Assessing the Impact of Infrastructural Development on Manufacturing Value Added and Employment in Africa Emerging Economies

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Abstract:

This study empirically investigates the impact of infrastructural development on manufacturing value added and employment in Africa emerging economies over the period 1980-2018. This study employed pooled mean group estimation, which efficiently estimated non-stationary panel datasets with cross-sectional dependence and unobserved heterogeneity. Our empirical estimates indicate an increase of 1% in access to electricity would contribute to manufacturing value added (MVA) and employment growth by 0.02% and 0.03% respectively.

Our results show that the coefficient of the ICT is positive and statistically significant in influencing MVA and employment. Again, the results show that foreign direct investment has positive relationship with both MVA and employment at 5% level of significance as indicated by the coefficient. Likewise, our results reflect a positive association with MVA and employment in the economies Transport infrastructure has negative effect on MVA and employment. Our estimates suggest that on average, a 1% increase in transport infrastructure will lead to about 0.018% and 0.076% decrease in MVA and employment respectively. Regarding the impact of macroeconomic factors, we found that level of development has negative effect on MVA and employment, an indication that the growth generated by Africa countries does not support employment. The findings of the study reveal that electricity and ICT infrastructure, along with other macroeconomic factors are important drivers MVA and employment in Africa emerging economies. However, the capacity of infrastructure to enhance MVA appears to have weakened, hence the palpably weakness to generate employment.

Keywords: infrastructure; manufacturing value added; employment; Africa's emerging economies; pooled group estimation.

JEL Classification: C32; L60; L86.

Introduction

It is widely held view that infrastructural development provides the basic foundation that precipitates industrialization for any nation. Recent research suggests that the industrial sector, especially the manufacturing, is the key engine of growth because of its potential to improve productivity and job creation. Rodrik (2012), Jie and Shamshedin (2019) rightly notes that very few countries have been able to grow, accumulate wealth, and reduce poverty and inequality without investing in the manufacturing industries. The desire for the structural transformation of African

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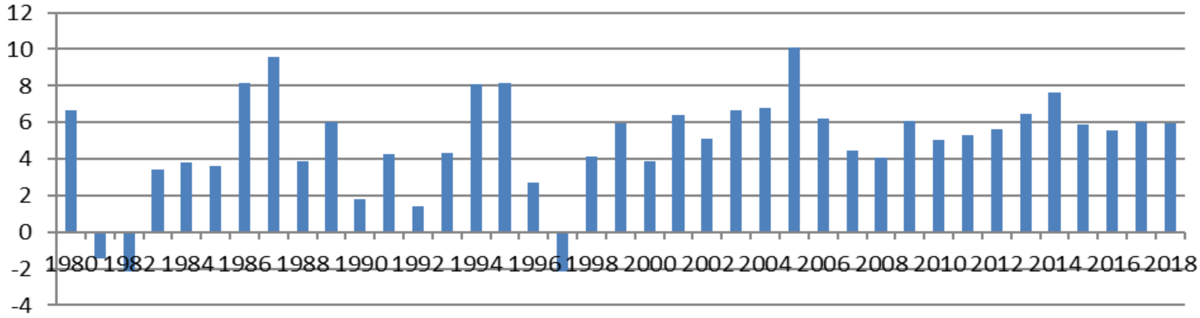
countries has led to massive investment in infrastructure in order to drive the economy and make significant progress in generating increased manufacturing productivity, create employment and strive towards the attainment of the sustainable development goals (World Bank 2019). Unfortunately, growth in manufacturing value added (henceforth referred to MVA) has be irregular with negative growth in some years. As illustrated in Figure 1, MVA witnessed negative growth in 1981, 1983 and 1997. The highest positive growth of 9.86% ever recorded in 1987, which however plummeted to 3.85% the following year. Although MVA improved marginally to 5.99% in 1989, it declined to 1.79% in 1990. In 2000, 2001, 2002, 2003, 2004, 2005, MVA stood at 3.88%, 6.39%, 5.11%, 6.69%, 6.82%, 10.09% and 6.24% respectively. Between 2007 and 2012, average growth in MVA was 5.09% while it grew averagely by 6.15% between 2013 and 2018.

Figure 1. Manufacturing value added in Africa (annual % growth, 1980-2018)



Meanwhile, as indicated by African Development Bank (2019) most Africa countries witnessed growth in the last two decades, very high level of unemployment, especially for the youths still prevails in the continent. This has led to the question whether in emerging economies; the infrastructure has contributed to manufacturing performance. The concern is that, infrastructural development not only aid manufacturing value-added but can potentially contribute to employment and stabilization of macroeconomic variables. In emerging economies, the potential of the manufacturing sector to generate employment is high because large proportions of the population are employed in agricultural and traditional sectors (Signe 2018).

In its general connotation, infrastructure refers to capital-intensive and non-capital facilities that enhance productive activities and quality of life. Its definition has also been restricted to include systems and facilities that have traditionally been provided by the government. However, following World Bank (2000), the definition of infrastructure has been extended to include inter-related technology and information stock that drives production. Although a vast literature emphasizes that infrastructure contributes to economic growth and critical in the production process, productivity, there is paucity of research with respect to infrastructural development-manufacturing value added-employment linkages, especially for emerging Africa economies. Mahyideen, *et al.* (2012) asserts that infrastructure is a critical factor in the growth process and enhances the production of goods and services in a more efficient manner. Infrastructural development is of crucial importance for manufacturing productivity. Improved productivity provides opportunity for relatively cheap commodities which invariably create employment. In addition, faster productivity growth has the potency to dampen unemployment rate without necessarily increasing the rate of inflation (Satya *et al.* 2004, Abiad *et al.* 2016, Stupak 2018).

The relationship between infrastructure and manufacturing performance is well documented in economic development literature. At several levels, infrastructure is required for industrial development to improve income and levels of productivity. It is widely held view that investments in infrastructure have immediate and lagged effect on job creation due to its spillover effects on other economic opportunities. For the USA economy, Abiad *et al.* (2015) provide evidence that investment in infrastructure generally decreases unemployment rate both in the short and long-term. Similarly, infrastructural investment increases labor demand in the short, medium and the long term. Bivens (2017) opine that efficient transport infrastructure provides economic and social benefits by improving productivity and access to market, ensuring balanced regional economic development, creating employment, promoting labor mobility and connecting communities. It has also been argued by Yazdan and Hossein (2013), Sepehrdoust (2018) that ICT can influence manufacturing productivity through various channels such as the production of goods and services to value in the economy. This group of researchers further contends that ICT improves efficiency and productivity which ultimately provide employment opportunities. As enunciated by Luger, Butler and Winch (2013), while infrastructure through the services it supplies supports manufacturing activity in various ways, innovations in infrastructure also stimulate innovations in manufacturing. It is therefore evident that public infrastructure in an input for manufacturing industries and beneficial to sustained employment.

The relationship between infrastructural development and manufacturing performance has become very important subject of discourse, especially in Africa and despite an increasing interest there has been limited research quantifying these benefits in emerging Africa economies. This paper extends and contributes to literature on the effect of infrastructural development on manufacturing value added and employment in several ways. Firstly, we show why infrastructural development is imperative to manufacturing output and employment and hence the need to improve the infrastructure substantially. Secondly, the paper empirically analyzed the impact of infrastructural development on MVA and employment in eight Africa emerging economies (henceforth referred AEE8) using data for the period, 1990-2018. These economies have existing and emerging manufacturing sector with greatest potential to undergo manufacturing-led structural diversification. Thirdly, we employed augmented mean group (AMG) estimator estimator proposed by Eberhardt and Teal (2012), which has the capacity to efficiently estimate non-stationary panel datasets with cross-sectional dependence and unobserved heterogeneity not accounted for by previous studies. This study is also important as it will provide a lead towards the attainment of Sustainable Development Goal of building resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

1. Literature Review

One strand of literature that evaluated the impact of different infrastructure on manufacturing growth and productivity using specific country variables agrees that infrastructure is the set of interrelated structural elements that provide framework that supports development structure. One of such studies was conducted in Pakistan by Soneta *et al.* (2012) and found that transport, electricity and gas distribution has insignificant effect on manufacturing output in the study relied on time series regression model based on data collected from 1981-2009. Another study, Rietveld, Kameo *et al*. (1994) examined the impact of roads, telecommunication and electricity on the development of manufacturing industries and found positive and significant impact of infrastructure on manufacturing sector productivity. In Mexico, Castañeda *et al*. (2000) researched on the impact of highway and electricity on manufacturing output and finds that 10 percent growth in highways increases manufacturing output by between 0.62% and 0.96%. Sahoo *et al.* (2010) studied the effect of electricity, energy power, telephone, road, railway and port on manufacturing output and found that public infrastructure has positive and significant effect on manufacturing productivity growth. Hulen, Bennathan and Srinivasan (2003) study focused on the impact of electricity on manufacturing productivity in India. It was found that the effect of electricity on manufacturing depends largely on the degree of network, which is more pronounced in relatively underdeveloped areas. In a related study, Soneta (2012) shows that 10 percent increase in the stock of electricity increases manufacturing output by about 1.9% - 2.9%. Collaborating this, Bivens, (2017) asserts that efficient transport improves productivity, market accessibility, regional growth and employment opportunities.

Another strand of literature employed firm level data to analyze the relationship between infrastructure and manufacturing productivity. Such studies include Battasso and Conti (2010) who estimated the impact of roads on manufacturing productivity. Overall results exhibit that roads has significant impact on manufacturing productivity in the absence of barriers from government. Deng (2003) provided an update of the survey focusing on estimating the contribution of transport infrastructure to productivity. The study concludes that strong network externalities of transport infrastructure may result in nonlinearity of the relationship between transport. The absence of spatial concerns in infrastructure's impacts is an important source of inconclusive results. Also, Yeaple and Golub (2007) studied the effect of infrastructure on industrial growth and international specialization, adopting production equation, specialization, infrastructure equation and panel data of 18 developed and developing countries and 10 manufacturing industries from 1979-1997. The study finds significant effect of infrastructure on industrial productivity and explains international disparities in comparative advantage among nations. Mamatzakis (1999) argue that transport reduces cost of production in the manufacturing sector and private demand. The cost saving impact of improvement in public infrastructure varies from 0.02% in food industry to 0.78% in wood industry. Satya *et al.* (2004) examines the effects of public infrastructure on the performance of 12 two-digit manufacturing industries in Canada.

The estimated coefficients provide strong evidence of the importance of public infrastructure on manufacturing productivity. Goel (2003) primarily focused on the impact of infrastructure on the productivity of registered manufacturing sector in India using capital, labor and intermediate input and assumed infrastructure to be a quasi-fixed. Estimated results suggest that infrastructure provision accentuates manufacturing productivity and lowers cost of production. Chitkara and Nagpal (2017) adopts a non-parametric index number approach to investigate the connection between manufacturing sector development and public infrastructure in India states and found that the development of the manufacturing sector is strongly correlated with the conditions of infrastructure.

Some empirical studies also found that the condition and performance of infrastructure potentially affect economic output and employment (Stupak 2018). For the USA economy, Abiad *et al.* (2015) finds that improvement in public infrastructure generally decreases unemployment rate both in by 0.11% in the short term and 0.35% in the medium term. In the same vein, an increase in infrastructural investment would increase labor demand by 1.13% in the short term, 1.07% in the medium term, and 0.08% in the long term while Mcguckin *et al.* (1998) used survey data from 1993-1988 to show that ICT improves manufacturing productivity at two different points in time. Md and Alam (2014) finds that ICT had significant impact on output and labor productivity. Cronin *et al.* (1993) also emphasize that ICT infrastructure is also related to total productivity. Anyanwu (2017) conclude that ICT exerted positive and significant effect on manufacturing value added in the case of North Africa. With data from cross-section of countries, Canning (1999) finds that electricity and transport have almost the same marginal impact on manufacturing productivity as total capital, while ICT exhibit higher marginal effect. Rud (2000) finds that electricity accounts for about 15% of the variation in manufacturing output across states in India. Another study in this regard was conducted by Abri and Mohamoudzadeh (2005) and found that ICT and industrial productivity were positively correlated. Seitz and Licht (1995) use data from 11 west Germany states and found that public infrastructure improves competitiveness by reducing production and transport cost. In Middle East countries, Yazdan and Hossein (2013) study finds that ICT had insignificant effect on productivity growth. On the contrary, Steenkamp and Rooney (2017) finds that infrastructure has positive and significant effect on manufacturing output in the case of middle-income countries. Mesagan and Ezeji (2016) examine the effect of economic and social infrastructure on manufacturing sector performance in Nigeria. The result shows that ICT had positive impact on manufacturing performance while electricity had insignificant negative effects on manufacturing value added. Adopting the Autoregressive Distributed Lag (ARDL) model and the Toda-Yamamoto causality test Effiom and Okoi (2018) examined the relationship among human capital, technological development, infrastructure, and the performance of the manufacturing in Nigeria between 1970 and 2015. Result had it that human capita development, infrastructure and technology has no effect on manufacturing performance.

Some studies have discussed the importance of foreign direct investment (FDI) in creating employment in both developed and developing countries (Abor and Harvey 2008, Adamu and Embugus 2012, Onimisi 2014, Strat *et al*. 2015, Abbas and Xifeng 2016). In 2008, Abor and Harvey analyzed the empirical effect effect of FDI on employment creation and wages in Ghana and finds that FDI has positive and significant positive effect on employment. In another study focusing on China, Du and Ishizuka (2014) found that FDI has contributed significantly to the development of manufacturing capacity of China. Using data from 1991-2012 from the latest 13 members of the EU, Strat *et al.* (2015) provides strong evidence that FDI is beneficial in employment creation. In Nigeria, Onimisi (2014) examine the impact of FDI and employment using data from 2002-2012. The author find that FDI negatively affects employment. In another study focusing on Zanzibar Stone Town, Abbas and Xifeng (2016) revealed that FDI has positive effect on employment. For OECD countries, Baldwin (1995) findings indicates that domestic factors have generally accounted for changes in total employment than changes in demand for imports. More importantly, the increased effects of export to generate employment is usually dampened by increased imports.

The significant role of FDI in supporting manufacturing performance is also indicated in some recent studies. Okoli and Agu (2015) assesses the impact of FDI flow on the performance of the manufacturing firms in Nigeria. Adopting the OLS estimate with FDI modeled as a quadratic function to account for its turning point and the VECM to ascertain both the long run and the short run causalities, findings suggest that FDI inflows has positive effect on the manufacturing value added which is only feasible in the long run. In a similar study for Nigeria, Idoko and Taiga (2018) examine the effect of FDI on manufacturing value output between 1981 and 2015 with the Vector Auto Regression (VAR) technique and Johansen Co-integration test. The empirical results from the impulse response function and variance decomposition test indicates that FDI has a positive but insignificant effect on the manufacturing output. Authors also finds a long-run relationship between FDI and the manufacturing output. A more recent study by Jie and Shamshedin (2019) employed Vector Autoregressive model (VECM) to discusses the effect of FDI in industrialization in Ethiopia, using data from 1992-2017. Although the study demonstrate that FDI has a positive and significant impact on industrialization, its impact is more pronounced in the long-run.

Other variant of studies, such as Sodipe and Ogunrinola (2011), Oloni (2015) have observe that a negative relationship exists between economic growth (proxied by GDP growth) and employment, especially in developing countries. This affirm that economic growth does not support employment. Olusaji (2016) also discovered that there is no causality from GDP to employment. However, using panel data from Eastern European Countries, Soylu, Çakmak and Okur (2018) finds that 1% rise in GDP reduces unemployment rate by 0.08%.

Apparently, the literature review has shown that several studies have examined the influence of infrastructure on manufacturing productivity in both developed and developing countries, with varied results. While some studies contend that infrastructural facilities tend to be associated with higher manufacturing output, others show that the effect of infrastructure on manufacturing output is minimal. Several studies appear to confirm negative relationship between infrastructure and manufacturing productivity. None of these studies have examined the effects of infrastructural development on MVA and employment in AEE8. This provides a point of departure from the existing studies.

2. Methodology

A basic way to portray the role of infrastructure in manufacturing is through an input production function, a refinement of the standard Cobb-Douglas production function represented as:

$$Q = F (K, L. G) \quad (1)$$

where: Q is aggregate output, K is aggregate stock of fixed capital and L is the stock of labor force.

Overall, the estimation of the effects of infrastructure on manufacturing performance has demonstrated the adoption of three approaches: production function approach, cost-function approach and vector auto regression (VAR) function. In all, the production function is most appropriate especially for cases where infrastructure is not disaggregated (Zegeye 2000, Luger *et al.* 2013). In relation to the first approach, the channels through which infrastructure affect manufacturing performance represented in a production function expressed as:

$$Q_i = A_i (t) f_i (K_{i,} L_i, G_i) \quad (2)$$

where: Q_i denotes output, A_i (t) shift in the production function ascribed to technical progress, $K_{i,}$ private capital, L_i labour and G_i government public input (roads, highways, among others).

Supposing that the function assumes the simple Cobb-Douglas form, then equation (2) can be written explicitly as:

$$Q = A_i (t) K^{\lambda k} L^{\lambda l} G^{\lambda g} \quad (3)$$

Taking the natural logarithm of both sides, equation (3) becomes:

$$ln_Q = \lambda_0 + \emptyset_t + \lambda_K ln_K + \lambda_l ln_L + \lambda_g ln_G + U \quad (4)$$

Based on theoretical framework posited above and following the work of Yazdan and Hossein (2013), Steenkamp and Rooney (2017), the modified relationships for our empirical estimation can be written as:

$$manv_{it} = \alpha_i + + \beta_{1i} lnelect + \beta_{2i} lntrans_{it} + \beta_{3i} lnfdin_{it} + \beta_{4i} lnlev_{it} + \epsilon_{it} \quad (5)$$

$$manemp_{it} = \alpha_i + \beta_{1i} lnelect + \beta_{2i} lntrans_{it} + \beta_{3i} lnfdin_{it} + \beta_{4i} lnlev_{it} + \epsilon_{it} \quad (6)$$

where: $manv$ is manufacturing value-added, $manemp$is employment in the manufacturing sector employment, $elect$ is electricity infrastructure, $trans$is transport infrastructure, $ictx$ is information and communication technology (ICT), $fdin$ is foreign direct investment, dev is Level of development, β_1, β_2, β_3, β_4 are estimated coefficients related to the explanatory variables, *i* = 1, ... N*;* *t* = 1, ...T).

To test a long-run cointegration, different methods such as Fully Modified Ordinary Least Square (FM-OLS), Panel Dynamic Ordinary Least Squares (PD-OLS) and pool mean group estimation (PMGE) can be utilized. However, our study utilized PMGE proposed by Pesaran *et al.* (1999), Eberhardt and Teal (2012). The model assumes that while long-run relationships among in the variables are identical but coefficients and error variances differs across the groups. According to Mahyideen *et al.* (2012), Phajsansilp (2015), Othman *et al.* (2018), PMGE combine pool and averages while allowing the intercept, short-run coefficient and error variances to differ across the groups, especially in studies where countries involved have lower degree of heterogeneity. The framework has the ability to capture both the long-run and short-run relationship among the variables and the convergence parameter. The process inherent in PMGE is illustrated as:

$$y_{it} = \beta_i x_{it} + u_{it} \quad (7)$$

where: $u_{it} = a_{1i} + \lambda_i f_t + \varepsilon_{it}; x_{it} = a_{2i} + \lambda_i f_t + \delta_i g_t + \omega_{it}$

In equation (7), y_{it} and x_{it} are observables, β_i is the country-specific slope on the observable regressor and u_{it} contains the unobservable (α_{1i} and f_t) and the error term ε_{it}. α_{1i} is the group fixed effects, which capture time-invariant heterogeneity across groups. f_t is the unobserved common factor with heterogeneous factor loadings λ_i, which can capture time-variant heterogeneity and cross-section dependence. g_t with factor loading δ_I is added to show that x_{it} is affected by other factors other than the ones which affect y_{it}. The unobserved common factor (f_t) which affects the error u_{it} could lead to endogeneity problem. Given that *ft* and *gt* can be nonlinear and nonstationary, there is apparent implication for cointegration. These perceived problems can be conveniently handled with the application of PMGE. In the estimation of PMGE the following procedures are involved: use first difference ordinary least squares to generate a pooled regression model augmented with year dummies (Dum_t). The year dummy coefficients are estimated and the time dummy coefficient approximates the unobserved common factors that are potentially driving the variables in each panel unit is determined. The estimates are finally generated as averages of the individual country estimates. Since our study consists of large T (38 years) and small N (8 countries), it is instructive to determine the suitability of the application of PMG estimation.

Data on eight Africa emerging economies from 1980–2018 based on the indicators included in our analysis were generated from World Bank's (World Development Indicators) (WDI) and African Development Bank's (Africa Infrastructure Development Index) (AIDI). The countries covered by the study are: Botswana, Ghana, Kenya, Mozambique, Nigeria, Tanzania, Uganda and Zambia as emerging economies in Africa. In line with the specific objectives of the study, the dependent variables are manufacturing value-added (total volume of goods manufactured within an economy, proxied by manufacturing value-added, % annual growth) and employment in the manufacturing sector. The explanatory variables are electricity infrastructure (access to electricity in rural areas as % of population), transport infrastructure (transport composite index), information and telecommunication technology (ICT composite index; percentage of individuals using the internet, fixed-broadband internet subscriptions, active mobile-broadband subscriptions, percentage of individual using computer, mobile-cellular telephone subscriptions per 100 inhabitants). We also included other control variables such as foreign direct investment (foreign direct investment, net inflows (% of GDP) and level of development (GDP growth, annual %). The descriptive statistics of the variables used in the estimations which reports the sample mean, median and standard deviation are presented in Table 1.

Table 1. Descriptive statistics of the variables used for empirical estimation

Variable	Mean	Standard deviation	Minimum	Maximum
manv	5.14	7.21	10.90	19.22
manemp	2.01	9.88	0.99	23.45
elect	506	191	001	5688
trans	5.02	2.11	0.39	18.44
ictx	2.21	4.09	0.20	23.44
fdin	1,735.91	1,323.45	1,200.02	2,792.92
manv	5.14	7.21	10.90	19.22

Source: Author's based on data generated from WDI and AIDI

2.1. Baseline Results

The Levin-Lin-Chu (2002), Im-Pesaran-Shin (2003), ADF-Fisher and the PP-Fisher tests with null hypothesis of no unit root tests were conducted. However only the Im-Pesaran-Shin (2003) test result was summarised in Table 2.

Table 2. Panel Unit Root Test

Variable	Level		First Difference		Order of integration
	Im-Pesaran-Shin Statistic	Im-Pesaran-Shin *p-value*	Im-Pesaran-Shin Statistic	Im-Pesaran-Shin *p-value*	
manv	-5.6454	0.9237	-3.0005	0.0001	I(1)
manemp	2.3284	0.5332	-9.5006	0.0000	I(1)
elect	5. 5783	0.0881	-9.7006	0.1000	I(1)
trans	-9.54805	0.0000			I(0)
ictx	-2. 2497	1.2122			I(0)
fdin	-1.7322	0.0896			I(0)
dev	-2.8732	0.6789			I(0)

Source: Authors' estimation

The results in Table 2 shows that the null hypothesis of unit root for the panel cannot be rejected. All the variables are stationary in the first difference, suggesting that the panel variables are integrated at level I (0) and I (1) and none of the variables are I (2) or a higher level of integration. In this study therefore, nonstationarity of dataset poses no problem for the AMG estimator. The Pedroni residual cointegration results in Table 3a and 3b shows that five out of the six test statistics are significant

Table 3a. Panel Cointegration Result for Model 5

Statistics	Within-Dimension (Panel)				Between-Dimension (Group)	
	Statistic	Probability	Weighted Statistic	Probability	Statistic	Probability
v-Statistic	-3.0489	0.9990	-2.9894	0.0628		
rho-Statistic	2.6653	0.9997	2.5631	0.8909	3.0338	0.0074
PP-Statistic	-3.6250	0.0000	-7.2616	0.0000	-11.8212	0.0012
ADF-Statistic	-4.8159	0.0000	-5.835538	0.0000	-3.2031	0.0000

Note: Included observations: 304; Cross-sections included: 8.
Source: Authors' estimation

Table 3b. Panel Cointegration Test Result for Model 6

Statistics	Within-Dimension (Panel)				Between-Dimension (Group)	
	Statistic	Probability	Weighted Statistic	Probability	Statistic	Probability
v-Statistic	-1. 2045	0.8585	-3.4120	0.9982		
rho-Statistic	4. 7304	1.0000	3.0449	1.0000	6.8120	0.0000
PP-Statistic	-9. 8980	0.0000	-5.7304	0.0000	-11.8215	0.0000
ADF-Statistic	-3.2031	0.0000	-3.0388	0.0000	-2.7304	0.0001

Note: Included observations: 304; Cross-sections included: 8
Source: Authors' estimation.

The PP-Statistic and ADF-Statistic are significant for both the panel within dimension and group between dimension. Given that their probability values are less than 0.05. We reject the null hypothesis and conclude that the variables are cointegrated. Thus a long run relationship exists between variables in the model. Table 4 presents the Breush-Pagan LM, Pesaran scaled LM and Bias-corrected scaled LM residual cross-section dependence test results.

Table 4. Residual Cross-Section Dependence Test

Residual Cross-Section Dependence Test	Model 5		Model 6	
	Statistic	Probability	Statistic	Probability
Breush-Pagan LM	189.0014	0.0000	585.8374	0.0000
Pesaran scaled LM	11.2029	0.0000	32.14583	0.0000
Bias-corrected scaled LM	6.0469	0.0000	31.56891	0.0000

Note: Total panel observations: 304; Cross-sections included: 8.
Source: Authors' estimation.

For both models, we reject the null hypothesis of no cross-section dependence in residuals since the probability values are less than 0.05. This outcome further support and justify the use the PMGE for panel data sets with cross-sectional dependence. The PMGE occupies an intermediate position between the mean group and dynamic fixed effect, where it allows the intercepts, short-run coefficients and error variances to differ freely across groups but constrains the long-run coefficients to be similar across groups (Othman *et al.* 2018). Table 5 reports the results of the pooled means group (PMG) estimation. Coefficient estimates of MVA equation are presented in Column 1 while coefficient estimates of the employment equation are presented in Column 2.

Table 5. Result of the Pooled Means Group estimation

Variable	Manufacturing value added	Employment
Lnelect	0.021*** (0.064)	0.027*** (0.075)
Lntrans	-0.018*** (-0.34)	-0.076** (-2.09)
Lnictx	0.030 (0.101)	0.014 (0.075)
Lnfdin	0.090** (2.41)	0.061** (2.04)

Variable	Manufacturing value added	Employment
Lndev	-0.232** (-0.105)	-0.241**(-0.135)
Constant	-43.4963 (-0.50)	-23.1981 (-0.50)
Wald Chi² test	18.49	13.69
Prob > Chi²	0.0025	0.0348
Number of countries	8	8
Number of observations	304	304
Root mean squared error		

Note: z-values are in parenthesis, ***=1% significant level, ** = 5% significant level, * = 10% significant level
Source: Authors' estimation

The PMG estimation results in Table 5 suggest a positive relationship between electricity infrastructure and MVA and employment. The respective magnitude of the MVA and employment is about 0.02 and 0.03 at 1% significant level. This indicates that for emerging economies in Africa, a 1% improvement in access to electricity leads to 0.02% increase in MVA and employment by 0.03%. This is contrary to the finding of Soneta *et al.* (2012) that electricity has negative effect on manufacturing output in Pakistan. Our results show that the coefficient of the ICT is positive and statistically significant in influencing MVA and employment, conforming to the findings of Anyanwu (2017). We can conclude that increase in access to ICT tend to accentuate improvements in MVA and employment in Africa emerging economies. Again, the results show that foreign direct investment has positive relationship with both MVA and employment at 5% level of significance as indicated by the coefficient.

The result is in line with most empirical studies which show that FDI is important in fostering employment in the manufacturing sector (Du and Ishizuka 2014, Abbas and Xifeng 2016). With respect to the role of FDI, the result shows that it has positive association with MVA and employment in the economies in conformity with Okoli and Agu (2015), Idoko and Taiga (2018), Jie and Shamshedin (2019). However, Abbas and Xifeng (2016) suggest that although increase of trade openness is a growth opportunity for a country, domestic resources can also be deployed in adequate quantities to produce goods for export. Also, domestic production capabilities have to be already in place in order to respond to international competition.

Transport infrastructure has negative effect on MVA and employment. As seen in Table 5, our estimates suggest that on average, a 1% increase in transport infrastructure will lead to about 0.018% and 0.076% decrease in MVA and employment respectively. This is contrary to the findings of Battasso and Conti (2010), Soneta *et al.* (2012) and Bivens, (2017) that transport infrastructure aids manufacturing output. Bivens (2017) transport improves productivity, market accessibility and employment opportunities. The negative relationship found in emerging economies may be attributable to the fact investment in infrastructure that aid manufacturing follows a similar pattern in the emerging economies. The network externalities of transport infrastructure may result in nonlinearity of the relationship.

The absence of spatial concerns in infrastructure's impacts could also be important source of the relationship. We next assess the impact of level of development (represented by percentage growth in GDP) on MVA and employment. Our results indicate that level of development is negative. This shows that the level of development generated by Africa countries does not support employment. Our result resembles that of Sodipe and Ogunrinola (2011), Oloni (2015) and Olusaji (2016). Our outcome however contradicts the findings of Soylu, *et al.* (2018) that economic growth reduced employment in Eastern European countries.

Conclusion

This study aimed to empirically assesses the impact of infrastructural development on manufacturing value added and employment in Africa emerging economies, which are Botswana, Ghana, Kenya, Mozambique, Nigeria, Tanzania, Uganda and Zambia for a period of 38 years (1980-2018). Using pooled mean group (PMG) estimation, we have examined how various indicators of infrastructure (electricity, transport and ICT) affect manufacturing value added (MVA) and employment.

In our analysis, we have also included macroeconomic variables, namely, foreign direct investment and level of development. Our empirical estimates indicate an increase of 1% in access to electricity would contribute to MVA and employment growth by 0.02% and 0.03% respectively. Our results show that the coefficient of the ICT is positive and statistically significant in influencing MVA and employment, Again, the results show that foreign direct investment has positive relationship with both MVA and employment at 5% level of significance as indicated by the coefficient. Likewise, our results reflect a positive association with MVA and employment in the economies

Transport infrastructure has negative effect on MVA and employment. Our estimates suggest that on average, a 1% increase in transport infrastructure will lead to about 0.018% and 0.076% decrease in MVA and employment respectively. Regarding the impact of macroeconomic factors, we found that level of development has negative effect on MVA and employment, an indication that the growth generated by Africa countries does not support employment. The findings of the study reveal that electricity and ICT infrastructure, along with other macroeconomic factors are important drivers MVA and employment in Africa emerging economies (AEE8). However, the capacity of infrastructure to enhance MVA appears to have weakened, hence the palpably weakness to generate employment. Based on the research, we emphasize that, to improve MVA and employment, electricity and ICT infrastructural development should be prioritized in the industrialization policies of AEE8.

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