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External Debt, Investment, and Economic Growth: A Seemingly Unrelated Regression Model for Low-Income Countries

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Abstract This study analyzes whether external debt is a driving factor for investment and economic growth in low-income countries. Using data over the period 2000~2017, we performed an analysis using the 23 countries in the sample and a split-sample analysis wherein we separated less indebted countries (12) from more indebted countries (11). Empirical results of the seemingly unrelated regressions model indicate that external debt significantly decreases investment and economic growth for both the total sample and the sub-samples. In addition, we found that trade openness is positively and significantly related to the level of growth per capita. This positive association is confirmed for both the total sample and the split sample. Findings also indicate that the level of growth exerts a positive and significant effect on investment for the total sample and for less indebted countries.

Keywords: External debt, Investment, Economic growth, Low-income countries, SUR Model

JEL Classifications: F34, O40

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I. Introduction

Although the relationship between external debt, investment, and growth has been widely documented, it continues to be one of the most important concerns that have recently attracted the attention of policymakers and academics. Literature on the relationship between external debt, investment, and economic growth provides mixed and inconclusive results. Results of studies based on a linear econometric approach can be classified into three categories. The first category supports the position that external debt decreases investment and growth (Borensztein

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1990, Iyoha 2000, Were 2001, Lopes 2002, Maghyereh and Omet 2002, Berensmann 2004, Hameed *et al.* 2008, Presbitero 2012, Guei 2019). Other studies support the opposite view, showing that external debt has a positive effect on investment and growth (Jayaraman and Lau 2009, Ahlborn and Schweickert 2015, Egbetunde 2012, Sánchez-Juárez and García-Almada 2016, Owusu-Nantwi and Erickson 2016). Finally, few empirical studies report no significant impact. An important aspect of the research in this area indicates that the relationship between external debt, investment, and growth could be nonlinear. Hence, there is a threshold below or above which external debt can affect either investment or growth (Krugman 1988, Sachs 1989, Reinhart and Rogoff 2010a, 2010b, Checherita-Westphal *et al.* 2012, Mupunga and Le Roux 2015).

Low-income countries[1)] can be considered appropriate subjects of this study for several reasons. Recently, Kirbey *et al.* (2019) reported that the median level of public debt has increased by 20% of the GDP in low-income countries since 2013. This increase constitutes an important part of government revenue, which is absorbed by interest payments. In another statistic, Nishio and Bredenkamp (2018), from the World Bank and International Monetary Fund, found that the median level of public debt has risen 13.5% since 2013. They also reported that the level of debt continues to increase even in countries with fragile economies such as Burundi and Gambia.

The ineffectiveness of public debt in boosting economic growth in these countries necessitates analysis on how external debt stimulates investment and spurs growth in low-income countries. In this vein, Rucaj (2018) stated that the total external debt increased 10% to 7.1 trillion US dollars in low-income countries in 2017, indicating a growth rate of 4% over that in 2016. Similarly, an IMF (2018) report suggested that low-income countries struggle with large external debt. In some cases, the most important factor is not the level of external debt relative to GDP but ensuring that the external debt is directed toward income-generating and productive activities. It is also important to assess the ability of a country to repay the debt (Zaghdoudi and Hakimi 2017).

This study analyzes whether external debt could be a driving factor for investment and economic growth. To this end, we use a sample of low-income countries over the period 2000~2017. Specifically, we performed an analysis using the 23 countries in the sample and a split-sample analysis in which we separated less indebted countries (12) and more indebted countries (11). Since investment is considered the main channel through which capital affects growth and a high level of growth can attract more capital, investment and GDP growth are strongly correlated. It is almost a tautology that investment leads to growth, because investment is a component of GDP in the national income identity. For this reason, we estimate a seemingly unrelated regressions (SUR) model developed by Zellner (1962, 1963) and later adopted by several authors

1) According to the World Bank's classification as of July1, 2018, low-income economies are defined as those that had a GNI per capita of 995 US dollars or less in 2017.

such as Kmenta (1971), Felmlee and Hargens (1988), and Kim and Cho (2019).

This study differs from the existing literature in several aspects. First, although the relationship between external debt, investment, and growth has been widely documented, few studies focus exclusively on low-income countries. Second, to better understand the dynamic relationship between external debt, investment, and economic growth, we performed analyses on the total sample and on sub-samples consisting of less indebted countries and more indebted countries. This is in contrast to previous studies that test the total sample of low-income countries as one block. We believe that there is a strong difference in the levels of external debt that makes the division of the total sample highly useful. For example, we observe a ratio of external debt to GNP of 1380.767% for Liberia in 2003 and only 10.269% for Haiti in 2011. Third, previous studies use a balanced panel, the dynamic two-step generalized method of moments (GMM) approach, and fixed or random effect models to test the linkage between external debt, investment, and economic growth in low-income countries (Clements *et al.* 2003). In this study, we use simultaneous equations, more precisely, the SUR method developed by Zellner (1962). We believe that there is a strong channel through which one variable can affect the other and a narrow causal relationship between investment and growth. Furthermore, in the *growth model*, investment can be an independent variable pillar. Moreover, in the *investment model*, growth could attract more investment, making it a key factor for success. Finally, most previous studies either explore the linkage between external debt and investment or between external debt and growth. However, this study tests the impact of debt on investment and growth in low-income countries.

The remaining paper is structured as follows. A literature review is provided in section 2. Section 3 describes the sample and methodology. In section 4, we discuss the empirical results. Section 5 concludes and addresses some policy recommendations.

II. Related Literature

A. Relationship between external debt and investment

While investment is widely recognized as a crucial channel through which external debt can affect economic growth, studies on the direct relationship between external debt and investment are less common than those focused on the relationship between external debt and growth. The linkage between investment (public or private) and external debt was studied implicitly, or indirectly, in terms of the relationship between external debt and growth via the debt overhang hypothesis. However, few studies focus on the direct linkage between debt and investment, and the empirical results are mixed and inconclusive. Some studies report a negative

effect, while others support the opposite view. However, the negative effect is more pronounced than the positive association between debt and investment.

For example, Picarell *et al.* (2019) recently explored this issue in the European context. The authors used data on 26 EU countries over the period 1995~2015 to understand the linkage between external debt and public investment. To avoid the problem of endogeneity, the authors performed a GMM estimation, and their findings validate the debt overhang hypothesis. The authors found that a 1% increase in public debt decreases public investment by 0.03%. They also found that the negative effect is less pronounced in the Eurozone than in the entire EU.

Several empirical studies focus on emerging markets or developing countries. Deshpande (1997) used a sample of 13 severely indebted countries over the period 1971~1991 to explore the effect of external debt on the level of investment. Empirical results show that the effect of external debt differs across the study period. Over the entire period, the study found a negative relationship between external debt and investment. However, in the first half of the study period, external debt was noted to have a positive effect, which became negative in the second half.

Using data on the Nigerian economy over the period 1970~2013 and using the autoregressive distributed lag bounds test, Adamu (2016) found that external debt and debt service exert a negative impact on public capital investment. In the case of Mexico, empirical results regarding positive and negative impact are mixed. Using information relative to 31 federal entities in Mexico over the period 1993~2006, Ramírez and Erquizio (2012) found a negative relationship between new debt obtained by governments and spending on public investment. Similarly, based on data related to 32 federal entities in Mexico for the period 2005~2009, Rodríguez and Azamar (2013) found that any increase in debt decreased both investment and economic growth. In contrast to numerous studies showing the negative effect of external debt on investment, few studies support a positive association between external debt and investment. To explore the link between public debt, investment, and growth, Sánchez-Juárez and García-Almada (2016) studied 32 states in Mexico for the period 1993~2012. They applied dynamic models of panel data and the GMM as an econometric approach. Results revealed that public debt exerts a positive effect on public investment, which, in turn, positively affects economic growth.

In the case of Colombia, Salamanca and Monroy (2009) confirmed the negative effect of external debt, reporting that a higher level of external debt decreases public investment.

B. Relationship between external debt and growth

The linkage between external debt and growth is widely documented both theoretically and empirically; however, results are conflicting and inconclusive. Studies using linear models yield three different results: negative, positive, or no significant effects.

A large number of studies suggest that external debt negatively affects the level of growth

(Berensmann 2004, Hameed *et al.* 2008, Presbitero 2012, Guei 2019). In their study, Onafowora and Owoye (2017) focused on Africa; more specifically, they used data related to the Nigerian economy to test the effect of external debt on economic growth over the period 1970~2014. Their findings based on structural vector autoregression show that external debt shocks negatively affect growth and investment, confirming the debt overhang hypothesis. With regard to Africa, Shittu *et al.* (2018) used a sample of five Sub-Saharan African (SSA) countries for the period 1990~2015 to analyze the dynamic relationship between debt and growth. They used the panel cointegration analysis, fully modified ordinary least square (OLS), and dynamic OLS techniques as econometric approaches. The findings indicate that external debt is negatively and significantly associated with economic growth. Furthermore, their results indicate a bi-directional causality between the two variables.

Other studies indicate a positive association between debt and growth (Ahlborn and Schweickert 2015, Egbetunde 2012, Sánchez-Juárez and García-Almada 2016, Owusu-Nantwi and Erickson 2016). To study the linkage between external debt on growth, Jayaraman and Lau (2009) used a panel of six Pacific Island countries for their analysis covering the period 1988~2004. They found that there is a bi-directional causal relationship between economic growth and external debt in the short run. However, in the long run, there is no causal relationship. Thảo and Trường (2018) conducted a mixed linear and nonlinear study to analyze the relationship between external debt and growth in Vietnam for the period 2000~2013. The results of the linear approach indicate a positive association between external debt and economic growth. They found that an increase of 1% in external debt raises the level of growth by 1.29%. The nonlinear results indicate that the optimal threshold of external debt is 21.5%, below which it stimulates growth. However, the effect becomes negative above this threshold.

Few studies found no significant effect on the relationship between external debt and growth (Kourtellos *et al.* 2013, Panizza and Presbitero 2012). In addition to studies that support a linear relationship, a growing body of empirical work finds a nonlinear relationship between external debt and economic growth (Krugman 1988, Sachs 1989, Reinhart and Rogoff 2010b, Checherita-Westphal *et al.* 2012). Studies taking a nonlinear approach aim to define the debt overhang threshold. Results differ from one study to another due to different contexts and estimation techniques. For example, Elbadawi *et al.* (1997) define a debt overhang threshold for a sample of 99 developing countries at around 97% of the GDP compared with a threshold of 35-40% found by Pattillo *et al.* (2011). Within the same context, Cordella *et al.* (2005) determine a threshold of external debt of 79 developing countries as a percentage of GDP of 10-35%. Compared with developing countries, studies focused on developed countries define a higher threshold for external debt. For example, the optimal threshold is 90% in Reinhart and Rogoff (2010b) and 85% in Cecchetti *et al.* (2011).

With regard to Asia, Xuan *et al.* (2012) used data on China over the period 2003~2008

to examine the linkage between external debt and economic growth. They found that the effect depends on the level of external debt. Beyond a certain point, external debt becomes a barrier to economic growth and may even trigger an economic crisis.

The nonlinear relationship between external debt and growth in Africa was tested by Ndoricimpa (2017). The author used a sample of 38 African countries for the period 1980~2010. Results show that the optimal threshold is sensitive to the estimation technique. Moreover, the author found that a low level of debt does not have a significant effect on growth; however, a high level of debt was found to be detrimental to economic growth.

Based on a dataset of 10 countries for the period 2005~2015, Vu *et al.* (2018) analyzed the existence of a threshold effect in the relationship between external debt and growth. Their findings indicate that the optimal threshold of external debt as a percentage of GDP is 33.17%. They found that external debt is positively correlated with growth below this threshold. However, beyond this threshold, a 1% increase in external debt decreases GDP growth by 0.02%. Using a Markov-switching model, Doğan and Bilgili (2014) analyzed the nonlinear relationship between external debt and economic growth in Turkey for the period 1974~2009. Empirical results indicate that public and private external debt has a negative impact on growth. However, the negative effect of public debt on economic growth is more pronounced than that of private debt.

Although existing studies widely document the relationship between external debt and growth or between external debt and investment, few studies investigate the joint effect of external debt, domestic investment, and growth (Clements *et al.* 2003, Njimanted *et al.* 2014). When reviewing the relevant literature, we noted the lack of studies combining external debt, investment, and growth. To fill this gap, this study aims to explore the dynamic relationship between external debt, investment, and economic growth in low-income countries.

III. The Model

In this section, we first describe the sample selection and motivations to split the total sample into two sub-samples. Next, we describe the empirical approach and model specification and define our variables. Finally, we present a descriptive analysis and check for multicollinearity.

A. The sample

To test the impact of external debt on investment and economic growth, we use a sample of low-income countries over the period 2000~2017. This differs from Clements *et al.* (2003) who used 55 low-income countries as classified by the IMF's Poverty Reduction and Growth Facility. In this study, the initial sample of 31 countries is determined using the World Bank classification of

"low income." However, six countries[2] are excluded due to the non-availability or non-continuity of data related to the level of external debt. Hence, only 25 countries are considered.

Furthermore, Clements *et al.* (2003) use all low-income countries to test the effect of external debt on investment and growth. In this study, we divide the sample into two sub-samples: less indebted and more indebted countries. We believe that outliers may dominate or skew the results when using a sample that includes countries with extremely high or low ratios of external debt to GNP, such as 1380.767% (Liberia in 2003) and 10.269% (Haiti in 2011). For this reason, we believe that splitting the sample is highly useful.

According to Global Development Finance (2000) and earlier World Bank reports, countries can be classified into three categories based on the ratio of external debt to gross national product (NPVD[3]/GNP). Countries are classified as less indebted if their NPVD/GNP< 48%, more indebted if 48% ⩽NPVD/GNP ⩽ 80%, and severely indebted if the ratio of NPVD/GNP > 80%. To classify the countries in the overall sample, we calculate the average ratio of the level of external debt to GNP for each country over the period 2000~2017. Based on the mean value of this ratio, we decide if this country is ranked among less or more indebted countries.

Based on the World Bank's classification, the final sample consists of 23 countries (12 less indebted and 11 more indebted countries[4]). We excluded Guinea-Bissau and Liberia, which were classified as severely indebted countries[5], since we cannot estimate a panel with only two countries. Moreover, we were unable to estimate the time series since the period of the

Table 1. List of less and more indebted countries

	Less indebted countries		*More indebted countries*
1	Afghanistan	1	Central African Republic
2	Benin	2	Chad
3	Burkina Faso	3	Congo, Dem. Rep.
4	Burundi	4	Gambia
5	Ethiopia	5	Guinea
6	Haiti	6	Madagascar
7	Mali	7	Malawi
8	Nepal	8	Mozambique
9	Niger	9	Sierra Leone
10	Rwanda	10	Tajikistan
11	Tanzania	11	Togo
12	Uganda		

2) Eritrea, Democratic People's Republic of Korea, Somalia, South Sudan, and the Syrian Arab Republic.

3) Net present value of debt

4) For more details, see Table 1.

5) The average values of the ratios of external debt to GNP are 127.063% for Guinea-Bissau and 475.007% for Liberia.

study covers only 18 years.

B. Empirical approach, model specification, and variables definition

To study the link between external debt, investment, and growth, we perform simultaneous equations. More precisely, we use the SUR method developed by Zellner (1962). The SUR model is a system of multiple equations (*M*) with a single dependent variable for each equation and (*K*) independent or exogenous variables. In this study, growth and investment are considered dependent variables. However, due to the channels through which investment can be considered a driver for growth and that, reciprocally, a high level of growth can attract more investment, investment and growth can also be considered independent variables. In the econometrics literature, variables are considered either *endogenous* (dependent) or *exogenous* (independent).

Based on previous studies (Zellner 1962, 1963, Kmenta 1971, Felmlee and Hargens 1988, Kim and Cho 2019), the general specification of SUR simultaneous equation systems can be represented as follows:

$$Y1 = \beta_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \ldots\ldots\ldots\ldots + \beta_{1K} X_{1K1} + \mathcal{E}_1 \quad (1)$$

$$Y2 = \beta_{21} + \beta_{22} X_{12} + \beta_{23} X_{23} + \ldots\ldots\ldots\ldots + \beta_{2K} X_{2K2} + \mathcal{E}_2 \quad (2)$$

$$\vdots$$

$$YM = \beta_{M1} + \beta_{M2} X_{12} + \beta_{M3} X_{M3} + \ldots\ldots\ldots + \beta_{MK} X_{MKM} + \mathcal{E}_M \quad (M)$$

Or

$$\boldsymbol{Y}_m = \boldsymbol{X}_m \boldsymbol{B}_m + \mathcal{E}_m \ (m = 1, 2\ldots\ldots\ldots\ldots M)$$

Here, Y_m is an $(N \times 1)$ vector of dependent variable. X_m is an $(N \times K)$ of independent variables (with $X_{mi} = 1$ for all m). β_m is a (K_m x 1) vector of coefficient regressions, and ε_m is an ($N \times 1$) vector of disturbances.

The use of the SUR method was motivated by the efficiency gained in estimation since it results in a combination of information from different equations. Moreover, this method can test restrictions that involve parameters in different equations. Compared with OLS estimators, the two-stage general least square and ML estimators of the SUR model are considered more efficient. These two methods provide smaller standard errors, especially for large samples. However, with reference to Hanushek and Jackson (1977), when dealing with a small sample size and having covariances of disturbances for the multiples' equation that equal zero, the

OLS estimators are the best unbiased linear estimates. Therefore, the SUR approach was used in this study.

The methodology used in this study is based on two steps. First, we test how external debt affects the investment pillar that stimulates economic growth. Following Clements *et al.* (2003), Tanzi and Davoodi (1997), and, more recently, Guei (2019) and Thảo and Trường (2019), our investment and growth models are given in Equations (1) and (2):

$$\boldsymbol{INVES} = \beta_{10} + \beta_{11}\boldsymbol{GDPPC}_{11} + \beta_{12}\boldsymbol{EXDBT}_{12} + \beta_{13}INFRA_{13} + \beta_{14}URBAN_{14} + \beta_{15}INF_{15} + \mathcal{E}_1 \quad (1)$$

After testing the relationship between external debt and investment, the second step explores the link between external debt and economic growth in low-income countries while taking into consideration the channel through which investment can affect economic growth. The growth model is presented in Equation (2):

$$\boldsymbol{GDPPC} = \beta_{20} + \beta_{21}GDPPC_{(t-1)21} + \beta_{22}\boldsymbol{INVES}_{22} + \beta_{23}\boldsymbol{EXDBT}_{23} + \beta_{24}SCHOOL_{24} + \beta_{25}TRADE_{25} + \beta_{26}POPG_{26} + \beta_{27}INF_{27} + \mathcal{E}_1 \quad (2)$$

All variables used to explain the investment and the growth models have a theoretical justification. The literature on external debt offers four main proxies. However, in this study, we used external debt stock as a percentage of GNI for many reasons. First, it was considered the most recently and most widely used (Zaghdoudi and Hakimi 2017, Zaghdoudi 2018, Al Kharusi and Stella Ada 2018, Shkolnyk and Koilo 2018, Guei 2019). Second, the present value of debt should reflect the degree of concessionality of loans (Clements *et al.* 2003). Third, there is continuity and availability of data in using this measure. Population growth (POPG), as a proxy for growth in the labor force, and investment (INVES) as capital and a channel though which capital affects growth are introduced as key inputs to the production process. Secondary school enrollment (SCHOOL) is included in the models to indicate the quality of human capital (Clements *et al.* 2003, Kodongo and Ojah 2016). Trade openness (TRADE) was theoretically used as a key driver to spur economic growth (Sachs and Warner 1995, Levine *et al.* 2000, Zhang *et al.* 2012, Menyah *et al.* 2014). The inflation rate (INF) was recognized as a pillar that affects investment and growth through financial expenses. Moreover, high inflation is associated with a decline in real wages that causes a decline in real income. All variable definitions are given in Table 2.

Table 2. Variable definitions

Variables	Definition	Source
GDPPC	GDP per capita growth (annual %)	WDI 2000~2017
$GDPPC_{(t-1)}$	The initial level of GDP per capita growth (annual %)	WDI 2000~2017
INVES	Total investment (% of GDP)	WDI 2000~2017
EXDBT	External debt stock (% of GNI)	WDI 2000~2017
SCHOOL	School enrollment, secondary (% gross)	WDI 2000~2017
INFRA	Individuals using the Internet (% of population)	WDI 2000~2017
TRADE	Trade (% of GDP)	WDI 2000~2017
URBAN	Urban population (% of total population)	WDI 2000~2017
POPG	Population growth (annual %)	WDI 2000~2017
INF	Inflation, consumer prices (annual %)	WDI 2000~2017

C. Descriptive analysis and correlation

Table 3 presents descriptive statistics for 12 less indebted countries and 11 more indebted countries over the period 2000~2017. All statistics displayed in the table are collected from the World Development Indicators database and are presented in percent form.

Table 3. Descriptive statistics

	Less indebted countries					More indebted countries				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
GDPPC	213	2.497	3.47	-6.935	18.515	198	2.001	5.676	-36.203	28.676
INVES	184	24.202	8.379	7.011	55.856	198	19.17	9.969	4.562	64.852
Exdbt	210	38.698	27.965	10.269	175.849	198	60.245	36.648	14.049	202.624
SCHOOL	146	30.718	16.26	6.572	71.209	121	36.089	20.096	6.112	87.441
Infra	214	4.666	5.63	0.004	23.706	198	3.903	5.088	0.005	21.961
TRADE	202	50.652	15.792	20.964	116.363	198	71.011	25.133	25.042	175.351
POPG	216	2.744	0.853	-0.267	5.605	198	2.668	0.659	0.259	4.63
Urban	216	24.407	11.076	8.246	54.346	198	34.045	10.185	14.61	60.599
INF	211	6.445	6.754	-8.238	44.357	161	14.193	48.996	-8.975	513.907

Table 3 shows that the average value of GDP per capita (*GDPPC*) is 2.497% with a maximum of 18.515% and a minimum of -6.935%. Compared with less indebted countries, more indebted countries registered a lower level of growth. We found that the mean level of growth is 2.001%. From these statistics, we conclude that less indebted countries experienced a high level of growth over this period.

Regarding total investment, statistics also confirm the superiority of less indebted countries over the more indebted ones. For the first group, the average value of total investment is 24.202%

compared with 19.170% for the second group. Based on the World Bank classification, we found that the first group of countries had a lower level of external debt compared with the second group. For less indebted countries, the mean value of the ratio of external debt is 38.698% versus 60.245% for more indebted countries. For convenience, we restate here that countries are classified as less or more indebted based on the average value of their external debt ratios over the period 2000~2017.

The average and maximum values of the ratio of debt service to GNP for less indebted countries are 1.551% and 9.969 %, respectively. However, more indebted countries pay more in debt service. For these countries, the average ratio of debt service to GNP is 1.771% and the maximum is 11.019%.

Regarding the inflation rate, the data indicate that on average, more indebted countries recorded a higher inflation rate than less indebted countries. The average level of inflation for less indebted countries is 6.445% compared with14.193% for more indebted countries. For the latter group, some countries exhibit extremely high inflation. For example, the Democratic Republic of Congo registered a hyperinflation rate of 513.907% in 2000 and 359.937% in 2001. During this period, the principal cause of hyperinflation in this country was an uncontrolled budget deficit financed by money creation (IMF 2001). To summarize, we conclude that more indebted countries recorded a lower level of growth and investment and a higher level of inflation compared with less indebted countries.

We now check for multicollinearity among the variables. Table 4 shows the correlations between the variables in this study. The Pearson correlation is used to analyze the nature and level of correlation.

Table 4. Correlation Matrix

	GDPPC	$GDPPC_{(t-1)}$	*INVES*	*EXDBT*	*SCHOOL*	*INFRA*	*TRADE*	*URBAN*	*POPG*	*INF*
GDPPC	1.0000									
$GDPPC_{(t-1)}$	0.2107	1.0000								
INVES	0.2003	0.1281	1.0000							
EXDBT	-0.1632	-0.1767	-0.4452	1.0000						
SCHOOL	0.1027	0.1047	-0.0353	-0.2140	1.0000					
INFRA	0.0508	0.1063	-0.0468	-0.1365	-0.0432	1.0000				
TRADE	0.1994	0.1690	0.1714	-0.0527	0.4183	-0.0014	1.0000			
URBAN	-0.0869	-0.0619	-0.2611	0.1639	0.1360	0.3698	0.1972	1.0000		
POPG	0.0161	0.0295	0.1768	0.1022	-0.4654	0.1207	0.0400	-0.0083	1.0000	
INF	-0.1501	-0.1497	-0.1128	0.1575	0.1689	-0.1074	-0.0808	0.0312	-0.0552	1.0000

Table 4 shows that the correlations between the independent variables are weak. Thus, we conclude that there is no significant concern regarding multicollinearity.

IV. Discussion of Results

In this section, we first discuss the empirical results using the total sample. Second, to obtain the desired results from the comparative analysis, we discuss the results of the splits ample in which we divide the total sample into two sub-samples: less indebted countries and more indebted countries.

A. Results of the total sample

In this sub-section, we discuss the results of using the total sample to test the linkage between external debt, investment, and growth. The first step in applying the SUR model is to check the residual correlation results shown in Table 5. The results show that the correlation of the two equations is different from zero (0.1947). Moreover, the probability associated with the Breusch-Pagan test is lower than 5%, which confirms that the residuals are correlated.

Table 5. Correlation matrix of residuals

The total sample		
	GDPPC	*INVES*
GDPPC	1.0000	
INVES	0.1947	1.0000
Breusch-Pagan test of independence		
chi2 (1)	10.451	
Prob	(0.0034)	

Table 6 presents the results of the effect of external debt on investment and growth when the total sample (23 countries) is tested.

The results in Table 6 indicate that external debt is negatively and significantly correlated with both investment and growth for the total sample. An increase of 1% point in external debt decreases total investment by 0.088% point and economic growth by 0.182%point. The high level of external debt as a percentage of GDP supports the debt overhang hypothesis in most cases. In this situation, economic growth is slowing and negative signals are being sent to both domestic and foreign investors, which discourages further investment given the macroeconomic instability. The negative association between external debt and growth is fundamentally justified by the debt overhang hypothesis. An increase in the level of debt up to a certain point enables the private sector to benefit from additional possibilities for future investment (Myers 1977). However, a high level of external debt is associated with an increase in debt service. When a country is unable to pay the principal and interest owed to lenders, it is categorized as having defaulted on payment, further deteriorating its economic situation.

This result is in line with Presbitero (2012), Guei (2019), Were (2001), and Lopes (2002).

Results also indicate that the lagged variable of *GDPPC* is positively and significantly correlated with the current level of *GDPPC*. This means that the current *GDPPC* positively depends on the previous level of *GPPC*.

Table 6. Results of SUR model for the total sample

		Coef.	Std. Err.	*Z*	P>*z*
INVES	*GDPPC*	0.259	0.112	2.310	0.021**
(Equation 1)	*EXDBT*	-0.088	0.016	-5.440	0.000***
	INFRA	-0.173	0.231	-0.750	0.455
	URBAN	0.070	0.049	1.430	0.153
	INF	-0.056	0.068	-0.820	0.413
	_cons	32.075	3.983	8.050	0.000***
GDPPC	$GDPPC_{(t-1)}$	0.205	0.067	3.040	0.002***
(Equation 2)	*INVES*	0.072	0.040	1.810	0.070*
	Exdbt	-0.182	0.090	-2.020	0.044**
	SCHOOL	-0.123	0.081	-1.511	0.131
	TRADE	0.053	0.016	3.370	0.001***
	POPG	-1.146	0.433	-2.650	0.008***
	INF	-0.046	0.041	-1.130	0.257
	_cons	2.814	1.864	1.510	0.131
Equation	Obs	RMSE	*R*-sq	*chi2*	P
INVES	215	7.163	0.189	55.62	0.000
GDPPC	215	4.058	0.166	48.14	0.000

(Note) ***,** and * indicate level of significance respectively at 1%, 5% and 10%

The second important result is the reciprocal interrelationship between investment and growth. Findings indicate that there is a reciprocal relationship between these two indicators: an increase of 1% point in investment leads to a 0.072% point increase in economic growth, and a 1% point increase in growth increases investment by 0.259% point. Considering investment as a production factor, economic theory supports the notion that investment can stimulate economic growth. The higher the rate of investment, the higher is the output level (Solow 1956). Investment is recognized as one of the most important drivers of growth; an increase in investment activity contributes to wealth accumulation, creates more job opportunities, and increases the level of wages. This subsequently enhances economic development and growth. This finding is consistent with the works of Levine and Zervos (1998), Loayza and Ranciere (2006), and Hamdi *et al.* (2017).

Furthermore, our results show that trade is considered a key determinant for economic growth in low-income countries. Trade openness is found to be positively and significantly correlated

with the dependent variable (*GDPPC*). According to Grossman and Krueger (1991), the positive association between trade openness and economic growth can be explained in terms of three effects. The first is the scale effect in which trade enhances the level of production and level of domestic consumption, thus accelerating economic activity. The second is the technical effect. Trade liberalization increases the flow of new technology that improves production methods and processes. Finally, trade changes the economic structure of the host country under the composition effect. This finding corroborates the works of Grossman and Krueger (1991), Menyah *et al.* (2014), Falvey *et al.* (2013), and Hakimi and Hamdi (2016).

As a proxy for human capital and labor force growth, *POPG* exerts a negative and significant effect only for the growth model. The negative relationship between *POPG* and economic growth was confirmed by Malthus (1798). He reported that the standard of living would be depressed with an increase in population. The negative association between *POPG* and economic growth was confirmed many years later. An increase in population decreases the returns to labor, which negatively affects the quality and the quantity of work (Becker *et al.* 1999). Furthermore, if *POPG* and economic growth are uncorrelated or have a nonlinear relationship, the resources available on earth will not vary proportionally to the size of the population. Hence, *POPG* reduces the potential for economic growth in the long term (Linden 2017). This empirical finding is consistent with the works of Yao *et al.* (2013) and Banerjee (2012). To better understand the linkage between debt, investment, and growth, and to make a comparison, the following sub-section presents the results of the splits sample.

B. Results of the split sample

As with the total sample, Table 7 presents the results of the correlation matrix of the residuals and the Breusch-Pagan test of independence for the split sample.

Table 7. Correlation of disturbances

	Less indebted countries		**More indebted countries**	
	GDPPC	*INVES*	*GDPPC*	*INVES*
GDPPC	1.0000		1.0000	
INVES	0.2753	1.0000	0.3662	1.0000
Breusch-Pagan test of independence				
chi2 (1)	11.491		18.357	
Prob	(0.0029)		(0.0012)	

Table 7 indicates that the correlation between investment and growth is different from zero (0.2753 for less indebted countries and 0.3662 for more indebted countries). Moreover, the probability of the *chi*-square of the Breusch-Pagan test of independence is lower than 5% (0.0029

for less indebted countries and 0.0012 for more indebted countries). Therefore, we can reject the hypothesis that residuals are independent and assert that the residuals of the two equations are correlated. Table 8 presents the empirical results of the SUR model for less indebted countries and more indebted countries.

Table 8. Results of SUR model for less indebted countries (PV/GNP < 48%) and more indebted countries (48% ⩽PV/GNP⩽ 80%)

		Less indebted countries		More indebted countries	
		Coef.	Z	Coef.	Z
INVES	*GDPPC*	0,276	2,020**	0.252	1.53
(Equation 1)	*EXDBT*	-0,076	-4,880***	-0.068	-2.330**
	INFRA	0,270	3,040***	0.087	0.26
	URBAN	0,381	0,710	0.093	2.340**
	INF	0,093	1,110	0.156	1.41
	_cons	5,090	12,750***	2.591	6.600***
GDPPC	$GDPPC_{(t-1)}$	0,004	2,940***	0.249	2.370**
(Equation 2)	*INVES*	0,035	0,720	0.082	1.2
	EXDBT	-0,027	-2,100**	-0.019	-3.110***
	SCHOOL	0,088	3,050***	0.023	0.67
	TRADE	0,067	2,710***	0.069	2.330**
	POPG	-1,708	-3,860***	0.936	0.94
	INF	0,043	0,810	-0.063	-0.980
	_cons	6,755	2,730***	0.102	0.03

Equations	Obs	RMSE	*R*-sq	chi2	P	Obs	RMSE	*R*-sq	chi2	P
INVES	123	5.052	0.471	112.78	0.000	92	8.464	0.130	16.14	0.006
GDPPC	123	3.104	0.191	31.64	0.000	92	4.886	0.208	26.77	0.000

(Note) ***,**, and * indicate level of significance at 1%, 5%, and 10%, respectively

As with the total sample, the findings indicate that external debt significantly decreases investment and growth for both less and more indebted countries. The negative effect is more pronounced for the investment model than for the growth model. We found that a 1% point increase in external debt decreases investment by 0.076% point for less indebted countries, while a 1% point increase in external debt decreases investment by 0.068% point for more indebted countries. Regarding the effect of external debt on economic growth, the same negative impact was confirmed for both less and more indebted countries. However, contrary to the investment effect, there is no strong difference of external debt on growth for the two groups of countries. We found that a 1% point increase in external debt decreases growth by 0.027% point for less indebted countries and by 0.019% point for more indebted countries.

The results shown in Table 8 indicate that the level of *GDPPC* is positively correlated with

the level of investment and is significant at the 5% level. Countries with a high level of growth can attract more local and foreign investment. Moreover, a high level of growth can be considered a positive signal for investors regarding the economic stability of the country. As with the total sample, we found that the lagged variable of *GDPPC* exerts a positive and significant effect on the current level of *GDPPC* for both less indebted and more indebted countries.

Infrastructure is found to be a factor that encourages investment in less indebted countries. Results show that there is a positive and significant association between infrastructure, proxied by the percentage of the population that uses the Internet, and the level of total investment. A 1% point improvement in infrastructure increases total investment by 0.27% point. A strong and wide-reaching infrastructure supports investment and could increase investment inflow. Telecommunications and Internet usage as proxies for infrastructure make information exchange easier and faster, thus improving decision-making. Countries with a good quality of infrastructure stimulate internal investment, attract more foreign direct investment, and enhance productivity and economic development. This result is in line with the studies by Globerman and Shapiro (2002), Wen and Newell (2007), Zeb *et al.* (2014), and Youssaf and Erum (2018).

As a measure of the quality of human capital, the rate of school enrollment exerts a positive and significant effect at the 1% level on growth in less indebted countries. Theoretically, this indicates that primary and secondary school enrollment leads to stronger economic growth. However, enrollment in higher education, including universities and technical colleges, decreases economic growth (Barro 1991). The positive association between secondary school enrollment and economic growth is due to the likelihood that these graduates will find it easier to participate in the workforce and have an active life. As per Mankiw *et al.* (1992), a 1% point increase in secondary school enrollment ratio raises growth by 0.088% point.

Similar to the analysis of the total sample, trade openness is found to be positively associated with *GDPPC* and significant at the 5% level for both less and more indebted countries. This result confirms the crucial role of trade openness in boosting economic growth in low-income countries. The rationale for the positive effect of trade on economic growth was discussed for the result of the total sample. The negative effect of *POPG* observed for the total sample in the growth model is only confirmed for less indebted countries, where we found that *POPG* is negatively and significantly associated with *GDPPC* as a dependent variable.

V. Conclusion and Policy Recommendations

The relationship between external debt and growth has been widely documented (Krugman 1988, Sachs 1989, Berensmann 2004, Hameed *et al.* 2008, Presbitero 2012, Sánchez-Juárez

and García-Almada 2016, Owusu-Nantwi and Erickson 2016, Guei 2019). Few studies focus on the linkage between external debt and investment. On one hand, investment is considered as an important channel that affects growth. On the other hand, a high level of growth could be considered a positive signal to attract more domestic and foreign investment.

We used a sample of low-income countries over the period 2000~2017. Taking into account the possible difference in the levels of external debt among those countries, we performed an analysis using the 23 countries in the sample and a split-sample analysis wherein we separated less indebted (12) from more indebted (11) countries.

The results of the SUR model indicate that the effect of external debt on investment and growth is negative for both less indebted and more indebted countries. This means that investment and growth in these countries are not dependent on an *implicit threshold* of external debt in less indebted countries (NPVD/GNP< 48%) and more indebted countries (48% ⩽NPVD/GNP ⩽ 80%). These findings suggest that the relationship between external debt, investment, and growth in low-income countries could be nonlinear. Therefore, the results would hold more meaning if we apply nonlinear models that precisely define the optimal threshold of the level of external debt.

We also found that in less indebted countries, infrastructure significantly increases the level of total investment, and growth could be boosted by improvement in school enrollment rates and trade activities. With regard to more indebted countries, results show that investment is positively and significantly associated with urbanization and that trade can spur economic growth.

This study offers certain important findings and policy recommendations to policymakers in low-income countries. For these countries, external debt limits investment and growth for both less and more indebted countries. This means that the effect is not dependent on the level of debt but may be related to the management of debt. Policymakers in these countries should ensure that external debt will be channeled into income-generating and productive activities. Low-income countries are advised to stabilize macroeconomic conditions to manage debt service requirements and avoid payment defaults.

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