"The effect of fiscal decentralization on economic growth in sub-national governments of Ethiopia: A two-step system general methods of moments (GMM) approach"

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THE EFFECT OF FISCAL DECENTRALIZATION ON ECONOMIC GROWTH IN SUB-NATIONAL GOVERNMENTS OF ETHIOPIA: A TWO-STEP SYSTEM GENERAL METHODS OF MOMENTS (GMM) APPROACH

Abstract

The study examines the impact of fiscal decentralization on Ethiopia's Subnational (Regional) economic growth. The study followed a quantitative research procedure employing data from 2008 to 2021. The units of analysis in the study are Ethiopia's subnational governments (SNGs). The study used the two-step System General Method of Moments (GMM) of dynamic panel estimation because it resolves concerns such as endogeneity and heteroscedasticity. The study's findings revealed that expenditure, revenue, and composite decentralization have a statistically significant negative effect on regional economic growth. Moreover, among the control variables, inflation and government size have a statistically significant detrimental effect on regional economic growth. However, human capital has no significant effect. Ethiopia's fiscal decentralization contradicts the goals and theoretical underpinnings of fiscal federalism. This may be because fiscal decentralization and economic activities function within an ethnically based federalism framework. The primary implication is that the federal government needs to reevaluate the transfer of fiscal authority to SNGs. Transforming tax policy into a robust institutional mechanism for economic growth is vital. The revenue and spending sides of intergovernmental relations also need to be closely related. As opposed to prior studies, which utilized one or two fiscal decentralization indicators, this study used multiple indicators, making the study more thorough and closing the knowledge gap.

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JEL Classification	O18, E62, C12

INTRODUCTION

The public finance system, which includes government expenditure and revenue (taxes, borrowing, and grants), may enhance long-term economic growth. The following three premises form the basis of the fiscal federalism hypothesis, which connects decentralization with economic growth.

First, the SNGs are much closer to the consumer or voter than the central government, so they better understand local preferences. Using this information advantage, they can improve economic growth through efficient public service delivery (Oates, 1972, 2005; Boadway & Tremblay, 2012). Second, decentralization could encourage competition among local governments to better align local public service delivery with local tastes to draw movable production elements, which

spurs economic growth (Tiebout, 1956; Boadway & Tremblay, 2012). Third, decentralization may restrain the rent-seeking behavior of local officials and politicians by establishing penalties such as losing citizens' votes or mobile production factors. It also forces them to develop better policies and initiatives that increase their effectiveness and local economic growth instead (Brennan & Buchanan, 1980; Weingast, 2009).

Decentralized spending demonstrates local governments' motives for spending taxpayer money. Given the initial hypothesis of the administrative unit inhabitant's homogenous social wants, it is plausible to anticipate that the expenditure decentralization will positively impact the economic agents' behavior. Spending on the budget is separated into two categories: productive and non-productive. Fiscal decentralization might lead to a specific weighting of productive expenditures within the overall spending structure. Besides, the corollary of fiscal federalism is represented by revenue devolution. As a result, the structural optimization of revenue sources is a concern of SNGs in public finance.

Scholars found a mixed bag of results on the effect of fiscal decentralization on economic growth (e.g., Davoodi & Zou, 1998; Naumets, 2003; Jin & Zou, 2005; Rodriguez-Pose & Kroijer, 2009; Philip & Isah, 2012; Iqbal et al., 2012; Baskaran & Feld, 2012; Blöchliger et al., 2013; Liu, 2017).

Acknowledging the contributions of earlier studies to the literature on fiscal federalism, in addition to the inconsistencies in the results, they failed to use a complete panel regression diagnosis test to select the most appropriate model for their research, which is why their findings are inconsistent. Because it causes an endogeneity issue and weakens the model's robustness, it questions their findings. The studies must be more cohesive and credible because they only utilize one or two metrics to gauge fiscal decentralization.

No other country in the world currently practices such forms of ethnic federalism as Ethiopia. With five tiers of government (federal, regional state, Zone, woreda, and local), each of which has a nearly identical structure in the executive, legislative, and judicial branches, Ethiopia's government began a decentralization program in 1991 based on ethnic federalism (Ghebrehiwet, 2015; Lee, 2013).

The arrangement recognizes individuals based on the ethnic group they belong to but does not consider those who wish to identify as Ethiopian nationalism. Alternatively, it serves as a "surrogate mother" for a person who identifies him/herself under the brand of Ethiopian nationalism, making Ethiopia's federalism arrangement a "mother of segregation." Fiscal decentralization operates under the federal arrangement. Ethiopia has used a unique arrangement, which may have a detrimental effect on investment, significantly affecting economic growth in the long run. Besides, a few studies have been conducted in this context; therefore, the present study fills the knowledge gap in the literature.

1. LITERATURE REVIEW

The relationship between decentralization and its presumed outcomes, such as improved economic development, closing gaps, and efficient service delivery, can be divided into two theoretical strands: first-generation fiscal federalism (FGFF) and second-generation fiscal federalism (SGFF).

Fiscal decentralization is a technique for distributing duties for delivering public goods to different levels of government with the resources needed to carry out the tasks assigned to them and aims to capitalize on the knowledge gain of SNG produced by their proximity to local communities (Tiebout, 1956; Oates, 1972). Theories suggest numerous mechanisms by which fiscal decentralization affects growth. In public finance literature, fiscal federalism theories have long been a source of debate.

It is a procedure to grant SNG autonomy over local resources (different tax bases) to pay for their spending plan (Boadway & Tremblay, 2012). The FGFF advocates for the central government to

be responsible for redistributive responsibilities. Moreover, it encourages revenue centralization compared to expenditure. The theory recommended centralized taxation of mobile inputs, such as income, payroll, and sales taxes, to decrease the mobility of production factors. A significant portion of government revenue comes from this tax base. SNGs have different tax systems and rates due to the decentralization of the tax bases used to fund the revenue system, which raises tax collection and enforcement costs. The idea of benefit, which showed that the benefit obtained by households should be proportional to the expense of possessing it, was a vital component of the SGFF's argument for SNGs to be self-sufficient in their spending demands.

Fiscal decentralization budget distribution focuses on SNGs expenditure decision autonomy for provisions on public goods (Boadway & Tremblay, 2012). In the fiscal decentralization process, budget allocation is urged to come first. Since local government should know about their spending requirement to increase the required revenue (Shah, 2006), it has much more political cost than revenue assignment since the central government leaves regional government budget control, which increases the reliance and loyalty of SNGs to the center at the expense of local community needs. This, in turn, may put the efficiency of public spending in great danger.

The inter-regional transfer system emphasizes grants or subsidies supplied by the central government to the SNGs to accomplish predetermined goals (Boadway, 2005; Shah, 2006; Oates, 2005). The FGFF places a strong emphasis on achieving the following three goals. First, the discrepancy between SNG revenue allocations and spending requirements led to resolving fiscal deficits. Second, to pay for the projects that the federal government started. Lastly, it urges the reduction of lateral fiscal imbalances and subsidizing spillover effects.

The three previously mentioned points make it clear that the FGFF's intergovernmental transfer system prioritized gap-filling. It gives larger equalization grants to SNG that has experienced a more significant fiscal deficit and needs an explicit method of addressing the inter-jurisdictional spillover effect (Oates, 1972, 2005; Boadway &

Tremblay, 2012). Additionally, there needs to be a formal system to give SNGs incentives to step up their efforts to collect more tax money.

As a result, instead of stepping up its attempt to collect more taxes, the regional administration spends much more money and competes over a common fund. The SGFF contended that encouraging rent-seeking could occur by giving SNG with wider gaps a larger payment. It promotes the close connection between revenue and expenditures and is an explicit mechanism for controlling the inter-jurisdiction spillover effect.

The SNG can pay its expenditure needs through this additional option. While the FGFF is more constrained in granting SNGs autonomy, fiscal federalism theories accept borrowing. Project investment is necessary for interregional equity and efficiency, and it should be financed through borrowing rather than relying on transfers from the center (Boadway & Tremblay, 2012). SNGs can raise money by taking out loans from lenders or issuing government bonds and securities on the capital market, according to Martinez-Vazquez and Vulovic (n.d). Borrowing autonomy allows a local government to spend money following local preferences rather than being constrained by the federal government's dictates, which can reduce productivity.

Therefore, fiscal federalism theory connects decentralization with economic growth by adopting two premises. First, since SNGs are more familiar with local preferences than the center, decentralization may promote economic growth by improving the effectiveness of local public service delivery. Because of this, they can increase economic growth by adequately providing public services (e.g., Oates, 1972, 2005; Boadway & Tremblay, 2012). Second, decentralization would encourage SNGs to compete to create a better fit between local public service supply and local desires to draw mobile manufacturing elements, which would result in economic growth (e.g., Tiebout, 1956; Boadway & Tremblay, 2012).

Moreover, in the decentralized fiscal system, the public-finance strongly advises that policies aimed at providing public services like infrastructure and education sensitive to regional and local

circumstances than centrally determined policies disregarding the inter-jurisdictional spatial variations of preferences (Davoodi & Zou, 1998).

Barro (1990) was the first to make an empirical attempt to examine the impact of government spending on economic growth. Following Barro's footsteps, Davoodi and Zou's (1998) study was the first to significantly attempt to incorporate fiscal decentralization into an endogenous growth model. Though these two initiatives opened the door to an empirical investigation of the relationship between fiscal decentralization and economic growth in various national contexts, a few studies were conducted in Ethiopia. Therefore, the present study aimed to investigate the effect of fiscal decentralization on economic growth.

2. METHODS

For models based on dynamic panel data, Arellano and Bond (1991) and Arellano and Bover (1995) developed GMM model estimation. Following that, Blundell and Bond (2000) employed it for the first time to eliminate the issue of possible endogeneity in growth regression models. The technique's main benefit is that it can be used without additional instruments. Utilizing internal instruments to prevent simultaneity or reverse causation might help alleviate any endogeneity problems (Blundell & Bond, 2000). The estimating technique also accounts for the unobserved heterogeneity by considering year-fixed effects.

In an empirical sense, the validity of the instruments used in the present study GMM estimation is tested using the specification tests suggested by Arellano and Bover (1995). First, the Arellano-Bond test for serial correlation is modified to determine if the first-differenced residuals exhibit second-order serial correlation. The residuals' serial uncorrelation is the null hypothesis. If the null hypothesis cannot be ruled out, this shows no second-order serial correlation and that the GMM estimator is reliable. Second, the Sargan test examines the respective null hypothesis of instrument validity. The failure to reject the null hypothesis confirms the instruments' validity. Because the Sargan and Hansen tests for over-identification and the serial autocorrelation of the error term

are provided directly, the analysis on Stata with xtabond2 does not require the post-estimation of these tests (Roodman, 2009).

2.1. Data and sample

It is getting easier to assess actual occurrences using secondary data. The pertinent secondary data collected from The Ministry of Finance and Economic Cooperation (MoFEC), Nine regional state governments, and one city from 2008 to 2021 served as the study's analytical unit. The study sample size is 140 (10 units of analysis x 14 years).

2.2. Specification and estimation procedures

According to Blundell and Bond (1998, 2000), the two-step system GMM estimators correct the residuals for heteroscedasticity and produce consistent estimates in the presence of a lagged dependent variable as the lagged levels of explanatory variables turn out to be weak instruments for the first difference equation. A loss of important observations also affects the first differences in GMM estimation. First-differences GMM estimation will likely perform poorly and needs better finite sample qualities in these circumstances (bias and imprecision). Instead, Arellano and Bover (1995) proposed a system GMM estimator. The standard set of equations in first differences and an additional set of levels equations are combined in the system GMM estimator.

The three fiscal decentralization indicators equation to be estimated can be written as follows in the levels and first differenced forms, depending on the explanations given above:

$$
\begin{aligned}
\ln RGDPgr_{it} &= \beta_0 + \beta_1 \ln\left(RGDPgr_{it-1}\right) + \\
&+ \beta_2 \ln\left(Exp\,Dec_{it}\right) + \beta_3 \ln\left(Gov't\,size_{it}\right) + \\
&+ \beta_4 \ln\left(Inflation_{it}\right) + \\
&+ \beta_5 \ln\left(Human\,capital_{it}\right) + V_{it},
\end{aligned} \tag{1}
$$

$$
\begin{aligned}
\ln RGDPgr_{it} &= \beta_0 + \beta_1 \ln(RGDPgr_{it-1}) + \\
&+ \beta_2 \ln\left(Re\,v\,Dec_{it}\right) + \beta_3 \ln\left(Gov't\,size_{it}\right) + \\
&+ \beta_4 \ln\left(Inflation_{it}\right) + \\
&+ \beta_5 \ln(Human\,capital_{it}) + V_{it},
\end{aligned} \tag{2}
$$

$$\ln RGDPgr_{it} = \beta_0 + \beta_1 \left(\ln RGDPgr_{it-1} \right) +$$
$$+ \beta_2 \ln \left(Comp\,Dec_{it} \right) + \beta_3 \ln \left(Gov't\,size_{it} \right) +$$
$$+ \beta_4 \ln \left(Inflation_{it} \right) +$$
$$+ \beta_5 \ln \left(Human\,capital_{it} \right) + V_{it}. \qquad (3)$$

2.3. Research variables

Several significant elements must be considered while defining an empirical model (See Table 1). Following other studies, this study employed the gross domestic product growth rate to measure economic growth.

The present study selected explanatory variables depending on how theoretically connected they were to the dependent variable. The study examined the existing literature and measured Ethiopia's fiscal federalism using expenditure, revenue, and composite decentralization. The study also used control variables such as the government's size, inflation rate, and human capital. Therefore, Table 1 presents the operational definitions and computation of the study's dependent, independent, and control variables.

3. RESULTS

As presented in Table 2, the average value of RGDPgr is 0.2, with a minimum value of −4.048 and a maximum value of 3.495. The mean and standard deviations of independent and control variables are presented as follows, regarding explanatory variables, Exp Dec (Mean = 3.1; Std. Dev = 3.42), Rev Dec (Mean = 0.518; Std. Dev = 2.182), and Comp Dec (Mean = 0.528; Std. Dev = 2.183). Besides, regarding the control variables, Gov't size (Mean = 0.244; Std. Dev = 0.189), Inflation (mean = 0.116; Std. Dev = 0.101), and Human capital (Mean = 4.862; Std. Dev = 1.679).

Table 1. Research variables

Source: Developed by the authors (2021).

Variables	Definition	Computed	Source	Expected sign
Dependent variable				
Regional Economic growth (RGDPgr)	It is the growth rate of regional domestic products	Real RGDP growth rate	Davoodi and Zou (1998); Iqbal et al. (2012); Liu (2017)	
Independent variables				
Expenditure decentralization (Exp Dec)	It is the regional government's expenditure autonomy for their assigned responsibility	It is computed as the subnational expenditures as % of federal government expenditures	Davoodi and Zou (1998); Schneider (2003); Liu (2017)	+/–
Revenue Decentralization (Rev Dec)	It is the magnitude of regional government revenue autonomy to cover their expenses from their revenue share and the level of dependency on the federal grants	It is calculated as own sub-national revenues as % of total revenues	Schneider (2003); Liu (2017)	+/–
Composite Decentralization (Comp Dec)	It is a combined effect of expenditure and revenue decentralization	The ratio of revenue decentralization to (1 − Expenditure Decentralization)	Martinez-Vazquez and Timofeev (2010); Iqbal et al. (2012); Baskaran and Feld (2012)	+/–
Control variables				
Government size (Gov't size)	It is the size of the public sector	It is measured by Subnational expenditure as % of regional GDP	Loizides and Vamvoukas (2005); Martinez-Vazquez and Timofeev (2010); Makreshanska-Mladenovska and Petrevski (2019)	+/–
Inflation	Inflation reflects the increases in the pricing of goods and services over time	The annual inflation rate measures it	Zhang and Zou (1998); Iqbal et al. (2012); Baskaran and Feld (2012)	+/–
Human Capital	It is the availability of an educated and skilled workforce	It is measured by sub-national government investment in social development	Used by the study	+

Table 2. Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
RGDPgr	130	.2	.83	−4.048	3.495
Exp Dec	140	3.103	3.422	.003	16.2
Rev Dec	140	.518	2.184	.066	26.052
Comp Dec	130	0.528	2.183	0.67	26.51
Gov't size	140	.244	.189	.006	.833
Inflation	130	.116	.101	−.451	.36
Human capital	140	4.862	1.679	.588	7.968

Additionally, Tables A1 and A2 in the appendix show the normality and multicollinearity test results, respectively. As indicated in Table A1, the variables in the study have a normal distribution. Besides, Table A2 confirmed that the models in the study are free from multicollinearity problems.

The study's first objective is to measure the effect of expenditure decentralization on economic growth. To this end, the study used the two-step system

GMM regression. Table 3 presents the model results on the effect of revenue decentralization on economic growth in Ethiopia. The Chi-square test statistics indicated the model's goodness of fit. Besides, the Sargan test accepted all specifications and validated the over-identifying restrictions in the GMM estimation. The test for AR (2) validated the absence of second-order autocorrelation.

As presented in Table 3, expenditure decentralization (P = 0.019; β = −0.37), gov't size (P =0.098; β = −0.389), and Inflation (P = 0.000; β = −0.369) have a statistically significant negative effect on economic growth. However, human capital has no significant effect on economic growth.

The study's second objective is to examine the effects of revenue decentralization on economic growth. As shown in Table 4, the AR (2) test showed the absence of second-order autocorrelation. The over-identifying of the Sargan test as-

Table 3. The effect of expenditure decentralization on economic growth

RGDPgr	Coef.	St. Err.	z value	p-value
Exp Dec	−.37	.158	−2.34**	.019
Gov't size	−3.897	2.352	−1.66*	.098
Inflation	−3.697	.567	−6.52***	0.000
Human capital	.026	.303	.09	.931
Constant	2.654	1.693	1.57	.117
Number of observations 130				
Arellano-Bond Test for Autocorrelation		AR (1) test	−2.15**	.032
AR (2) test			−0.15	.882
Sargan Test of Overid. Restrictions		Wald chi2 (63)	56.3	.712
Model test		Wald chi2(4)	69.02***	0.000

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$ imply statistically significant at 1%, 5%, and 10% levels, respectively.

Table 4. The effect of revenue decentralization on economic growth

RGDPgr	Coef.	St.Err.	z value	p-value
Rev Dec	−.154	.048	−3.21***	.001
Gov't size	−6.31	2.162	−2.92***	.004
Inflation	−6.994	2.32	−3.02***	.003
Human capital	−.271	.22	−1.23	.219
Constant	3.906	1.406	2.78***	.005
Number of observations 130				
Arellano-Bond Test for Autocorrelation		AR (1) test	−1.182*	.068
AR (2) test			−0.48	.649
Sargan Test of Overid. Restrictions		Wald chi2 (63)	58.49	.638
Model test		Wald chi2(4)	116.06***	.000

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$ imply statistically significant at 1%, 5%, and 10% levels, respectively.

Table 5. The effect of composite decentralization on economic growth

RGDPgr	Coef.	St.Err.	z value	p-value
Comp Dec	−.477	.258	−1.85*	.065
Gov't size	−3.398	1.958	−1.74*	.083
Inflation	−2.077	.475	−4.37***	.000
Human capital	.001	.001	0.95	.343
Constant	.235	.486	0.48	.629
Number of observations 130				
Arellano-Bond Test for Autocorrelation		AR (1) test	−1.178*	.074
AR (2) test			0.25	.800
Sargan Test of Overid. Restrictions		Wald chi2 (63)	62.51	.494
Model test		Wald chi2(4)	35.23***	.000

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$ imply statistically significant at 1%, 5%, and 10% levels, respectively.

serted the acceptance of restrictions in the GMM estimation for all specifications. The Chi square-test statistics confirmed that the model is robust.

Table 4 shows that revenue decentralization (P = 0.001; β = −0.154), gov't size (P = 0.004; β = −0.631), and Inflation (P = 0.003; β = −0.69) have a statistically significant negative effect on economic growth. However, human capital has no significant effect on economic growth.

The study's third objective is to examine the effects of composite decentralization on economic growth. Based on Table 5, the AR (2) and Sargan test confirmed the absence of high-order correlation and the instrument's validity. Chi square-test statistics confirmed the model's appropriateness.

As presented in Table 5, composite decentralization (P = 0.065; β = −0.447), gov't size (P = 0.083; β = −3.398), and Inflation (P = 0.000; β = −2.077) have a statistically significant negative effect on economic growth. However, human capital has no significant effect on economic growth.

4. DISCUSSION

A comprehensive review of the effect of fiscal decentralization on regional economic growth is a crucial area for research, given the growing body of literature on the topic. The present study investigated the cause-effect relationship between fiscal decentralization variables and regional economic growth in Ethiopia. The study discusses the finding as follows.

The study finding is consistent with those of studies that come across the significant negative effect of expenditure decentralization on economic growth, such as Davoodi and Zou (1998), Zhang and Zou (1998), Jin and Zou (2005), Rodríguez-Pose and Ezcurra (2011), and Nguyen et al. (2019). It also supports studies that found revenue decentralization significantly negatively affects economic growth (Naumets, 2003; Rodríguez-Pose & Ezcurra, 2011; Nguyen et al., 2019). However, the finding contradicts studies that found a significant positive effect, such as Zhang and Zou (2001), Imi (2005), Malik et al. (2006), Philip and Isah (2012), Iqbal et al. (2012), Su et al. (2014), and Liu (2017). However, the study finding disagrees with Iqbal et al. (2012), who found that composite decentralization significantly contributes to economic growth.

Besides, the study finding on government size confirms Rodríguez-Pose and Ezcurra (2011) and Baskaran and Feld (2012), who found that government size significantly negatively affects economic growth. However, it differs from Tarigan (2003) and Iqbal et al. (2012), who found a significant positive effect. It is also at odd with Blöchliger et al. (2013), who found that government size has an insignificant effect on economic growth.

The study supports scholars who found that inflation has a significant negative contribution to economic growth (Naumets, 2003; Iqbal et al., 2012; Baskaran & Feld, 2012). Nevertheless, it opposed studies that found the negative contribution of the inflation rate on economic growth (Jin & Zou, 2002; Su et al., 2014). Moreover, the study's finding

contradicts Iqbal et al. (2012), who found that human capital has a positive statistically significant effect on economic growth.

Though the study's empirical results support some of the prior studies mentioned above, they directly contradict the fiscal federalism theory. Since the theory claims that the more accessible a government is to its citizens, the more likely it is to realize efficient resource allocation, which will result in economic growth (Tiebout, 1956; Oates, 1972; R. Musgrave & P. Musgrave, 1983).

CONCLUSION

The study aims to investigate the effect of fiscal decentralization on regional economic growth. For empirical analysis, the study employed two steps of GMM estimation.

The Chi square-test statistics show that the three models used in the study are reliable. The Sargan test of over-identification failed to reject the null hypothesis, proving the validity of the study's instruments. Additionally, because AR (1) is statistically significant, but AR (2) is not, test statistics imply that the models are reliable and adhere to the correct specifications.

The study's findings revealed that expenditure, revenue, and composite decentralization have a statistically significant negative effect on regional economic growth. Moreover, among the control variables, inflation and government size have a statistically significant detrimental effect on regional economic growth. However, human capital has no significant effect.

Based on the results of the study, the following conclusions are drawn.

Though Ethiopia has established and exercised fiscal federalism that altered the country's political, administrative, and economic landscape, it prohibits fiscal decentralization from reaching its full potential. Consequently, fiscal decentralization has a detrimental effect on SNGs' economic growth. As a result, the study's findings may have significant policy consequences for the government and decision-makers, indicating that Ethiopia's federalism is incompatible with its objectives. Therefore, the study recommends that decentralizing the revenue side should be closely linked to decentralizing the expenditure side. Besides, intergovernmental transfers should not be the primary funding source for regional governments. It should also establish a firm control structure to make SNGs accountable for spending.

STUDY LIMITATIONS AND FUTURE RESEARCH

The following are the study's limitations: First, it is difficult to get reliable statistics because Ethiopia's constitution only allows the federal government to collect import and export taxes. As a result, the trade balance must not be considered when calculating the RGDP for the study. The study also excluded Addis Ababa City Administration because it often receives federal grants. It also ruled out the newly established regional states (Sidama and South-Western).

Future research may consider variables like political and geographical context. Future studies will adopt a mixed research approach because it supports using qualitative data to triangulate quantitative findings.

AUTHOR CONTRIBUTIONS

Conceptualization: Million Adafre Bushashe, Yitbarek Takele Bayiley.
Data curation: Million Adafre Bushashe, Yitbarek Takele Bayiley.
Formal analysis: Million Adafre Bushashe, Yitbarek Takele Bayiley.

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APPENDIX A

Table A1. Test of normality

Source: Study Panel Data (2008–2021).

Variable	Obs.	Pr(skewness)	Pr(kurtosis)	Adj. Joint chi2(2)	P value
RGDPgr	130	0.002	0	27.39	0
Exp Dec	140	0	0.075	23.05	0
Rev Dec	140	0	0	207.41	0
Comp Dec	140	0	0	30.76	0
Gov't size	140	0	0.033	24.6	0
Inflation	130	0	0	50.15	0
Human capital	140	0	0	48.61	0

Table A2. Test of multicollinearity. Matrix of correlations

Source: Study Panel Data (2008–2021).

Variable	RGDPgr	Exp Dec	Rev Dec	Comp Dec	Gov't size	Inflation	Human capital
RGDPgr	1	–	–	–	–	–	–
Exp Dec	0	1	–	–	–	–	–
Rev Dec	−0.137	−0.092	1	–	–	–	–
Comp Dec	−0.085	−0.298	0.55	1	–	–	–
Gov't size	−0.303	−0.18	−0.16	−0.506	1	–	–
Inflation	−0.17	−0.161	0.154	0.119	−0.023	1	–
Human capital	0.015	0.182	−0.052	0.099	0.069	−0.141	1