Construction, institutions and economic growth in sub-Saharan Africa

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ERSA working paper 622

July 2016

Economic Research Southern Africa (ERSA) is a research programme funded by the National Treasury of South Africa.

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July 11, 2016

Abstract

The construction sector in developing countries has propelled economic growth in the most recent period, yet analysis of growth performance has failed to take this into account. This article is a comparative analysis of the relationship between the construction sector and aggregate output for a panel of sub-Saharan African (SSA) countries using a panel generalized methods of moments (GMM). After accounting for the effects of institutional set up, cross sectional heterogeneity and non-linearity, our results revealed that the construction sector affects growth positively and most importantly, developing the right institutions could further enhance this impact. The intrinsically non-linear relationship between construction and output growth is very mute in our sample, suggesting that, SSA countries have not yet reached the stage of development where construction growth becomes trivial. We further show that East Africa experienced a robust impact of construction on economic growth compared to West and Southern Africa.

***Keywords*:** Construction; Output growth; Institutions; Endogeneity
***JEL Classification*:** C51; N6; O4; P48

1 Introduction

Construction is a very broad term, including but not limited to physical structures of various types used by many industries as inputs in the production of goods and services (Chan et al., 2009). This description encompasses residential construction and commercial buildings. What constitutes the construction

*Financial assistance from the National Research Foundation (NRF) and the Economic Research Southern Africa (ERSA) towards this research is hereby acknowledged. Opinions expressed and conclusions arrived at, are those of the authors and are not necessarily to be attributed to the NRF and ERSA.

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sector further extends to a myriad of activities from the design phase to the engineering, procurement and the execution of small, medium and large-scale infrastructure projects. Lastly, all activities relating to alterations, maintenance, and repairing of infrastructure fall under the construction sector.

The construction industry thus plays an important role in the national economy. It is a key barometer of the health of an economy because of its strong linkage to output fluctuations. The sector contributes directly to GDP by entering the national accounts as a component of fixed investment. Fixed investment in turn represents additions to the nation's capital stock. Theoretically, therefore, construction may play a dual role in the economy: first, as part of aggregate demand, determining output movements in the short run, and second, by augmenting a nation's stock of productive assets, construction activities are central to the determination of long run economic growth. More broadly, the construction sector establishes a number of inter sectoral linkages with other sectors of the economy, and produces multiplier effects— creating much-needed housing, improving public services, developing tourist sectors and transport links. Thus, a vibrant and thriving construction sector could well proxy a healthy and well-functioning economy.

Most of the recent growth in the world economy has occurred in developing regions. IMF (2013) indicates that of the 10 top fastest growing economies in the world, half were based in sub-Saharan Africa, with GDP growth in double digits. While some of this growth is linked to commodity price booms, the effect of investment and expansion in construction activities cannot be ignored. At the same time data from the UN agency on trade and development, UNCTAD (2011), show that the construction sector has grown by about 5% in sub-Saharan Africa and it is on an upward trajectory. In spite of the breadth and depth of the construction sector, economist, have typically focussed on very narrow aspects of construction: mainly investments in physical infrastructure. From neoclassical theory, Solow (1956), Swan (1956) to new growth theory, Romer (1990), Barro (1990), this narrow definition is often emphasized in terms of the role of physical capital in growth. So far, the empirical literature is far from unanimous, however, a number of studies report a significant positive effect of infrastructure on output, productivity/ or long-term growth rates. For example Park (1989), Ofori (1990), Field and Ofori, 1988) confirm a positive relationship between the construction sector and aggregate output performance. In particular, these studies highlight the strong multiplier effects of construction, and the forward and backward linkages between construction and other sectors of the economy. Taking physical infrastructure in particular, Aschauer (1989), Esterley and Rebelo (1993), World Bank (1994), Démurger (2001) and Wu (2010) posit that reliable and efficient economic and social infrastructure has the potential to raise labour productivity, and this in turn could lower production and transaction costs. Thus investments in improving transport, energy, information and communication technology, water, sanitation and irrigation enhances economic growth. At the micro-level, infrastructure investment augments private sector activities and can give birth to new markets, production opportunities and trade (Kumo, 2012).

Given the seeming importance of the construction sector to aggregate output it is surprising how little is known about its determinants, and the institutional mechanisms that help shape constructions role in the economy. In particular, very little is known about the institutional mechanisms that drives construction from tendering, award of contracts, project initiation, supervision and execution to the completion stages. Rather, the construction literature has either focused on its impact on growth at the national and local levels, thus ignoring the institutional dimension. Esfhani and Ramirez (2003) attempt to model institutions in their study, however, they stop short of identifying the particular institutional mechanisms responsible for the investment-growth relationship. Because the construction industry involves complex, non-standard production processes that foster asymmetric information between clients and providers, and because of its many close ties to government (see Estache, 2006), it is frequently held up as an industry susceptible to rent seeking worldwide (Kenny, 2006). This paper goes beyond the narrow confines of fixed investments and contributes to the growing literature on the relationship between the construction sector and the economy, by investigating the causal relationship between the construction, institutional mechanisms and economic growth for a panel of sub-Saharan African countries. Particularly, it examines whether the construction sector as well as institutions have any significant impact on economic growth. Additionally, it considers whether the presence of quality institutions is necessary for the construction sector to have a significant effect on economic growth; this is achieved by way of interacting construction activities with institutional variables. The article also examines the sub-regional differences regarding the effect of the construction sector on growth; that is, the importance of the sector for economic growth in three sub-regional groupings, namely, West Africa, East Africa and Southern Africa. Further, the article examines the non-linear relationship between construction and growth, otherwise called the called Bon curve, where construction rises with output at the initial stages of growth, reaches a point of inflection and thereafter declines (see Bon, 1992).

The rest of the paper is organised as follows: the next section examines the literature on construction and economic growth. Section 3 discusses stylized facts on the construction industry in sub-Saharan Africa. We specify our empirical model and justify the variables used in section 4. Section 5 analyses and discusses the results and in Section 6 we conclude.

2 Construction and economic growth: a review

The extant literature examines the construction sector in general and its impact on growth. Lopes (1998), Lopes et al (2002), Bon (1992), Hillebrandt (2000), Park (1989), Ofori (1990) confirm the positive relationship between the construction sector and aggregate output performance. In particular, these contributions highlight the strong multiplier effects of construction, and the forward and backward linkages between construction and other sectors of the economy.

The main empirical challenge in the literature on construction and growth

is the identification of cause and effects. That is, a positive correlation between the two variables might be due to the effect that governments spend more on infrastructure in countries or periods that feature high growth since financing constraints are less binding in this case. Several empirical contributions report a positive relation between infrastructure and GDP-growth for different regions and time periods. At the same time, most of these studies take the positive relationship between construction and growth as linear. As highlighted by Bon (1992), the relationship between the construction sector and growth is intrinsically non-linear. Using figures from a wide array of countries at different stages of development, Bon (1992) argues that at low levels of development, construction activity is relatively low. However, as structural changes occur with the shift from agrarian economy to one driven by services and industry the share of construction as a proportion of aggregate output increases, peaking at the level of middle income countries. At a more developed phase the priorities of a nation shifts from the mundane issues of housing shortage, limited office spaces and water and sewerage problems to matters of social security, thus the share of construction to output declines. This finding, although not well analysed in the literature has formed the basis for subsequent examination of the non-linear relationship between construction and growth. Subsequent studies, *inter alia,* Rameezdeen and Ramachandra (2008), Wong et al (2008), Ruddock and Lopes (2006) attempt to model the construction growth relationship by accounting for non-linearities. Although a significant advance from the early literature a lot of gaps remain, empirically.

Endogeneity in the relationship between construction and growth has not been given much thought in the literature. Does growth give birth to more construction works or it is the construction sector the initiate's growth? Additionally, the role of institutions is not properly interrogated. For a sector like construction, institutional factors are very likely to play a critical role in the tendering and contract award process, design, implementation and execution of projects.

It is costly to undertake construction projects and construction must take place in both formal and informal institutional set ups (Mina, 2010). We thus echo the argument by Esfahani and Ramirez (2003) that institutional capabilities tend to lend credibility and effectiveness to government policy and play important roles in the development process through infrastructure growth. Thus, instead of simply designing infrastructure projects, good thought ought to be given to institutional and organizational reforms. The literature, both empirical and theoretical, has so been very silent on the important role of institutions in construction. Additionally studies such as Esfahani and Ramirez (2003) only broached the topic and left a number of issues hanging.

3 Stylized Facts on Construction Sector in SSA Countries

This section presents the stylized facts on the construction industry in SSA countries using data on the share of construction expenditure in GDP over the sample period.

Figure 1 shows the average trend for the construction sector for three country groups: the average for West Africa, East Africa and Southern Africa. The three groupings have been showing a slight upward trend, with the share of construction ranging from 3.5% to 7%. Given the current state of infrastructural development in most SSA countries, this low share is an indication of the unexplored potentials in the sector. Comparing the three groups, we note that construction sector in East Africa is of larger importance than West and Southern Africa groups, as it has shown persistent increase and its path is clearly distinguished from the others. During the period 2000 to 2004, the average share declined slightly in the West and Southern African countries while the East Africa group kept the upward momentum. We also note that the trend for West and Southern Africa groups are almost identical during the second half of 2005 to the second half of 2008. The effect of the recent Global Financial Crises is reflected in the steady path for the East African during 2008 to 2009 on the one hand, and the slight decline for the West and Southern African groups during 2009 to 2010 on the other hand. More recently (after 2011), the sector's importance in Southern Africa has surpassed its importance in West Africa.

Figure 2 focuses on the average importance of the construction sector for the individual countries, during three sub periods: 2000 to 2004, 2005 to 2009, and 2010-2013. Compared to the sub-regional groupings, figures shows significant differences for the individual countries in various sub periods. The top four during the period 2000 to 2004 were Ghana (8.12%), Tanzania (7.66%), Lesotho (6.46%), Zambia (6.16%), whereas the bottom four were Mozambique (1.95), Madagascar(1.86%), Sierra Leone(1.58%) and Zimbabwe(0.49%). Most of the countries however, experienced slight growth in the average share for the 2005 to 2009 sub period. Turning to the 2010 to 2013 sub period, we can observe a marked increase in the importance of construction sector for the individual countries. Again, the top four remains Ghana (13.80%), Zambia (10.70%), Tanzania (10.05%), Uganda (8.93%), as it was in the previous sub-period. Interestingly, the bottom four now includes Mozambique (2.69%), Sierra Leone (1.96%), Guinea-Bissau (1.64%), Cote d'Ivoire (1.43%), without Zimbabwe trailing as it had done in sub-sequent sub periods. It is also worth noting that other countries experienced slight declines compared to their previous sub period averages. These include Malawi, Mali, Mauritius, and Senegal.

Regarding the differences in the relative importance of the construction industry in the various countries, several plausible factors can be identified: first, differences in construction demand, second, differences in access to credit facilities and third, availability of the required skilled labour, and fourth, differences in institutional and legal quality. These problems are not peculiar to

sub-Saharan African countries only but developing countries in general. As noted by Ofori (2006) the construction industry in developing countries face these and other challenges including poor cost and sub-standard work quality; outmoded statutes and codes with poor implementation mechanism; as well as excessive bureaucracy. Given the upward trend in the construction industry for most countries, the question that remains is whether growth in the sector translates into economic growth and whether institutional factors play a role in determining how impactful the sector becomes. We address these questions the in the empirical section.

4 Empirical Methodology

4.1 Data and Empirical Models

The present study uses macroeconomic data of annual frequency covering 2000-2013 for 26 Sub-Saharan African countries, mostly gleaned from various sources but organized for easy accessibility on the Analyse Africa database.[1] We use an extended growth model based on earlier empirical works of Barro (1991, 1996, 2003) and Mankiw et al. (1992). Our model specification is as follows;

$$y_{it} = \beta_0 + \beta_1 y_{it-1} + \beta_2 Con_{it} + \beta_3 Ins_{it} + \beta_4 (Con_{it} x Ins_{it}) + \sum_{j=1}^{N} \beta_j X_{it} + \varepsilon_{it} \quad (1)$$

where y_{it} is real GDP per capita growth in constant 2005 USD for country i in time t; ε_{it} represents the error term; Con_{it} stands for construction, which is measured as the growth rate of the share of construction expenditure in GDP for country i at time t. Data for the construction variable was collected from the UNCTAD database. A priori, we expect a positive and significant relationship between construction and economic growth.

Ins_{it} represents institutional variables for country i at time t. The existing literature provides both theoretical and empirical evidence in support of the fact that good institutions enhance economic growth (Acemoglu et al., 2004; Alfaro et al., 2004). All things being equal, an improvement in a country's institutional quality should have a positive impact on economic growth. We use five sets of indices as indicators for institutional quality to capture the effect of quality institutions on economic growth and construction activities. These include the Economic Freedom of the World Index as well as its sub-indices, from the Fraser Institute. Overall, this index measures the extent to which a country's institutions are supportive of economic freedom in five broad areas, namely: freedom to trade internationally; legal structure and security of property rights; regulation of credit, labour and business; size of government; and access to sound money. We also collect data on various sub-indices; specifically, Legal

[1] The countries are Benin, Botswana, Burkina Faso, Burundi, Cote d'Ivoire, Ethiopia, Ghana, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritius, Mozambique, Namibia, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Tanzania, Togo, Uganda, Zambia, and Zimbabwe.

Enforcement of Contracts, Protection of Property rights and Bureaucracy cost, all rated on a scale from 0 (worst) to 10 (best) (Gwartney et al., 2015). In addition, we proxy the quality of corruption institutions with the Freedom from corruption index, which measures the amount of corruption within a country's economy. The data was obtained from the Heritage Foundation and is rated on a scale of 0 (Worst) to 100 (Best). Since, higher values correspond to higher institutional quality, we expect a positive relation between the various indices and economic growth.

X_{it} refers to the set of control variables for country i at time t. We use a number of control variables, including population, trade openness, savings, inflation and lagged growth rate of real GDP per capita. The data on annual population growth rate is collected from the World Development Indicators and is measured as the exponential rate of midyear population from year t-1 to t. A rapidly increasing population may lead to a continuous decline in capital per worker, which in turn leads to lower productivity and declining growth. Thus, we hypothesize a negative relationship between population growth and economic growth.

The new growth theory postulates that international exchange of goods and services as well as technologies fosters economic growth. This happens mainly through the investment and technology channels. Often, the traded sector tends to be more capital intensive than the non-traded sectors for most economies, thus requiring investment, which comes through opening up to international trade. In addition, imported immediate goods are required in most instances in the production of investment goods (see Baldwin & Seghezza, 1996). Opening up to international trade also comes along with technology spillovers as well economies of scale in research and development (see Romer, 1990; Krugman, 1990; Helpman and Grossman, 1991; Rivera-Batiz and Romer, 1991). We therefore hypothesize a positive relation between trade openness and economic growth. Trade openness is the sum of exports and imports of goods and services measured as a share of GDP. The data is gleaned from the World Development Indicators through the Analyse Africa database (2015).

We also include inflation to capture the influence of macroeconomic instability on the level of growth. The expected sign for inflation is negative, implying that macroeconomic economic instability is detrimental to growth. Savings is measured as gross domestic savings as a percentage of GDP and it is expected to have a positive impact on growth, as postulated by existing growth theories (see Modigliani,1970, 1990; Maddison, 1992; Carroll and Weil, 1994) and following empirical evidence by Agbloyor et al (2014). We also include the initial level of per capita GDP growth rate (y_{t-1}) to capture the rate of convergence (see Barro, 2003).

If quality of institutions complements development projects, then we would expect a significant impact of their combined effect on growth. In view of this, β_4 captures the interactive effect between construction and institutions. The significance of interaction terms implies that the marginal effect of construction on economic growth depends on the level of institutional quality.

4.2 GMM dynamic panel estimation methodology

Researchers often face the problem of endogeneity when estimating the relationship among economic growth, and its determinants. For instance, if high level of investment in construction activities leads to growth, then higher growth might prompt more investment in construction. The literature also presents evidence of a two-way causation between institutions and growth (Chong and Calderon, 2000). To overcome the challenge of endogeneity, previous studies (Esfhani and Ramirez, 2003) make use of the instrumental variable Two Stage Least-Square estimation (2SLS) technique. However, this estimator is not efficient in the presence of heteroscedasticity. We employ a GMM-based estimator, which allows for efficient estimation in the presence of arbitrary heteroscedasticity, as it invokes the orthogonality conditions (Hansen, 2000; Hayashi, 2000). Specifically, we make use of the difference GMM estimator, popularly known as the Arellano-Bond linear dynamic estimator (Arellano and Bond, 1991; Arellano and Bover, 1995). This approach is well-suited for the case where we have lagged endogenous variables as instruments and cross-section fixed effects. The Arellano-Bond estimation is expressed as the first difference of Equation 1 as follows

$$\begin{aligned} y_{it} - y_{it-1} = \lambda_1(y_{it-1} - y_{it-2}) + \lambda_2(Con_{it} - Con_{it-1}) + \lambda_3(Ins_{it} - Ins_{it-1}) \\ +\lambda_4(CI_{it} - CI_{it-1}) + \sum_{j=1}^{N} \lambda_j(X_{it} - X_{it-1}) + (\varepsilon_{it} - \varepsilon_{it-1}), \qquad (2) \\ CI_{it} = (Con_{it} x Ins_{it}) \end{aligned}$$

The first difference transformation removes cross-section fixed effects, which may be correlated with the exogenous variables. The cross-section fixed effects do not vary with time, thus can be easily removed through the first difference transformation – failure to remove them could lead to biases in the estimations.

It is instructive to note that the error term in the first-difference equation (Eq. 2) $(\varepsilon_{it} - \varepsilon_{it-1})$ tend to be correlated with $(y_{it-1} - y_{it-2})$ which may pose endogeneity problems. This problem is however resolved by including the lagged endogenous and exogenous variables as instruments as proposed by Arellano and Bond (1991) and Arellano and Bover (1995). By instrumenting the first-differenced lagged dependent variable in Equation 1 with its past levels (as done by the differenced GMM estimator), we are also able to control for any potential autocorrelation.

In line with the above discussion, this study includes lagged endogenous and exogenous variables as instruments in the difference equation. However, by including lagged endogenous and exogenous variables as instruments, we are only controlling for weak forms of endogeneity. In other words, these variables may not be correlated with the error term, as is required, but could be influenced by the dependent variable. Thus, we perform the Sargan/Hansen test of over-identifying restrictions (i.e J-statistic) to test the overall validity of our

instruments.[2]

5 Empirical Results

5.1 Descriptive Statistics

Table 1 presents the descriptive statistics for all the variables used in the estimations. The average level of per capita GDP growth is 5.3%, while the minimum (-12.7) and maximum (55.5%) indicates a wide spread in growth. The growth rate of construction expenditure as a share of GDP shows an average value of 7.3%, which is greater than the growth rate of GDP; the standard deviation is about 15%, suggesting that on average, construction expenditure as a share of GDP deviates from the mean by about 15%. The average scores for economic freedom, legal enforcement of contracts, protection of property rights and bureaucracy cost are 6.2, 3.5, 4.8, and 5.4, respectively. It is worth noting that these institutional measures are rated on a scale from 0 (worst) to 10 (best); hence, the low average ratings indicates that institutions in SSA are not strong. Again, the SSA countries record an average score of 29.3 out of 100 for freedom from corruption index. This comes as no surprise considering the systemic corruption that characterize many countries in the region.

The mean level of total trade as a share of GDP is 70.1% (ranges from 20.96% to 209.89%). This is quiet large and indicate that significance of export and import activities to the economies in SSA. The mean level of inflation of 7.8 suggest relative macroeconomic stability for the period covered in this study, although the minimum and maximum (-9.6 and 44.4) suggest wide variations for the respective countries. Average savings is 7.8% and the standard deviation (15.0%) as well as minimum (-58.5%) and maximum values (44.7%) indicate a wide variation across the individual countries. while average annual population growth is 2.4%.

Table 2 shows the correlation matrix. We observe a positive relationship between construction and GDP growth. Regarding the institutional variables, economic freedom, protection or property rights, and freedom from corruption are negatively correlated with growth; legal enforcement of contracts and bureaucracy cost are positively related to economic growth. However, all institutional variables, with the exception of economic freedom and freedom from corruption, shows a positive correlation with the growth rate of construction expenditure as a share of GDP. A negative correlation exist between openness and economic growth as well as between savings and growth. Interestingly, inflation shows a positive correlation with economic growth. Similarly, population and growth are positively correlated.

[2]The Sargan test of over-identifying restrictions is robust when the instrument rank is greater than the number of coefficients estimated in the model.

5.2 Panel GMM Regression Results

This section summarizes the results of estimating Equation 2 using the dataset described in section 4.

5.2.1 Construction, Institutions and Growth

This section throws light on the nexus between construction activities and economic growth.in SSA Table 3 reports GMM results of 10 different specifications of the effect of construction and institutions on growth. The construction variable enters the model with a lag, considering the fact that construction activities do not have a contemporaneous association with economic growth, but rather takes sometime before reflecting in economic growth. Specifications 1-5 are based on Equation 2 (without interacting tem), which mainly looks at the effects of construction and the individual institutional variables on growth. Specification 6 to 8 includes an interaction term for construction with the various regional groupings (i.e West Africa, East Africa, and Southern Africa). These are the baseline results, which will be compared to subsequent analysis with the interaction term. The reported J-statistic is simply the Sargan statistic and since the instrument rank is greater than the number of estimated coefficients in the various models, we proceed to construct the Sargan test of over-identifying restrictions, under the null hypothesis that the over-identifying restrictions are valid. The test statistic is distributed as$\chi(p-k)$, where p is the instrument rank and k is the number of estimated coefficients. The p-values (>0.05) confirms the validity of our instrumentation approach.

With the exception of model 4, the estimation results in Table 3 provide an overwhelming support for the hypothesis that growth in the construction sector may have a positive impact on growth – between 0.028% and 0.086%. Specifically, model 2 suggest that a 1% increase in construction expenditure is associated with an increase of 0.086% in output growth. Model 3 also suggest an output growth of 0.082% in response to a 1% increase in construction expenditure. This is an affirmation of the urgent need for massive infrastructural development, which is lacking in most SSA countries. Regarding the regional differences, model 6, 7 and 8 shows that the effect of construction on growth in the West African Sub-region is 0.0869 (p-value <0.05) while that of East Africa and Southern Africa are 0.2811 (p-value <0.05) and 0.0833 (p-value >0.05), respectively. This suggest that effect of the construction sector on growth is much stronger in the East African sub-region (in line with Figure 1), weaker in West African and insignificant in Southern parts. In sum, the results reveal that construction has a positive effect on growth. Our finding corroborates the positive impact of construction on growth found in earlier studies like Lopes (1998), Lopes et al (2002), Bon (1992), Hillebrandt (2000), Park (1989), Ofori (1990). More recently, Hong (2014) also found that investment in the real estate sector has a strong impact on growth in the short term.

Our model specifications also include variables capturing the ability of SSA institutions to guarantee economic freedom, ability of the legal system to guaran-

tee contract enforcement and protect of propriety rights, as well as institutional mechanism that ensure bureaucratic efficiency and freedom from corruption. We find that the present quality of most institutions in SSA countries (economic freedom, protection of property rights and bureaucracy cost) tends to have a negative and statistically significant effect on GDP per capita growth, which is contrary to our expectation (see model 1, 3, and 4). A plausible explanation is that the quality of institutions alone may not enhance growth in isolation in SSA countries. It is also instructive to note that the current institutional ratings for most of the countries in the sample are very low. For instance, the average rating for economic freedom, legal enforcement of contracts, protection of property rights, and bureaucracy cost are 6.2, 3.5, 4.8, and 5.4, respectively, out of 10 (see Table 2). Thus, while theory suggests that quality institutions are growth enhancing, that effect is yet to be felt in SSA countries. This in contrast to Osman et al (2012) who finds that institutional factors such as effective regulatory system, improved contract enforcement system, property rights protection, are indispensable conditions for long-run economic development of SSA countries. That notwithstanding, we find that the lesser countries are perceived to be corrupt, the better their growth outcomes, as shown by the positive coefficients for corruption perception index in model 5.

Regarding the other control variables, we observe that the effect of openness is positive and significant in most of the models; hence, the more SSA countries are open to international trade, the more the benefit in terms of growth. We also find that inflation, which by intuition represents the level of macroeconomic stability, has negative effect and significant effect for some of the models. With respect to savings, we find a negative and significant effect only in model 5 and 10. Population shows an insignificant effect in most of the models; the only exception is model 1 where it shows a positive effect.

5.2.2 Moderating role of institutions

As the previous section captures the marginal impact of construction and institutions on growth, this section considers the moderating role of institutions in the construction-growth nexus. We are particularly interested in knowing whether the quality of institutions affects growth by influencing construction activities. Thus, following the specification in Equation 2, we include an interaction term between the various institutional variables and the share of construction in GDP, as reported in Table 4. As before, the large p-values for the J-statistics confirms the validity of our instrumentation approach.

Model 1b includes an interaction term of construction and economic freedom and shows a positive effect on growth. Specifically, interacting the share of construction in GDP with the economic freedom leads to growth of 0.011%. The interaction term of construction and protection of property rights, as shown in model 3b, also has a positive and significant impact on growth. That is, carrying out construction activities in an environment where property rights are protected could lead to marginal growth of 0.021%. In model 4b, we interact construction and institutions that curb the cost of bureaucracy and find

that it influences growth positively – a 1% increase raises growth by 0.096%. Similarly, an interaction between a less corrupt environment and construction may cause growth to increase by 0.002%. We do not find a significant impact from the interaction of construction and legal enforcement of contracts. One important implication of these findings is that having good institutions may bolster the effect of construction services on economic growth, thus creating an additional impact. For instance, having less bureaucracy would mean that approvals for construction projects do not suffer delay. Likewise, a less corrupt system would ensure that the scarce resources for infrastructure development are not channelled into bribing officials but rather committed fully to ensure quality infrastructural outcomes. In essence, having capable institutions is an essential condition for effective infrastructural growth. In other words, institutional capabilities play a key role in the development process by aiding in the effective realization of the benefits from infrastructural growth, as echoed by Esfahani and Ramirez (2003).

Esfhani and Ramirez (2003) attempt to model institutions in their study, however, they stop short of identifying the particular institutional mechanisms responsible for the investment growth relationship. The size of the respective estimated coefficients in Table 4 suggest that the institutional variables are not of equal importance in mediating the construction-growth nexus. According to the results in Table 6, the order of importance is reducing the burden of bureaucracy, protection of property rights, economic freedom and a corruption-free environment. Developing such institutions to set the rules and norms could help reduce the transaction cost associated with construction activities (Tan, 2002).

Again, openness is positive and significant in models 2b, 3b, 4b and 5b, indicating that growth hinges on the competitiveness of trading sector of the economy. Models 2b, 3b and 5b shows that inflation, the proxy for macroeconomic instability, has a negative and significant impact on growth. Openness would generally have a positive impact on growth while a high level of macroeconomic instability would generally affect growth negatively. The sign for openness and inflation do not diverge from these expectations, in most cases. The sign for gross domestic savings however remain negative in model 5b and statistically insignificant in all other models. The point estimates for population are surprisingly insignificant in all the models.

5.2.3 Capturing non-linearity

Bon (1992) argues that the relationship between the construction sector and output growth is intrinsically non-linear, in that construction industry activity begins to decline as a country becomes more developed, thus forming an inverted U-shape. Turning to this assertion, we estimate a model, which includes a quadratic term for construction. The results reported in Table 5 are far from supporting the evidence of a U-shape relationship, as most of the coefficients for the squared constructiontend to be insignificant. The few cases of significant coefficients are found in Model 2c (0.0015), Model 4c (0.0025), and Model

10c (0.0014). Yet, the sign of these coefficients are all positive and do not support the U-shape relationship but rather suggest that construction sector is a marginal increasing function with output growth particularly in SSA countries, most of whom are still developing. In other words, SSA countries have not reached that stage of development where construction growth becomes trivial. This is contrary to Wong et al (2008) who find that for an industrialized city construction investment is a marginal diminishing function with output.

5.2.4 Robustness Checks using construction value added

So far, we have used the growth rate of the share of construction expenditure in total GDP as our proxy for construction sector. In order to confirm the robustness of the results in the preceding sections, we employ another proxy, value added in construction, defined as the output of the construction industry less the value of intermediate inputs. To this end, we estimate equation 2, using this new proxy for construction. The results are reported in Table 6.

In line with our expectations, construction shows a positive and significant impact on growth in most of the model specifications, the only exceptions being model 7d and 10d. Model 1d suggest that a 1% in construction value added leads to approximately 0.07% growth. We find similar results for model 2d, 3d and 8d. In contrast, the marginal impact of construction on growth is lower for model 5d (0.02%) and insignificant for models 7d and 10d. Taken together, these results show that construction affects growth positively, irrespective of how it is measured. Proceeding to the marginal impact of the institutional variables, model 4d shows that bureaucracy cost has a negative impact on growth, which is an affirmation of the results in Table 4. Similarly, model 10d shows that the more a country is perceived to be free from corruption, the greater it affects growth. We do not find significant impact from the other institutional variables.

In model 6d, the interaction of construction valued added and economic freedom affects growth positively and significantly (0.012%, $p-$value <0.05), confirming the findings from the previous section. We also find a significant positive impact for the interaction of construction valued added and protection of property rights, which is similar to what we found earlier. Similarly, the interaction of construction and bureaucracy cost shows a positive impact on growth (0.008%, $p-$value <0.05). The interaction of construction and legal enforcement of contracts as well as freedom from corruption are not significant. Overall, these findings indicate that a well-functioning institutional setting is *sine qua non* for boosting the impact of the construction sector on output growth.

Turning to the control variables, we find that openness is significant, in most cases, with the expected positive sign, while inflation is negative and significant in only model 4d, 5d and 6d. Population is also positive but significant only in model 1d, 2d and 7d. We do not find significant results for savings.

6 Concluding Remarks

This study set out to enlarge the sparse empirical literature on the nexus between the construction industry, institutions and growth in SSA countries. Employing panel GMM technique on data for 26 countries spanning 2000 to 2013, our results showed that construction activities have a positive impact on economic growth in sub-Saharan African countries. Turning to sub-regional differences, we found that the effect of the construction sector on growth is much stronger in East Africa compared to West and Southern Africa. Considering non-linearity, we found no evidence in support of the U-shape relation between construction and growth; the results rather indicate that the construction sector is a marginal increasing function with economic growth. In other words, SSA countries have not reached the stage of development where construction growth becomes trivial. Most importantly, when we interact the construction with institutional variables, we find that a positive influence for the interaction term on economic growth. Thus, improving institutional capabilities could aid in the effective realization of the impact of the construction sector on growth. This calls for further development of institutions that enforce property rights, reduce the burden of bureaucracy, foster economic freedom and ensure a corruption-free environment.

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Tables 1: Descriptive summary statistics

	Mean	Std. Dev.	Min	Max	Obs
GDP per capita	5.2600	4.9661	-12.6509	55.5338	364
Construction	7.2460	14.7433	-52.3390	136.0528	338
Economic Freedom Index	6.1559	0.8245	2.9300	8.0900	346
Legal Enforcement of contracts	3.4677	1.4658	0.0000	6.2545	299
Protection of Property rights	4.7542	1.4468	1.4352	8.3677	263
Bureaucracy cost	5.3720	1.2377	1.0265	8.8519	253
Freedom from Corruption	29.3109	11.8858	10.0000	64.0000	357
Openness	70.0770	31.0105	20.9600	209.8900	363
Inflation	7.7786	6.6643	-9.6200	44.3900	344
Savings	7.7683	14.9596	-58.5400	44.7200	350
Population	2.3745	0.8885	0.1100	6.6800	364

Notes: The table reports the descriptive summary statistics

Tables 2: Correlation Matrix

Correlation	GDP	Construction	EFI	LEC	PPR	BC	Corruption	Openness	Inflation	Savings
GDP	1									
Construction	0.4008	1								
EFI	-0.2318	-0.0610	1							
LEC	0.0366	0.0976	0.4422	1						
PPR	-0.1733	0.0163	0.5476	0.3226	1					
BC	0.1027	0.0577	-0.3019	-0.2675	-0.3656	1				
Corruption	-0.2321	-0.0269	0.5245	0.2302	0.6616	-0.2522	1			
Openness	-0.1320	-0.0718	0.1533	0.1175	0.1739	0.0015	0.3904	1		
Inflation	0.1465	0.0715	-0.1119	0.1782	-0.0573	-0.0472	-0.1109	-0.0717	1	
Savings	-0.0182	-0.0549	0.3366	0.1347	0.3296	-0.2070	0.3024	-0.3952	0.0154	1
Population	0.1829	0.0927	-0.4205	-0.2777	-0.5248	0.2451	-0.7078	-0.7385	0.1250	-0.0308

Notes: GDP: Per capita GDP growth; Construction: growth rate of construction expenditure as a share of GDP; EFI: Economic Freedom Index; LEC: Legal Enforcement of contracts; PPR: Protection of Property rights; BC: Bureaucracy cost; Corruption: Freedom from corruption index; Openness: Total trade as a share of GDP; Savings: Gross domestic savings a percentage of GDP; Population: Annual population growth rate

Table 3: Construction, Institutions and Growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GDP(-1)	0.0816	-0.0073	0.0876	0.0899 [b]	0.0997 [b]	0.1410 [b]	0.1353 [c]	0.0748
	(0.0582)	(0.0723)	(0.1076)	(0.0375)	(0.0391)	(0.0627)	(0.0811)	(0.0856)
Cons(-1)	0.0444 [a]	0.0857 [b]	0.0823 [a]	0.0212	0.0281 [a]			
	(0.0159)	(0.0336)	(0.0176)	(0.0136)	(0.0096)			
Cons*WA						0.0869 [b]		
						(0.0359)		
Cons*EA							0.2811 [b]	
							(0.1389)	
Cons*SA								0.0833
								(0.0676)
EFR	-1.6476 [b]							
	(0.7143							
LEC		-1.1421						
		(1.1940)						
PPR			-0.4196 [c]					
			(0.2350)					
BC				-0.4330 [a]				
				(0.0733)				
Corruption					0.0339 [b]			
					(0.0170)			
Openness	0.1649 [a]	0.1159 [a]	0.0985 [b]	0.0640 [a]	0.0781 [a]	0.1510 [a]	0.1607 [b]	0.1659 [b]
	(0.0551)	(0.0379)	(0.0418)	(0.0208)	(0.0283)	(0.0284)	(0.0683)	(0.0718)
Inflation	-0.1194 [a]	-0.0383	-0.0657	-0.0537	-0.1022 [b]	-0.1463 [a]	-0.1428 [c]	-0.1229 [c]
	(0.0451)	(0.0573)	(0.0822)	(0.0556)	(0.0394)	(0.0454)	(0.0793)	(0.0684)
GDS	0.0065	-0.0696	-0.0097	0.0234	-0.0504 [a]	-0.0053	-0.0345	-0.0842
	(0.0628)	(0.0887)	(0.0791)	(0.0386)	(0.0170)	(0.0694)	(0.1492)	(0.1189)
Population	4.5989 [a]	0.7684	4.2276	-0.7400	-0.6469	1.0671	0.7905	3.8959 [a]
	(1.4940)	(1.6626)	(3.8907)	(0.9783)	(0.9674)	(0.9277)	(1.9431)	(1.0632)
Obs	243	222	183	179	252	235	257	257
Countries	26	26	26	26	26	26	26	26
Instrument rank	25	25	23	22	25	25	25	25
J-statistic	17.4821	15.4530	20.0097	14.2777	17.3540	18.72403	15.50301	19.32124
Prob(J-statistic)	0.4902	0.6307	0.2198	0.5046	0.4989	0.474664	0.690136	0.43641

Note: GDP: Per capita GDP growth; Cons: growth rate of construction expenditure as a share of GDP; Corruption: Freedom from corruption index; Openness: Total trade as a share of GDP; GDS: Gross domestic savings a percentage of GDP; Population: Annual population growth rate. Model 6 interacts construction with West African dummy, Model 7 interacts construction with East African Dummy, Model 8 interacts construction with Southern African Dummy. [a, b,] and [c] denotes significance at 1%, 5% and 10%, respectively

Table 4: Construction and Growth: The Role of Institutions

	(1b)	(2b)	(3b)	(4b)	(5b)
GDP(-1)	-0.0160	0.0918	0.0411	-0.0846	0.0860 [b]
	(0.0461)	(0.0558)	(0.0874)	(0.0728)	(0.0423)
Construction(-1)	0.0519 [c]	0.0397 [b]	0.0582 [b]	-0.4819 [a]	0.0348 [b]
	(0.0299)	(0.0182)	(0.0229)	(0.0915)	(0.0154)
Economic Freedom Index	-0.8631				
	(0.8682)				
Legal Enforcement of contracts		-1.1317			
		(1.2207)			
Protection of Property rights			-0.6956 [a]		
			(0.1875)		
Bureaucracy cost				-0.9329 [a]	
				(0.2331)	
Corruption					0.0109
					(0.0218)
Interaction term	0.0109 [a]	0.0108	0.0213 [a]	0.0956 [a]	0.0022 [b]
	(0.0039)	(0.0070)	(0.0070)	(0.0195)	(0.0009)
Openness	0.1028	0.1004 [a]	0.0695 [b]	0.1015 [a]	0.0688 [c]
	(0.0301)	(0.0371)	(0.0343)	(0.0365)	(0.0354)
Inflation	-0.0983	-0.1315 [b]	-0.0995 [c]	0.0030	-0.1100 [b]
	(0.0872)	(0.0528)	(0.0585)	(0.0623)	(0.0537)
Gross Domestic Savings	-0.0290	0.0649	-0.0725	0.0102	-0.0913 [a]
	(0.0487)	(0.1508)	(0.0638)	(0.0619)	(0.0299)
Population	0.8733	-0.9477	0.0786	3.6873	-0.5986
	(1.7662)	(0.8092)	(2.9671)	(2.9415)	(0.9426)
Observations	243	222	183	179	252
No. of Countries	26	26	26	26	26
Instrument rank	25	25	23	22	25
J-statistic	14.0410	15.2752	20.9787	12.3684	17.6174
Prob(J-statistic)	0.6642	0.5757	0.1375	0.5767	0.4134

Note: GDP: Per capita GDP growth; Construction: growth rate of construction expenditure as a share of GDP; Corruption: Freedom from corruption index; Openness: Total trade as a share of GDP; Savings: Gross domestic savings a percentage of GDP; Population: Annual population growth rate. Model 6 interacts construction with Economic freedom index, Model 7 interacts construction with legal enforcement of contracts, Model 8 interacts construction with protection of property rights, Model 9 interacts construction with bureaucracy cost and Model 10 interacts construction with freedom from corruption index.
[a, b,] and [c] denotes significance at 1%, 5% and 10%, respectively.

Table 5: Construction and Growth: – Testing for Nonlinearities

	(1c)	(2c)	(3c)	(4c)	(5c)	(6c)	(7c)	(8c)	(9c)	(10c)
GDP(-1)	0.0255	0.0587	0.0600	-0.0490	0.0934 [b]	0.0925	0.0905 [c]	0.0449	-0.0415	0.0740 [c]
	(0.0986)	(0.0531)	(0.1481)	(0.0744)	(0.0371)	(0.1079)	(0.0519)	(0.0739)	(0.1450)	0.0390
Construction(-1)	0.0602 [b]	0.0469 [c]	0.0886 [a]	0.0487	0.0109	0.0616	0.0326	0.0818 [b]	0.0896 [c]	0.0180
	0.0248	0.0258	0.0282	0.0358	0.0192	0.0395	0.0242	0.0413	0.0475	0.0197
Construction(-1)^2	0.0005	0.0015 [a]	0.0013	0.0025 [b]	0.0013	0.0008	0.0008	-0.0012	-0.0034	0.0014 [c]
	0.0010	0.0004	0.0011	0.0013	0.0008	0.0011	0.0020	0.0013	0.0041	0.0008
Economic Freedom Index	-1.6292					-1.9467				
	1.1195					1.9294				
Legal Enforcement of contracts		-0.6936					-1.0807			
		0.7836					1.3381			
Protection of Property rights			-0.5388 [b]					-0.6563 [a]		
			0.2257					0.1834		
Bureaucracy cost				-0.5198 [a]					-0.5959 [a]	
				0.1384					0.1295	
Corruption					0.0407 [b]					0.0158
					0.0191					0.0236
Interaction term						0.0221	0.0119	0.0229 [a]	0.0179 [b]	0.0021
						0.0091	0.0084	0.0078	0.0077	0.0012 [c]
Openness	0.1347 [b]	0.1069 [a]	0.0934 [b]	0.1347 [a]	0.0598 [c]	0.1474	0.1025 [b]	0.0494	0.0627	0.0564
	0.0533	0.0286	0.0401	0.0497	0.0353	0.0806	0.0396	0.0530	0.0554	0.0393
Inflation	-0.0426	-0.0657	-0.0541	-0.1431 [b]	-0.0928 [b]	-0.1709	-0.1331 [b]	-0.0812	-0.0458	-0.1064 [c]
	0.0549	0.0526	0.0836	0.0689	0.0447	0.0850	0.0582	0.0830	0.1109	0.0582
Gross Domestic Savings	0.0143	-0.0481	-0.0126	0.0448	-0.0517 [b]	0.0156	0.0568	-0.0610	-0.0106	-0.0833 [b]
	0.0578	0.0524	0.0673	0.0754	0.0250	0.1538	0.1346	0.0760	0.0725	0.0383
Population	2.2745	1.1446	5.0494	4.1286	-0.5385	2.3793	-0.8987	-1.5072	-0.1919	-0.4051
	1.7044	1.3850	5.4275	3.0071	0.9120	2.0130	0.8575	3.7464	3.1256	1.0064

Observations	217	222	183	179	252	243	222	183	179	252
No. of Countries	26	26	26	26	26	26	26	26	25	25
Instrument rank	25	25	23	22	25	25	25	23	26	26
J-statistic	17.578	15.917	19.151	14.168	17.415	13.328	15.856	20.213	10.748	17.696
Prob(J-statistic)	0.416	0.530	0.207	0.437	0.427	0.649	0.463	0.124	0.632	0.342

Note: GDP: Per capita GDP growth; Construction: growth rate of construction expenditure as a share of GDP; Corruption: Freedom from corruption index; Openness: Total trade as a share of GDP; Savings: Gross domestic savings a percentage of GDP; Population: Annual population growth rate. Model 6 interacts construction with Economic freedom index, Model 7 interacts construction with legal enforcement of contracts, Model 8 interacts construction with protection of property rights, Model 9 interacts construction with bureaucracy cost and Model 10 interacts construction with freedom from corruption index.
[a, b,] and [c] denotes significance at 1%, 5% and 10%, respectively.

Table 6: Construction valued added and Growth: Robustness Checks

	(1d)	(2d)	(3d)	(4d)	(5d)	(6d)	(7d)	(8d)	(9d)	(10d)
GDPG(-1)	-0.2160 [a]	-0.2359 [a]	-0.1938 [a]	0.0255	0.0144	-0.2586 [a]	-0.3822 [a]	-0.2707 [a]	-0.2742 [a]	0.1935 [a]
	(0.0301)	(0.0747	(0.0625)	(0.1039)	(0.0415)	(0.0418)	(0.1148)	(0.0785)	(0.0959)	(0.0675)
Construction Value Added	0.0670 [a]	0.0683 [a]	0.0656 [a]	0.0217 [c]	0.0165 [b]	0.0573 [c]	0.0943	0.0660 [b]	0.0610 [b]	0.0128
	(0.0137)	(0.0173)	(0.0140)	(0.0110)	(0.0073)	(0.0326)	(0.0704)	(0.0266)	(0.0285)	(0.0482)
Economic Freedom Index	1.2697					0.1213				
	(1.3467)					(1.8681)				
Legal Enforcement of contracts		-3.4748					-3.6518			
		(2.1386)					(3.2696)			
Protection of Property rights			0.4749					0.4961		
			(0.3449)					(0.3338)		
Bureaucracy cost				-0.2611 [a]					-0.0225	
				(0.0836)					(0.1750)	
Corruption					0.0268					0.2160 [b]
					(0.0174)					(0.0987)
Interaction term						0.0118 [a]	0.0167	0.0139 [a]	0.0082 [a]	-0.0083
						(3.6251)	(0.0112)	(0.0047)	(0.0031)	(0.0061)
Openness	0.1780 [a]	0.1260 [a]	0.1055 [c]	0.0791 [a]	0.0554 [b]	0.1806	0.2000 [c]	0.1404 [c]	0.1404 [a]	0.0641
	(0.0332)	(0.0404)	(0.0621)	(0.0279)	(0.0231)	(0.0557)	(0.1090)	(0.0760)	(0.0533)	(0.0429)
Inflation	-0.0942	-0.0693	-0.0332	-0.0697 [c]	-0.1115 [a]	-0.1324 [c]	-0.1225	-0.0250	-0.0249	-0.1000
	(0.0711)	(0.0647)	(0.0358)	(0.0361)	(0.0183)	(0.0733)	(0.0966)	(0.0744)	(0.0798)	(0.0836)
Gross Domestic Savings	-0.1140	-0.0319	-0.0166	0.1030	-0.0094	-0.1028	-0.1503	0.0057	0.0450	0.0612
	(0.0939)	(0.0658)	(0.1088)	(0.0670)	(0.0342)	(0.1104)	(0.1786)	(0.1411)	(0.1147)	(0.0995)
Population	5.7268 [a]	8.0465 [b]	2.1006	5.3648	1.2120	6.7766 [a]	4.2134)	4.2371	6.3578	-2.4301
	(1.4856	(3.8992)	(3.9326)	(4.2934)	(0.7679)	(2.3717)	(6.8204)	(6.4694)	(6.3569)	(1.7982)
Observations	169	152	123	141	202	169	152	123	120	251

No. of Countries	26	26	26	26	26	26	26	26	26	26
Instrument rank	22	22	20	21	24	22	22	20	20	25
J-statistic	15.3434	16.3189	14.0948	13.3342	15.1201	14.0488	13.0698	10.1888	10.4259	11.7435
Prob(J-statistic)	0.4270	0.3612	0.3672	0.5004	0.5868	0.4461	0.5210	0.5994	0.5787	0.8154

Note: GDP: Per capita GDP growth; Construction: growth rate of construction expenditure as a share of GDP; Corruption: Freedom from corruption index; Openness: Total trade as a share of GDP; Savings: Gross domestic savings a percentage of GDP; Population: Annual population growth rate. Model 6 interacts construction with Economic freedom index, Model 7 interacts construction with legal enforcement of contracts, Model 8 interacts construction with protection of property rights, Model 9 interacts construction with bureaucracy cost and Model 10 interacts construction with freedom from corruption index.
[a, b,] and [c] denotes significance at 1%, 5% and 10%, respectively.

Figure 1: Trends in Share of Construction in GDP (%) –Cross-Country Estimates

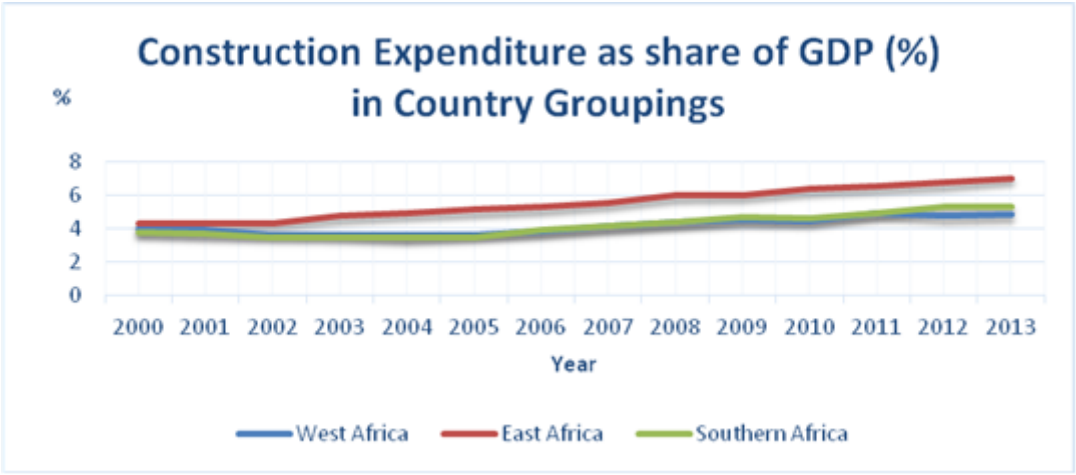

Figure 2: Share of Construction in GDP (%) – Country Averages