text.

**Foreign Aid Disbursed, average 1970-2007**
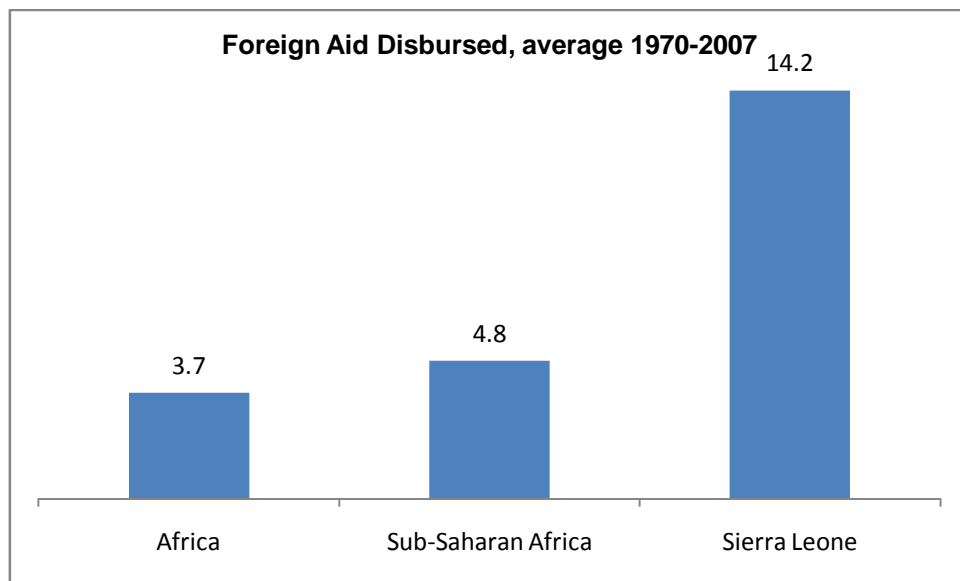
Source: Computed by author, based on data from World Bank's African Development Indicators (on line).

Appendix Figure A2
Line graph of sectoral contribution to GDP

Figure...: Sectoral Contribution to GDP

Source: Computed by author, based on data from World Bank's Development Indicators (on line).

Appendix Figure A3
Plots of the log level variables as used in the model

LRGDP

LAID

LR1

LIQ1

POLICY
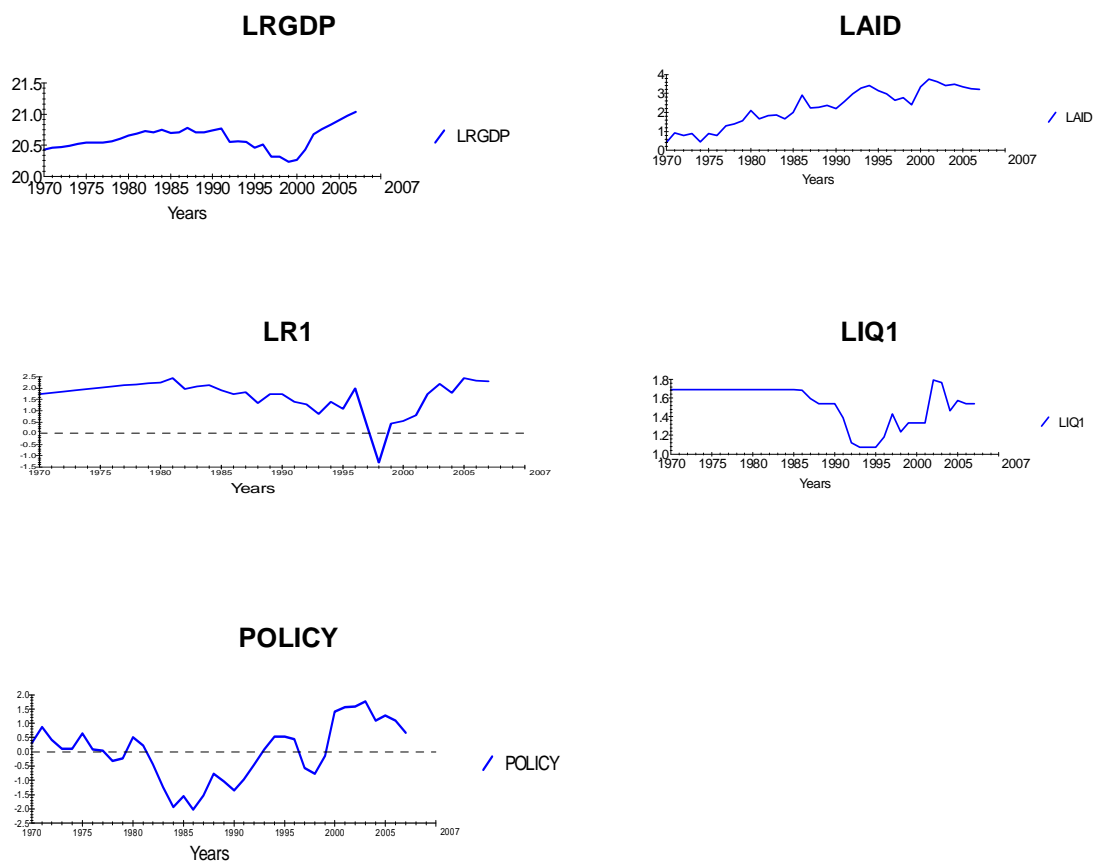
Source: Computed by author, based on data from World Bank's Development Indicators, African
Development Indicators (on line), and the ICRG online database.

Appendix 2: Data description and construction

All data series collected for this study are mostly from the World Bank's WDI and African Development Indicators databases, Polity IV or the ICRG. The series is annual and covers the years 1970 to 2007, a period that reflects a good availability of data for Sierra Leone in all the variables of the model.

Economic growth is measured by the annual log difference in real GDP and sourced from the World Bank database. Foreign aid, as used in this research, comprises official development assistance as a share of GDP, also sourced from the World Bank's WDI database.

The data on private investment is sourced from the WDI database and represents private investment as share of GDP.

The variable, IQ1, is property rights score, whose construction follows Knack and Keefer's (1995) construction of an index of property rights. Hence, we construct a property right score constituting the component of corruption, rule of law, bureaucratic quality, expropriation risk, and government repudiation of contracts taken from IRIS3 database of the ICRG. The components (corruption, rule of law and bureaucratic quality) have a rating of 0-6 with higher values indicating better ratings (i.e., less risk). The other two components (expropriation risk and repudiation of contracts) are rated 0-10 with higher values indicating better rating (i.e., less risk). To arrive at a comparative rating of these five components forming the property rights measure, we follow Knack and Keefer (1995) by converting corruption, rule of law and bureaucratic quality to 10-point scales (multiplying them by 5/3). When all five variables are of uniform scale of 0-10, a simple average of these five indices is then taken to arrive at the composite index of property rights denoted as IQ1. These components of property rights largely match those used as an index of institutional quality in the literature (e.g., Burnside and Dollar 2004; Sachs et al. 2004; Dollar and Levin 2005; Chandar and Caprio 2007; and Baliamoune-Lutz and Mavrotas 2008). Hence, in as much as we refer to it as a measure of property rights, it corresponds to its use as a measure of institutional quality for comparisons with other studies.

CRISIS/WAR is a variable of political instability and is captured as a dummy variable for the impact of civil conflict in Sierra Leone over the years 1991-2001.

Construction of the policy index

The index of macroeconomic policy as utilized in this study is constructed using the technique of principal component analysis with SPSS 15.0. The construction of the index is advantageous not only because it helps to conserve the number of degrees of freedom following the reduction in the number of variables to be used in the model, but it also helps to avoid the potentially high correlation among the macroeconomic variables. Sricharoen and Buchenrieder (2005: 2) note that 'PCA is an indicator reduction procedure to analyse observed variables that would result in a relatively small number of interpretable components (group of variables), which account for most of the variance in a set of observed variables'. The variables that formed the index include government consumption expenditure (GEX) as proxy for fiscal policy, inflation rate (INF) as proxy for monetary policy, and trade openness (TOPEN) as proxy for trade policy.

The PCA technique involves a data reduction process in which the variables are scored following their running with the package. The eigenvalues are also calculated for each component. In our construction of the 'policy' index, the eigenvalues show that 58 per cent of the variance is explained by the first principal component, with the second and third accounting for the remaining 42 per cent; this implies that the first principal component alone explains the variation of the dependent variable better than any other combination of the three variables used. Hence, the first principal component is considered as the appropriate measure of the macroeconomic policy index. In the construction of this macroeconomic policy variable, the scores obtained are 0.439 for trade openness, -0.440 for inflation and 0.436 for government expenditure (Appendix Tables A1 and A8). Hence, the individual contribution of the components of the policy index is shown as follows:

Policy = -0.440 INF + 0.439 TOPEN + 0.436GEX

Appendix Table A8
Principal component analysis for the generation of the policy
Index variable using SPSS15.0

Principal component	Eigenvalues	% of variance	Cumulative %
1	1.736	57.873	57.873
2	0.638	21.263	79.136
3	0.626	20.864	100.000

Variable	Component loadings	Component score	
INF	-0.763	-0.440	
TOPEN	0.763	0.439	
GEX	0.757	0.436	

where INF = inflation rate; TOPEN = trade openness; and GEX = government expenditure share of GDP.