Industrialization Drive and Economic Growth in Africa

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Abstract

This paper empirically examines the impact of industrialization on economic growth in Africa, and also how trade openness augments this effect. We consider the study of industrialization imperative following recent commitments of African governments and the African Development Bank to it, and also it been a core part of the Sustainable Development Goals. Industrialization is argued to be the way forward for economic transformation of developing countries. Employing data for the period 1980-2014 from 37 African countries and the generalized method of moments (System GMM), we show two main results; first, industrialization has on its own boosted economic growth in Africa. Second, trade openness augments the effect of industrialization on economic growth. Our results are robust to alternative measures of industrialization and subsampling analyses. Our results therefore indicate that the commitments to industrialization are calls in the right direction. They serve as a major signal for African governments to initiate and intensify policies of export promotion, providing requisite infrastructure (such as power, transportation and telecommunication) and also promoting entrepreneurship in the industrial sector especially among the youth.

Key Words: Industrialization, Manufacturing, Industry, Economic Growth, Africa, Generalized Method of Moments

JEL Codes: C33; O14; O47; O55

Highlights

- We assess the impact of industrialization on economic growth in Africa.
- Both manufacturing and industry value added have positive effect on economic growth.
- The results are robust to sub-regional analyses and alternative estimators
- Trade openness augments the effect of industrialization on economic growth in Africa.

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1 Introduction

"Industry ... is the means by which rapid improvement in Africa's living standards is possible ..." Kwame Nkrumah (1965).

"*Everybody wants development; but not everybody understands and accepts the basic requirements for development. The biggest requirement is hard work*" Julius Kambarage Nyerere (1968).

The last couple of decades have seen many African countries charting a tremendous unprecedented economic growth expedition, and this has lured the region into the global limelight.[1] This impressive growth trajectory has however preceded an appalling post-independence performance, especially in the 1970s and the early 1980s. Nonetheless the region requires a tremendous effort now to make growth sustainable, inclusive, a livelihood transformation antidote, and also a means to expedite the catching up process with other regions in the world. This is the case as regardless of the recent growth booms in some African countries, half of the world's extreme poor live in sub-Saharan Africa, and about 400 million people live on less than US$1.90 a day (World Bank, 2017a). The African Development Bank recounts that Africa's economic growth has not been inclusive enough to create enough jobs and improve quality of life of its people (African Development Bank, 2016).

The growth patterns over the years have been of interest to policy makers and researchers alike. This has attracted a massive investigation into the factors spearheading these growth patterns. Particularly well researched have been the roles of trade openness and foreign direct investment (FDI) on economic growth (Adams, 2009; Adams & Opoku, 2015; Agbloyor, Abor, Adjasi, & Yawson, 2014; Akinlo, 2004; Gui-Diby, 2014; Onafowora & Owoye, 1998; Sakyi, Commodore,

[1] Africa remains one of the fastest growing regions in the world (World Bank, 2012) with Sierra Leone, Niger, Cote d'Ivoire, Liberia, Ethiopia, Burkina Faso, Rwanda, Mozambique, Zambia and Ghana named among the fastest growing economies in the world (World Bank, 2013).

& Opoku, 2015; Zahonogo, 2017). It is however interesting to note that these studies have produced inconclusive results. A rigorous examination of the literature pinpoints that one important area that has been neglected or under explored has been the impact of industrialization on economic growth in Africa.

Following the industrial revolution in the 18th Century that brought about rapid growth in many western countries, many governments regarded industrialization as a panacea for accelerated growth. In not too distant from now, an impressive account can be given of the industrialization drive of a number of East Asian Countries that put them on a very high growth pedestal and earned them the name, the Asian Tigers. Industrialization is now regarded as one of the most important engines of economic growth and as a result many transformational policies of governments are driven toward developing the industrial sector (Wong & Yip, 1999). However the successful stories of industrialization have been different for Africa, as the statistics are not quite impressive.[2] The African Development Bank asserts that a persistent lack of industrialization is holding back Africa's economies (African Development Bank, 2016).

The 2017 African Economic Outlook report argues that Africa's economic transformation cannot be feasible without industrialization. It further contends it is only industrialization that can initiate the unconditional convergence of the region with the advanced countries. The African Union proclaims industrialization as the major strategy to promoting and achieving inclusive economic transformation. Industrialization is a catalyst for job creation, higher productivity, accessing capital, learning and innovation (Alexiou & Tsaliki, 2010; Haraguchi, Cheng, & Smeets, 2017; Lin & Monga, 2013; Necmi, 1999; Szirmai & Verspagen, 2015). Industrialization has the potential

[2] We elaborate on this in the next section.

of expanding export, and increasing export can open up the economies for technology spillovers. Without industrialization, Africa cannot sustain its recent growth (Page, 2011).

In this paper we examine the impact of industrialization on economic growth in Africa. We do this by making a case for 37 African countries over the period 1980-2014, by employing the generalized method of moments (GMM) methodology developed by Arellano & Bond (1991), Arellano & Bover (1995) and Blundell & Bond (1998) which caters for potential endogeneity. To the best of our knowledge there virtually exist no comprehensive study considering the impact of industrialization on economic growth in Africa. Nonetheless a related study worth mentioning is Wells & Thirlwall (2003). Though they focus on African countries the time span of their sample (1980-1996) is very limited and old to influence policy decisions today. Moreover their sample does not capture the period in which Africa has witnessed tremendous economic growth rates. Besides this study failed to account for endogeneity which questions the efficacy of their estimates. Endogeneity bias also remains one of the major criticisms of many of the previous studies done on other countries and regions, as they failed to cater for endogeneity. Also remarkably different from Wells & Thirlwall (2003) we perform a number sensitivity analyses-such as the use of alternative estimators, alternative measures of industrialization and subsampling analyses- that they failed to consider, nevertheless make the results more robust and constructive.

In relation to the above, we make enormous contribution to the literature in the following ways; i) we emphasize specifically on African countries, and as result we are able to tailor policy recommendations specifically targeted at assisting the development trajectory of the region, ii) we analyze how trade openness augments the impact of industrialization on economic growth, iii) we employ alternative measures of industrialization to boost the robustness of our results and

recommendations based on the results, iv) we employ a methodology, the system GMM, that caters for endogeneity bias.

Our study generates two main results; first, industrialization has on its own boosted economic growth in Africa. Second, trade openness is generally a major mediating factor to achieve a greater effect of industrialization on economic growth. The results are robust to alternative measures of industrialization, estimation methods and subsampling.

An examination of the impact of industrialization in Africa is a call in the right direction. This is the case as industrialization remains the core of many developmental initiatives of which Africa is part or is at the center of. For example, the Joint Africa-European Union (EU) Strategy Roadmap 2014-2017 stresses the essence of industrialization in Africa, and mentions it as one of the paramount areas of cooperation. The African Development Bank regards industrialization as the third of its High 5s priorities crucial for accelerating Africa's economic transformation.[3] In January 2015, the African Union adopted the Agenda 2063, and the core of this Agenda is geared towards growth and industrialization of African economies. The New Partnership for Africa's Development (NEPAD) which started in 2001 identified industrialization as the crucial instrument for growth and poverty elimination. In the 2016 United Nations (UN) General Assembly, it proclaimed the period 2016-2025 as the Third Industrial Development Decade for Africa.[4] In addition industrialization is the ninth goal of the Sustainable Development Goals. Considering these policies and initiatives, we believe that the results we get will inform policy makers on where

[3] Accordingly the five priorities are; Light up and power Africa, Feed Africa, Industrialize Africa, Integrate Africa, and Improve the quality of life for the people of Africa. Regarding industrialization, the Bank has committed itself to invest US$3.5 billion yearly in the next 10 years, through direct financing and leveraging. This is in the quest to boost industrialization to hasten economic transformation in Africa.

[4] The First Industrial Development Decade was for the period 1980 to 1989 and the Second Industrial Development Decade, 1993 to 2002. It must however be emphasized that these two did not bring about the transformation for which they were established.

they have fallen short and areas which need to pay more attention in their quest to industrialize to impact growth.

The paper proceeds as follows; section two gives an overview of industrialization and economic growth in Africa. Section three provides both theoretical and empirical literature on the subject. Section four gives a description of the data and the methodology employed by the paper. In section five we present and discuss the results. Section six concludes the paper.

2 Industrialization and Economic Growth in Africa

Over the last two decades the average economic growth in Africa has been a pleasant anecdote, and this growth trajectory has made the region comparable to others in the world (in terms economic growth rates). For example, data depict that for the period 1996-2000, Africa's growth averaged 3.53 percent relative to 3.2 in South and Central America, 3.34 in Asia and 3.46 in the world (see Table 1). For the period 2001-2005 and 2006-2010, the region's growth averaged 5.49 and 5.05 percent respectively, significantly outperforming the average of the world (2.91 and 2.27 percent respectively). Regardless of this rapid growth, African countries still lag behind other developing countries in relation to the pace of development.

Table 1: Economic Growth Rate in Africa (1971-2015)

Sector/Years	1971-75	1976-80	1981-85	1986-90	1991-95	1996-00	2001-05	2006-10	2011-15
Africa	**4.59**	**3.70**	**1.99**	**2.62**	**1.33**	**3.53**	**5.49**	**5.05**	**3.22**
America	6.61	5.77	0.96	1.91	3.18	3.20	2.63	3.73	2.08
Asia	5.41	4.75	4.10	5.62	4.23	3.34	4.20	4.69	4.34
World	3.76	3.86	2.69	3.65	2.16	3.46	2.91	2.27	2.50

Note: America is South and Central America.
Source: Authors' calculation based on data from the United Nations Conference on Trade and Development Statistics, UNCTADStat (2017)

GDP per capita growth is very low in many African countries relative to many Asian countries. The recent growth records have however instigated an optimism of hope of relegating poverty and under-development (Zamfir, 2016). The call to deepen Africa's growth and make it sustainable, inclusive and life transforming has been varied. However in many cases the concentration has been on the need to establish and develop its industrial base (African Development Bank, 2016; Zamfir, 2016; African Economic Outlook, 2017). The African Economic Outlook (2017) vehemently argues that economic independence and transformation of Africa cannot be attained unless the initiation and embracement of industrialization is taken seriously.

The first documented strategy of Africa towards industrialization was the Import Substitution Industrialization (ISI) in the post-independence in the 1960s. The strategy had the objective of equipping and enhancing domestic firms in producing hitherto foreign consumables, and also materials needed for production. Though this strategy received massive state support, issues such as firms' inability to compete foreign firms and lack of adequate domestic human capital thwarted its agenda. The woes of the strategy even worsened in the 1980s when following the economic and structural adjustment programmes of the World Bank and the International Monetary Fund, governments had to liberalize their economies, and lessen their direct control on industries they established. Africa therefore did not realize the objectives for which it set the ISI, and from then the story of industrialization has been an appalling one.

Gui-Diby & Renard (2015) in their work assert that industrialization has not yet taken place in Africa. The Africa Growth Initiative (2016) also argues that the industrial development in Africa has been delayed for more than 40 years. Page (2011) in his study established that between the period 1975 and 2005, the size, diversity and complexity of industry in the region all dropped, and concludes that Africa has deindustrialized. This is corroborated by the fact that Africa is missing

in essence regarding regional and global manufacturing. Africa's share of global manufacturing has dropped from about 3 percent in 1970 to awfully under 2 percent in 2013 (Zamfir, 2016). If no drastic measures are taken, the current pace of industrialization poses a great danger to the African Union's flagship Agenda 2063 -"A Prosperous Africa Based on Inclusive Growth and Sustainable Development" -that has made industrialization one of the pillars of achieving this agenda.

Africa's growth is largely driven by the service sector, since 1990 the services sector's contribution to GDP has averaged about 50 percent. For example, for the period 1990-1994, the services sector contributed an average of 50.39 percent to GDP as industry contributed 32.01 percent (see Table 2). For the period 2010-2014, as services contributed an average of 51.01 percent, industry did about 34 percent. In the year 2015 services contributed as much as 54 percent relative to about 30 percent by industry (Table 2). Available data depicts that the rate of growth in industry (or manufacturing) has failed to keep pace with the rate of growth in economic growth. This is particularly obvious post-2000 (see Figure 1). The manufacturing sector for example recorded a negative growth rate between the periods 1980 and 1985, 1990 and 1995, and 2005 and 2010. The industrial sector as a whole attained similar feat between 1985 and 1990, and 1990 and 1995 (see Figure 1).

From a historically agrarian background, the next phase of development that one would expect should be the industrial phase. However Africa seems to have skipped the industrial phase and proceeded to the service phase. This is largely not in line with the developmental expedition that most developed and Asian countries embarked on. This skip is however argued to be harmful to the region as it foregoes opportunities such as technological innovation, policy experimentation and learning (Africa Growth Initiative, 2016). With very fertile soil for agriculture, and so much

natural resource endowment, industrialization will help process and transform raw materials to boost local consumption and add value to exports. With a striving industrial sector, production and employment will increase both in the agricultural and industrial sectors, and the development of the services sector will be inevitable. This is the case as services such as banking, insurance, hospitality among others will be needed to boost consumption and trade. This will further increase employment in the region. Though the services sector in the region has a crucial role to play in industrial, manufacturing and agricultural development (UNCTAD, 2015), developing the industry is argued to be more important as it is a leading high-productivity sector with the ability to absorb huge numbers of moderately skilled workforce (Africa Growth Initiative, 2016; Page, 2011). Besides, the manufacturing output per worker is noted to be 6 times that of agricultural output (Africa Growth Initiative, 2016).

Table 2: Sectorial Contribution to GDP in Africa (Percentage)

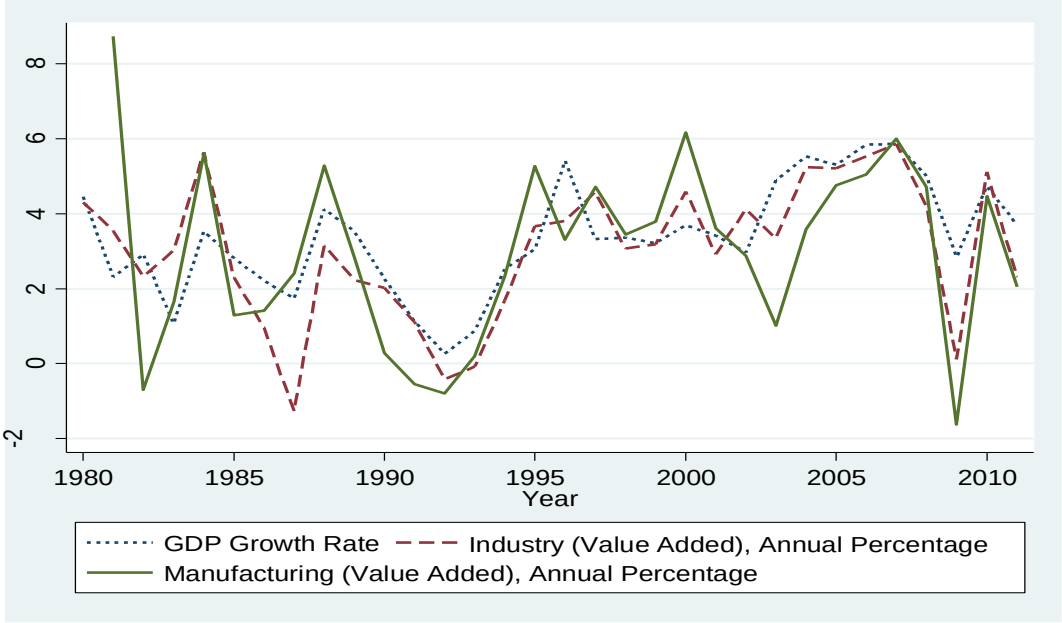
Sector/Years	70-74	75-79	80-84	85-89	90-94	95-99	00-04	05-09	10-14	2015
Agriculture	21.44	19.24	17.24	18.97	17.61	16.81	16.37	15.38	15.00	16.03
Industry	**30.06**	**32.00**	**33.51**	**31.39**	**32.01**	**30.78**	**32.38**	**34.71**	**33.98**	**29.98**
Services	48.50	48.76	49.26	49.63	50.39	52.41	51.24	49.91	51.01	54.00
Asia (Ind.)	39.25	40.79	39.61	37.15	36.67	34.77	34.16	36.85	37.90	36.05
America (Ind.)	38.52	40.03	39.41	39.37	34.97	30.22	33.46	34.36	32.35	30.13
World (Ind.)	37.60	37.40	35.88	33.34	31.33	29.21	27.88	29.01	29.63	28.40

Note: Ind. means industry, America is South and Central America.
Source: Authors' calculation based on data from the UNCTADStat (2017)

Skipping of the industrial phase of development is one of the major reasons for the rampant and rising unemployment in many African countries. The industrial sector is the least employment generator in Africa. Employment statistics from the International Labour Organization (ILO) show that for the period 2000-2003, the industrial sector contributed only an average of 12.17 percent to

employment in Africa, relative to 18.74, 22.04, 19.7 percent in Asia and the Pacific, Latin America and the Caribbean, and the world respectively (see Table 3). For the period 2008-2011 the averaged employment in the industrial sector was 12.48 percent relative to 22.48 and 21.38 percent in Asia and the Pacific, and the world respectively. These statistics demonstrate that largely the industrial sector in Africa lags behind other regions, and also the average for the world in employment generation.

Figure 1: Industry, Manufacturing and Economic Growth in Africa (1980-2011)



Source: Authors' construct based on data from the Africa Development Bank (2017).

Table 3: Sectorial Employment Distribution in Africa (Percentage)

Sector/Years	2000-2003	2004-2007	2008-2011	2012-2015
Agriculture	54.10	53.56	53.06	51.44
Industry	**12.17**	**12.02**	**12.48**	**12.89**
Services	33.74	34.42	34.47	35.68
Asia & the Pacific (Industry)	18.74	20.77	22.48	23.00
L. Amer. & the Carib. (Industry)	22.04	22.20	21.92	11.91
World (Industry)	19.70	20.74	21.38	21.59

Note: L. Amer. & the Carib. is Latin America and the Caribbean
Source: Authors' calculation based on data from the International Labour Organization Statistics (ILOSTAT, 2017).

The African Union, African Development Bank and some individual countries (governments) have realized the deplorable contribution of the industrial sector to employment in Africa, and have therefore made improving industrialization their major strategy of increasing employment and achieving economic transformation. For example, this year (2017), the Government of Ghana, has initiated a policy dubbed "One District One Factory", to in the next four years establish factories in each of the 216 districts in the country. In Tanzania, the President has declared industrialization as the main agenda of his government, and has started a five year (2016/17 – 2020/21) national development plan under the theme "Nurturing Industrialization for Economic Transformation and Human Development". The aims of these policies are to create jobs and move the countries to greater industrialization for economic transformation.

3 Related Literature

Under this section we review relevant theoretical and empirical literature related to our study.

3.1 Theoretical Literature

Industrialization in a broader sense can be considered as an increase in the value added of non-agricultural and non-services sectors to GDP. More specifically it is the increase in the value added of the secondary sector. However more often industrialization is used synonymously with the manufacturing sector. UNIDO (2013) regards deindustrialization as a long-term reduction in manufacturing in relation to other sectors. Industrialization is regarded as the main underlying strategy of economic development for every economy, drawing from experiences of the industrial revolution and the growth of the East Asian countries. In history only Australia, New Zealand and Canada have been able to develop relying mainly on agriculture (Thirlwall & Pacheco-López, 2017). However historically, the poorest countries are those that have failed to industrialize (Szirmai & Verspagen, 2015).

Theoretically the impact of industrialization on economic growth has traditionally followed Kaldor's laws of growth (Kaldor, 1966, 1967). Kaldor's laws of growth essentially postulate a positive relationship between the manufacturing sector and economic growth. The manufacturing sector is seen as the engine of growth, i.e. the main sector driving economic growth in the economy. One of the underlying reasons for his assertion is that, there exist surplus labour in the non-manufacturing sectors, and in essence the productivity of labour in the manufacturing sector is greater than other sectors. One other reason that can be cited for the hypothesis is, his assertion that the growth in demand and production in the manufacturing sector does not have a decreasing effect on the production of the non-manufacturing sectors. Kaldor's argument is premised on the idea that the manufacturing sector is dominated by dynamic economies of scale. Contrary to the conventional neoclassical growth studies that hinges on the supply side, Kaldor's growth hypothesis is centered on demand side of the economy. As a result he elaborates that technical progress and importantly appreciation in productivity is the outcome of a rise in demand for manufactured goods which subsequently leads to an increase in investment (Kaldor, 1975).

Kaldor's growth hypothesis can formally be presented in three laws; i) the first law hypothesizes a positive relationship between the rate of growth of production in all sectors and the rate of growth of manufacturing production. This implies a positive relationship between the manufacturing sector and economic growth. The manufacturing sector helps boost other sectors as it creates extra demand for goods produced by these sectors (Kaldor, 1975). Besides a booming manufacturing or industrial sector may induce export expansion and this can enhance economic growth (Alexiou & Tsaliki, 2010), ii) The second law, also referred to as Verdoorn's law relates the growth rate of productivity in manufacturing to the rate of growth of production in manufacturing, iii) The third law combines elements of both the first and the second laws and essentially postulates a positive

relationship between overall productivity growth in the economy and growth in manufacturing production. The premise of this law is upheld on the notion that the movement of surplus/redundant labour from other sectors to the manufacturing sector (the high productivity sector) will not cause a decline in aggregate output (Necmi, 1999). This is due to the reason that a rise in manufacturing output bring about a higher productivity through the dynamic effects and the interaction between economic activities. Even though Kaldor's assertion of an increasing returns in the manufacturing sector may be at variance with the constant or decreasing returns established in the neoclassical theory, it does have some resemblance with the new theories of endogenous growth (Lucas, 1988; Romer, 1986; Romer, 1990). This can be seen in the effect of manufacturing in transferring technological change (McCausland & Theodossiou, 2012; Wong & Yip, 1999).

Wong & Yip (1999) develops a theoretical model to analyze the relationship that exist between economic growth, industrialization, and international trade in a two-sector endogenous growth model. The two sectors they consider are the agricultural and the manufacturing sectors. The manufacturing sector is found to expand overtime due to the accumulation of physical capital in this sector (Szirmai & Verspagen, 2015), and human capital resulting from learning by doing. The agricultural sector nevertheless does not have any effect of learning by doing and as a result there is no growth in technology in this area.

The learning by doing effect in the manufacturing sector renders labour in the sector more and more productive relative to agricultural sector (Szirmai & Verspagen, 2015). Owing to the features of the manufacturing sector, its growth pulls the economy along. Wong & Yip (1999) add that when the economy is closed, its growth rate hinges on the learning by doing effect which is associated with output from the manufacturing sector. In this case the use of production subsidies will enhance economic growth. However, when the economy is opened, the use of subsidies is

limited and the growth rate of the economy among other things somehow depends on its pattern of trade and growth of the rest of the world. If the economy specializes only in agriculture, the growth rate of the economy reduces to zero due to the lack of investment in phyiscal capital amd learning by doing. The manufacturing sector therefore remains paramount to growth.

Lewis (1954) in his work pointed out that as there exists unlimited labour supply at the subsistence wage level, an economy centered on capitalism has a great potential of expanding incessantly by partially investing its profits to the point where all surplus labour will be absorbed. At any turn of re-investing the profit, more and more excess labour is absorbed and this expands the profits. With wage still pegged as the subsistence level, and the capitalist sector expanding, the contribution of profits, savings and investment also increases.

Lewis upholds that the role of the industrial class in the economy is very crucial in causing the capitalist sector to expand as they are those noted for ploughing back profits to invest more than any other sector. Investment or capital accumulation in the capitalist sector will not necessarily generate higher productivity especially if the rate of increasing output is at par with increasing labour (Haraguchi et al., 2017). Nevertheless productivity improves as labour is transferred from the subsistence to the sector where it is more productive (capitalist sector) by employing increasing levels of capital. However the wages of labour may still be fixed at the subsistence level so as to increase profit and invest more. With time, wages of labour will start increasing and once this occurs, major focus is shifted to capital substitution and this makes technology more capital intensive. With increasing capital, the productivity of labour increases thereby increasing growth in the economy. In essence developing the industrial sector is an indication of capital accumulation and rising economic growth (Szirmai & Verspagen, 2015).

3.2 Empirical Literature Review

The industrial/manufacturing sector-growth nexus (especially Kaldor's laws) has attracted an enormous empirical validation using both single and cross country data. Below, we review a number of these studies.

Hansen & Zhang (1996) examine Kaldors's engine of growth hypothesis using data on 28 regions in China for the period 1985 to 1991**,** and find evidence for the hypothesis. Alexiou & Tsaliki (2010) also find evidence performing an analysis for five Mediterranean countries, over the period 1975 to 2006, and using the fixed and random effect methods. Zhao & Tang (2017) examine the sources of economic growth in China in comparison to Russia between the period 1995 and 2008. They find that the rise in economic growth in China over the period was to a large extent contribution from the manufacturing sector, and to a lesser extend the service sector. However in Russia, growth was to a large extend driven by the service sector, followed by the primary sector.

Using the fixed effect and feasible generalized least squares (FGLS) estimations and data for the period 1992-2012, McCausland & Theodossiou (2012) also confirm Kaldor's hypothesis for 11 countries (United Kingdom, United States, Canada, Australia, Germany, France, Sweden, Greece, Japan, Korea, and Taiwan). They further find that the role of the service sector to economic growth is not comparable to that of the manufacturing sector. Necmi (1999) uses data from 45 developed and developing countries over the period 1960–1994 and using the Two Stage Least Squares also affirms Kaldor's laws. Atesoglu (1993) finds evidence for the United States using data for the period 1965-1988 and the ordinary least squares (OLS). Marconi, Reis, & Araújo (2016) also affirm this for 63 middle and high-income countries 1990-2011 using the GMM.

In 45 African countries for the period 1980-1996, Wells & Thirlwall (2003) find that the growth of GDP appears to be much more closely associated with the growth of the

manufacturing/industrial sector than the agricultural or service sectors. Using the spatial error model (SEM), spatial lag model (SAR) and the OLS, Güçlü (2013) finds evidence for Turkey using data for the period 1990-2000. Szirmai & Verspagen (2015) examine the impact of the manufacturing sector on economic growth for a sample of 88 developed and developing countries over the period 1950-2005. Employing the fixed effect model and the Hausman–Taylor estimation on the full sample, they find only a moderately positive effect of manufacturing on economic growth. They did not find such for the services sector. However dividing the sample into 1950–1970, 1970–1990 and 1990–2005, they only find a direct impact of manufacturing only for the first period. Similar results for this period are also found for the services sector.

A very elaborate study by Haraguchi, Cheng, & Smeets (2017) of both developed and developing countries shows that the industrialization driven growth is still potent for developing countries despite the recent claims of dwindling manufacturing development and the reduction in the relevance of manufacturing for economic development and transformation.

The theoretical underpinnings of the industrialization-growth nexus is generally towards one direction- i.e. the growth of the industrial sector promotes economic growth. Most of the empirical studies set out to authenticate the efficacy and validity of Kaldor's laws of growth (Alexiou & Tsaliki, 2010; Güçlü, 2013; Hansen & Zhang, 1996; Marconi et al., 2016; McCausland & Theodossiou, 2012; Wells & Thirlwall, 2003). These studies have employed both time series and panel techniques and have largely found evidence for the laws. It however worthy of emphasis that most of these studies have focused on countries outside Africa. Evidence in Africa is not well substantiated particularly for a sample capturing recent years. A very glaring limitation of most of the previous studies is that they have neither directly catered for the potential endogeneity bias between manufacturing/industry and economic growth nor used estimations that do same (Alexiou

& Tsaliki, 2010; Hansen & Zhang, 1996; McCausland & Theodossiou, 2012; Wells & Thirlwall, 2003). Like Marconi, Reis, & Araújo (2016), we circumvent this limitation by employing the system GMM. This paper does not directly follow the pattern of previous studies- i.e. testing Kaldor's laws of growth- but however set forth to examine the impact of industrialization on economic growth directly using data from 37 African countries over the period 1980-2014.

4 Methodology and Data Description

This section gives a description of the methodology employed by the paper. The section is subdivided into; model specification, estimation strategy and data respectively.

4.1 Model Specification

In examining the impact of industrialization on economic growth in Africa, we estimate our baseline empirical model as;

$$Y_{i,t} = \theta_1 + \theta_2 Y_{i,t-1} + \theta_3 indust_{i,t} + \theta_4 indust_{i,t} * Z_{i,t} + \theta_5 X_{i,t} + \mu_i + \gamma_t + \varepsilon_{i,t} \quad (1)$$

for $t = 1,2,3, \dots, T$ and $i = 1,2,3, \dots, N$

where $Y_{i,t}$, the dependent variable, is GDP per capita growth rate and it is a proxy for economic growth, $Y_{i,t-1}$ is a year lag of the dependent variable representing the initial level of growth, $indust_{i,t}$ is the major variable of focus and it is a measure of industrialization, $indust_{i,t} * Z_{i,t}$ is an interaction effect of an industrialization measure and a measure of trade openness, $X_{i,t}$ is a vector of other control variables, θ_i are parameters to be estimated. i and t represent country and time respectively. μ_i and γ_t are respectively country-specific and time-specific fixed effects. $\varepsilon_{i,t}$ is the error term.

The main variable that has been used in the literature to proxy industrialization is value added of manufacturing (Alexiou & Tsaliki, 2010; Gui-Diby & Renard, 2015; Hansen & Zhang, 1996;

Marconi et al., 2016; McCausland & Theodossiou, 2012; Necmi, 1999; Szirmai & Verspagen, 2015; Wells & Thirlwall, 2003). In this paper we employ this measure in addition to value added of industry to serve as a robustness check measure. Manufacturing refers to industries belonging to ISIC divisions 15-37, and industry corresponds to ISIC divisions 10-45 and includes manufacturing (ISIC divisions 15-37). Industry encompasses value added in mining, manufacturing, construction, electricity, water, and gas. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs (World Bank, 2017b).

We include interaction terms ($indust_{i,t} * Z_{i,t}$) to enable us analyze the interactive effect of industrialization and trade openness ($Z_{i,t}$) on our dependent variable. We proxy trade openness with two measures; trade openness measured as the ratio of total trade (sum of export and import of goods and services) and GDP, and the ratio of export (of goods and services) and GDP. In essence we find how these variables facilitate or mediate the impact of industrialization on economic growth. We do this to test the efficacy of the export-oriented industrialization or export substitution industrialization strategies. A positive and statistically significant coefficient of an interaction term implies that industrialization in the presence of the variables in $Z_{i,t}$ would improve economic growth, and a negative coefficient indicates a deterioration in economic growth. An inclusion of interaction term is likely to cause multicollinearity as it tends to be highly correlated with the original variables used to compute them (Azman-Saini, Baharumshah, & Law, 2010; Darlington, 1990). Therefore following Azman-Saini et al. (2010) and Gui-Diby (2014), we circumvent this in the following two ways; i) $indust_{i,t} * Z_{i,t}$ is regressed on $indust_{i,t}$ and $Z_{i,t}$ variables, ii) the residuals from the first step in (i) are used to represent the interaction term. In essence we estimate the following model, and thus use the residuals;

$$indust_{i,t} * Z_{i,t} = a_1 + a_2 Z_{i,t} + a_3 indust_{i,t} + \varepsilon_{i,t} \quad (2)$$

where $indust_{i,t} * Z_{i,t}$ is the interaction of the variables of interest and the industry measure. $Z_{i,t}$ is a measure of openness and $indust_{i,t}$, industrialization.

The constitutes of $X_{i,t}$ are made up of traditional covariates of economic growth; population, domestic investment, government expenditure, inflation (Adams, 2009; Adams & Opoku, 2015; Akinlo, 2004; Azman-Saini et al., 2010; Gui-Diby, 2014; Szirmai & Verspagen, 2015). Population is measured as the log of population, domestic investment as the log gross capital formation per capita, government expenditure as the log of government final consumption expenditure per capita, and inflation as GDP deflator (annual percentage). All monetary variables are expressed in constant U.S. 2010 dollars.

4.2 Estimation Strategy

In economic growth estimations, one of the major challenges has been how to surmount the problem of endogeneity or simultaneity bias. The potential endogeneity of industrialization variable and economic growth has been discussed at length (Marconi et al., 2016; Necmi, 1999). In this case both OLS and fixed-effects estimates of [1] will be biased. Failure to cater for the endogeneity bias is a serious problem as the estimates generated are spurious. The use of OLS in estimating [1] is also problematic if there exist (fixed) unobservable heterogeneity. A potential antidote to this is the use of the fixed-effects or within estimation. However fixed effect estimation of [1] would be consistent if current values of the explanatory variables were completely independent of past realizations of the dependent variable (Wintoki, Linck, & Netter, 2012). Otherwise fixed effect estimations would be biased. In addition, in using the fixed effect model we need to assume strict exogeneity of the explanatory variables.

The correction of the endogeneity bias has been the number one criticism for previous studies that have examined the effect of industrialization on growth, especially those testing the laws of Kaldor. A popular reaction to endogeneity is the use of external instruments in instrumental variable estimations. The use of the instrumental variables techniques help us identify the causes of growth if the instruments specified do not directly affect growth but only through the endogenous variable. The use of this approach has however not been criticism free. This is the case as in many of the cases the instrumental variables are either invalid, weak or both, and explain just a little variation in the endogenous variables (Bazzi & Clemens, 2013; Bound, Jaeger, & Baker, 1995). Reliance on these instruments could therefore produce inconsistencies in the regression estimates (Durlauf et al., 2005).

Progress in econometrics have in way eased the problem of identification to a large extent. Notably in recent decades is the advent of the generalized method of moments (GMM) estimators-the difference and the system (Arellano & Bond, 1991; Arellano & Bover, 1995; Blundell & Bond, 1998; Holtz-Eakin, Newey, & Rosen, 1988). The GMM is capable of controlling for endogeneity and unobserved heterogeneity by permitting the inclusion of lagged internal instruments. Nevertheless many studies have shown that the estimation of GMM employing all the mechanical instruments are not stable and have high tendency of been biased when the sample is finite due to the problem of many and weak instruments (Roodman, 2007, 2009). The crux of the GMM however is situated in the hope they give for circumventing a tedious estimation challenge; the combination of a short panel, a dynamic dependent variable, fixed effects, and an absence of good external instruments (Roodman 2009).

Though the use of both external and internal instrumental variables techniques are the major techniques for controlling endogeneity bias, their uses are both controversial (Bazzi & Clemens,

2013; Bound et al., 1995; Durlauf et al., 2005; Roodman, 2009). Using the xtabond2 estimation designed by Roodman (2007, 2009) one is able to overcome many of the challenges of the GMM. In this paper we adopt one of the alternative measures-the use of internal instrument techniques. Our choice is motivated on the grounds that external instrumental variables are very difficult to come by, justify theoretically and validate (Bazzi & Clemens, 2013; Durlauf et al., 2005).[5]

The dynamic GMM panel estimator exploits the dynamic relationships inherent in the explanatory variables. The fundamental estimation process involves two main steps. The first involves first differencing, and which the general form can be given as;

$$\Delta y_{i,t} = \alpha \Delta y_{i,t-1} + \beta \Delta x_{i,t} + \Delta \varepsilon_{i,t} \qquad (3)$$

where $y_{i,i}$, $x_{i,t}$ and $\varepsilon_{i,t}$ are the dependent variable, set of explanatory variables and the error term respectively. Δ is the first difference sign.

First-differencing removes any potential bias that may come from time-invariant unobserved heterogeneity. After this transformation, we estimate [3] by the GMM employing the lagged values of the explanatory variables as instruments for the current explanatory variables. The instruments are hence collected from the set of lagged dependent or explanatory variables. This is a potential advantage of dynamic panel models in the presence of time-invariant country-specific effect, and it is of great essence when either the dependent or explanatory variables (or both) are known to be correlated with the error term.

If the original models to be estimated are conceptually in levels, performing the differences have the potential of reducing the variation in the explanatory variables (Wintoki et al., 2012). Variables

[5] Durlauf et al. (2005) assert that the weakness and invalidity of several instruments have become unavoidable as the choice of instruments to use suffers some level of inaccuracy due to the qualitative and nonobjective judgment.

in levels may be weak instruments for first differenced equations, and also first differencing may also intensify the effect of measurement errors on the regressand (Arellano & Bover, 1995). These limitations can however be surmounted or alleviated by also including the equations in levels in estimation process (Arellano & Bover, 1995; Blundell & Bond, 1998). The first differenced variables can then be employed as instruments for the equations in levels in a system of equations made up of both equations in levels and first differences. Going by this manner produces a variant of the GMM dynamic estimator known as the system GMM. This leaves the one explained above to be known as the differenced GMM.

$$\begin{bmatrix} y_{i,t} \\ \Delta y_{it} \end{bmatrix} = \alpha \begin{bmatrix} y_{i,t-1} \\ \Delta y_{it-1} \end{bmatrix} + \beta \begin{bmatrix} x_{i,t} \\ \Delta x_{i,t} \end{bmatrix} + \varepsilon_{i,t} \qquad (4)$$

In this paper we focus on the system-GMM estimation and assess the validity of our approach, using two tests suggested by Arellano and Bond.[6] The first is the second-order serial correlations. The crux of this has to do with whether or not we have included adequate amount of lags to cater for the dynamic aspect of the model. If the assumptions of the estimation are valid then we expect the residuals in first differences to be correlated, however there should be no such correlations in the second differences $(AR(2))$. The second test we consider is the Hansen J test of over-identification. This enables us to evaluate the validity of the instruments. The Hansen J test is distributed chi square under the assumption that the instruments are valid. The system GMM is noted to be likely to generate too many instruments and this questions the potency of the Hansen J test. We however follow Roodman's Stata routine to collapse all the internally generated instruments (Roodman, 2009) to mitigate the multiplicity of instruments.

[6] All the GMM estimations are conducted by the xtabond2 Roodman (2009).

4.3 Data

The paper considers a sample of 37 African countries (see Table A.1 in the Appendix for the list of countries) over the period 1980-2014. Our choice of the sample size is solely determined by the lack of data for the main variables in some of the countries. All the variables used in the estimations are sourced from the World Development Indicators of the World Bank (World Bank, 2017b).

Despite the fact that the data we use are of yearly time span, we proceed to compute yearly averages. This is the case as Islam (1995) notes ''short term disturbances may loom large in such brief time spans''. Besides the estimation of the GMM requires N to be far larger than T. As a result we employ 5 year averages for the period 1980-2014. In undergoing this transformation, $\varepsilon_{i,t}$ may be considered to be less influenced by business cycle effects and also less probable to be serially correlated relative to the annual data setup (Islam, 1995). Tables A.2 and A.3 in the Appendix present the descriptive statistics and correlation matrix of all the variables.

5 Results and Discussion

In this section we present and discuss the empirical results of the study. The results are based on a sample range of 1980-2014, on a 5-year averages. Table A.4 (in the appendix) present results based on the fixed effect model. In Tables 1-4 we employ a more robust technique, the system GMM. For each Table we present 6 models; model 1 reports a simple model of economic growth, and in model 2 we augment model 1 with a human capital variable (education). Models 3 and 4 present robustness analyses with the inclusion of trade openness and its interactions respectively. Models 5 and 6 repeat model 4 and 5 however using export as the measure of openness. In all the estimated models, the dependent variable is the log of real GDP per capita which is used as a proxy for economic growth. In our main estimations, we employ manufacturing value added as the proxy for industrialization.

Preliminarily we estimate [1] using the fixed effect model. Our main measure of industrialization (manufacturing value added) is consistently positive and statistically significant in all the estimated models. The results also show a positive and statistically significant effect of the interaction between trade openness (both total trade and exports) and economic growth. The results of the fixed effect model however will be biased if the explanatory variables are not strictly exogenous. As a result we proceed to the use of a more robust estimator, the dynamic GMM, which caters for potential endogeneity bias.

The System Generalized Method of Moments (GMM) Results

Prior to reporting the results based on the system GMM, it is imperative to stress that the validity and the consistency of the estimates rely substantially on the model diagnostics. These are met by two main tests; first, the estimates require the absence of second-order autocorrelation in the error terms (Roodman, 2009), and in all the estimated models (see bottom of Tables 1-4), the estimates show that we cannot reject the null hypothesis of no serial correlation between the errors as all the p-values are greater than 5 percent. Hence, the instruments generated from the lags of the variables are valid for their current values. Second, the Hansen J test of over-identifying restrictions tests the overall validity of the instruments. Acceptance of the null hypothesis gives support to the model. The Hansen J tests of the estimated model suggest that the model is correctly specified and the instruments are valid (see bottom of Tables 1-4). In essence the models in the various estimations of the system GMM passed the validity tests for the instruments.

Table 1: Industrialization and Economics Growth in Africa (System GMM)

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
L. GDP	0.834***	0.790***	0.803***	0.782***	0.774***	0.780***
	(0.106)	(0.089)	(0.091)	(0.069)	(0.086)	(0.071)
Manufacturing	0.137**	0.171***	0.146**	0.132***	0.153***	0.098*
	(0.058)	(0.051)	(0.058)	(0.042)	(0.054)	(0.056)
Dom. Invest.	0.208***	0.193***	0.192***	0.182***	0.194***	0.217***
	(0.060)	(0.051)	(0.052)	(0.043)	(0.050)	(0.046)
Population	-0.015	-0.046	0.000	-0.018	-0.016	-0.037
	(0.039)	(0.061)	(0.055)	(0.051)	(0.060)	(0.070)
Inflation	-0.002	-0.002*	-0.002*	-0.003**	-0.002	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Gov't Exp	-0.172**	-0.171**	-0.161***	-0.135***	-0.155***	-0.153***
	(0.084)	(0.067)	(0.056)	(0.048)	(0.056)	(0.055)
Education		0.031	-0.002	0.015	0.019	0.045
		(0.047)	(0.047)	(0.046)	(0.052)	(0.062)
Trade Share			0.079	0.074		
			(0.102)	(0.078)		
Trade* manuf				0.071*		
				(0.040)		
Export Share					0.172	0.362*
					(0.187)	(0.197)
Export* manuf						0.140
						(0.104)
Constant	0.649	0.947	0.565	0.752	0.688	0.715
	(0.746)	(0.688)	(0.577)	(0.507)	(0.602)	(0.658)
ar2	-1.502	-0.993	-1.475	-1.176	-1.460	-1.261
ar2p	0.133	0.321	0.140	0.240	0.144	0.207
hansen	4.976	5.442	3.121	8.117	3.650	4.942
hansenp	0.547	0.606	0.927	0.522	0.887	0.839
No. of Insts	18	20	22	24	22	24

NB: The dependent variable in all the estimated models is economic growth measured as log of real GDP per capita. L. GDP is lag of the dependent variable, industry is log of industry (value added) per capita, manufacturing is log of manufacturing (value added) per capita, dom. invest represents domestic investment and it is log of gross capital formation per capita, population is log of population, inflation is GDP deflator (annual percentage), gov't exp represents government expenditure and it is log of general government final consumption expenditure per capita, education is log of secondary school enrolment, trade share is a measure of openness proxied with total trade (export plus import of goods and services) as a ratio of GDP, trade*manuf is an interaction term of trade share and the log of manufacturing (value added) per capita, export share is the ratio of export (of goods and services) and GDP, export*manuf is an interaction term of export share and the log of manufacturing (value added) per capita, trade*industry is an interaction term of trade share and the log of industry (value added) per capita, export*industry is an interaction term of export share and the log of industry (value added) per capita. All monetary variables are expressed in constant U.S. 2010 dollars. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Similar to the results of the fixed effect model presented above, the results of the GMM show a positive relationship between economic growth and industrialization (manufacturing value added) in Africa (see Table 1). The result is consistently significant in all the estimated models at the 1 percent level of significance, and suggest that with a 1 percent increase in industrialization, economic growth is expected to increase between 0.098 and 0.171 percent. This implies that an increase in industrialization, in this case a boost in the manufacturing sector has a high potential effect of increasing economic growth. Our result is largely in line with Kaldor's growth hypothesis and a chunk of empirical findings in other countries and regions (Alexiou & Tsaliki, 2010; Güçlü, 2013; Hansen & Zhang, 1996; Haraguchi et al., 2017; McCausland & Theodossiou, 2012; Szirmai & Verspagen, 2015).

The results add to the affirmation that industrialization is a major boost for economic growth, and therefore the way for African countries to go. Industrialization can be seen to influence economic growth in developing countries in a number of ways including; it is the sector with the greatest spillover or externalities effects, it is able to create employment for a chunk of the population, it generate more foreign currency through value added exports, and it can boost aggregate consumption in an economy.

Among other important factors, openness of an economy is crucial for an economy's industry growth and industrialization drive. Openness is important for industrialization at least for two reasons; i) through exports, the aggregate demand for an economy's industrial products can be highly boosted, and ii) openness increases the inflows of FDI into the industrial sector. Considering this, we augment our models with openness measures and their interactions with the industrialization measure.

Measuring openness with the ratio of total trade to GDP (trade share), though we find the coefficient to be positive but statistically insignificant, we find its interaction with industry statistically significant (Table 1, Models 3 and 4). A robustness check using exports (as a ratio of GDP) (export share) as a measure of openness produces results qualitatively akin to the latter (Table 1, Models 5 and 6). The interaction term based on export produces an estimate which is more than twice (0.362 percent) greater than the non-interactive estimates. The results imply that the growth effect of industrialization is greatly enhanced in an opened economy. Export-oriented industrialization is believed to speed up industrialization as a country produces and exports the commodity in which it has comparative advantage (Kaplinsky & Morris, 2008; Owens & Wood, 1997). Karunaratne (1980) recounts that the failure of import substitution polices to meet the objectives of industrialization in many countries caused them to embrace export oriented strategies. Almost all the African countries have embraced export promotion. It is evident that for many of the East Asian countries that have achieved massive growth transformation through industrialization in the past few decades have embraced export orientation keenly.

In all the estimated models, we find the coefficient of the domestic investment variable to be positive and statistically significant at the 1 percent level of significance. This implies that increase in domestic investment in Africa is a major boost to economic growth. This outcome is in line with Adams (2009), Adams & Opoku (2016) and Gui-Diby (2014). Government expedniture is found to have a negative coefficient in the estimated models, with levels of statistical significance ranging between 1 and 5 percent. The effect of government expenditure is mixed (Barro, 1991; Garrison & Lee, 1995), and it highly depends on what the bulk of government finances is sepnt on. The negative effect of government expenditure on economic growth that we find may be explained by the high prevalence of corruption in many of the African countries which has resulted in bloated

budgets and the provision of shoddy works. Barro (1991) contends that rising government spending can adversely affect the growth of the economy, as it generates distortions such as taxation which does not enhance the productivity and investment of the private sector. Fischer (1991) also stresses how increasing government expenditure can crowd-out private investment and eventually inhibit econmic growth.

Generally we find a negative relationship between inflation and economic growth, implying that a rising inflation rate inhibits economic growth. The growth inhibiting features of inflation can be reflected in its ability of increasing prices and curtailing consumption, increasing interest rate and potentially inhibiting investment by firms. Increasing inflation can send wrong signals to potential foreign investors and hence reduce capital inflows as well (Alfaro et al. 2004). Our result is akin to those of Adams & Opoku (2015). The results depict a statistically insignificant population coefficient, implying the growth of population does not have a significant impact on economic growth. The results depict that the coefficient of our measure of human capital (education), secondary school enrollment is generally positive howbeit statistically insignificant. Two reasons may account for this outcome; i) the increase in school enrollment has not increase with employment. In Africa many people from school remain unemployed and do not get the opportunity to use the skills acquired from education to positively impact economic growth; ii) as Hanushek (2013) notes, though the school attainment gap has been abridged in developing countries, much cannot be said of the quality of education that affect economic growth.

Robustness Checks

We check the sensitivity of the results by using an alternative measure of industrialization and also performing a subsampling analyses based on both the original measure of industrialization (manufacturing value added) and the alternative measure.

Table 2: Industrialization and Economics Growth in Africa. Results based on Industry

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
L. GDP	0.657***	0.714***	0.761***	0.695***	0.744***	0.683***
	(0.234)	(0.067)	(0.085)	(0.064)	(0.079)	(0.080)
Industry	0.286**	0.219***	0.157***	0.193***	0.173***	0.191***
	(0.124)	(0.033)	(0.045)	(0.033)	(0.046)	(0.035)
Dom. Invest.	0.220***	0.189***	0.212***	0.220***	0.201***	0.209***
	(0.065)	(0.049)	(0.043)	(0.040)	(0.048)	(0.040)
Population	-0.085	-0.097	-0.054	-0.098**	-0.089	-0.116**
	(0.088)	(0.064)	(0.049)	(0.042)	(0.054)	(0.056)
Inflation	0.000	-0.000	-0.001	0.000	-0.001	0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Gov't Exp	-0.174*	-0.164**	-0.166**	-0.157**	-0.163**	-0.128**
	(0.101)	(0.072)	(0.062)	(0.064)	(0.066)	(0.062)
Education		0.052	0.038	0.071*	0.059	0.076*
		(0.036)	(0.042)	(0.036)	(0.038)	(0.042)
Trade Share			0.150	-0.011		
			(0.120)	(0.060)		
Trade* indus				0.031		
				(0.025)		
Export Share					0.192	-0.071
					(0.204)	(0.131)
Export* indus						0.012
						(0.068)
Constant	1.947	1.567	0.898	1.436***	1.291*	1.672**
	(1.807)	(0.933)	(0.540)	(0.440)	(0.744)	(0.735)
ar2	-0.978	-1.147	-1.351	-0.808	-1.257	-0.863
ar2p	0.328	0.251	0.177	0.419	0.209	0.388
hansen	3.601	8.601	6.803	15.421	8.870	16.049
hansenp	0.730	0.283	0.558	0.080	0.353	0.066
No. of Instrs	18	20	22	24	22	24

NB: The dependent variable in all the estimated models is economic growth measured as log of real GDP per capita. L. GDP is lag of the dependent variable, industry is log of industry (value added) per capita, manufacturing is log of manufacturing (value added) per capita, dom. invest represents domestic investment and it is log of gross capital formation per capita, population is log of population, inflation is GDP deflator (annual percentage), gov't exp represents government expenditure and it is log of general government final consumption expenditure per capita, education is log of secondary school enrolment, trade share is a measure of openness proxied with total trade (export plus import of goods and services) as a ratio of GDP, trade*manuf is an interaction term of trade share and the log of manufacturing (value added) per capita, export share is the ratio of export (of goods and services) and GDP, export*manuf is an interaction term of export share and the log of manufacturing (value added) per capita, trade*industry is an interaction term of trade share and the log of industry (value added) per capita, export*industry is an interaction term of export share and the log of industry (value added) per capita. All monetary variables are expressed in constant U.S. 2010 dollars. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The alternative measure of industrialization we employ is industry value added. Industry value added transcends the manufacturing measure to include other activities of industrialization such as the production of electricity, water, and gas, construction and mining. This measure of industrialization we think is relevant as it depicts a somewhat holistic measure of industrialization. The inclusion of mining is particularly important as a substantial part of African governments' proceeds and GDP are contributed by the mining (and other extraction) sectors.

Regarding the subsampling analyses, we make a case for only the sub-Saharan African countries in the sample.[7] We deem this necessary as making an aggregate analysis of the whole of Africa may not give a true representation of sub-Saharan African countries which have charted quite a different economic growth and industrial course from North African countries. North Africa is the most developed region in Africa, and until recent years whereby its major economies have been battling with chaos and terrorism, its economic growth rates were better than those of SSA.

In Table 2 we rerun the estimations in Table 1 nonetheless using industry value added as the measure of industrialization. Akin to using manufacturing valued added, the results show a positive and statistically significant impact of industry on economic growth in all the estimated models. The impact of industrialization is therefore robust to different measures/proxies. Though we find both measures of trade openness to be positive, they are statistically insignificant as in Table 1. Also the interaction terms between trade openness and industry are not statistically significant. The rest of the estimates in Table 2 are largely qualitatively similar to the previous (Table 1) except that education turns statistically significant however marginally significant at the 10 percent level.

[7] We drop the North African countries in the sample.

Table 3: Industrialization and Economics Growth in SSA. Results based on Manufacturing

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
L. GDP	0.811***	0.746***	0.769***	0.797***	0.740***	0.779***
	(0.129)	(0.105)	(0.101)	(0.070)	(0.097)	(0.080)
Manufacturing	0.154**	0.217***	0.183**	0.137**	0.198***	0.130*
	(0.072)	(0.065)	(0.075)	(0.052)	(0.063)	(0.069)
Dom. Invest.	0.259***	0.223***	0.232***	0.256***	0.225***	0.256***
	(0.065)	(0.061)	(0.059)	(0.047)	(0.057)	(0.053)
Population	-0.005	-0.043	-0.012	-0.027	-0.014	-0.023
	(0.040)	(0.065)	(0.061)	(0.060)	(0.064)	(0.076)
Inflation	-0.001	-0.002	-0.002	-0.003***	-0.002	-0.002*
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Gov't Exp	-0.205**	-0.204***	-0.199***	-0.217***	-0.186***	-0.203***
	(0.096)	(0.074)	(0.063)	(0.056)	(0.062)	(0.065)
Education		0.052	0.009	0.045	0.033	0.041
		(0.057)	(0.058)	(0.060)	(0.062)	(0.066)
Trade Share			0.027	0.114		
			(0.109)	(0.084)		
Trade* manuf				0.129***		
				(0.041)		
Export Share					0.098	0.301
					(0.186)	(0.188)
Export* manuf						0.162
						(0.112)
Constant	0.462	0.745	0.704	0.389	0.512	0.459
	(0.802)	(0.742)	(0.603)	(0.516)	(0.626)	(0.711)
ar2	-1.618	-0.776	-1.238	-0.753	-1.189	-0.907
ar2p	0.106	0.438	0.216	0.451	0.234	0.364
hansen	3.898	2.711	2.527	3.760	2.142	2.686
hansenp	0.690	0.910	0.960	0.926	0.976	0.975
No. of Insts	18	20	22	24	22	24

NB: The dependent variable in all the estimated models is economic growth measured as log of real GDP per capita. L. GDP is lag of the dependent variable, industry is log of industry (value added) per capita, manufacturing is log of manufacturing (value added) per capita, dom. invest represents domestic investment and it is log of gross capital formation per capita, population is log of population, inflation is GDP deflator (annual percentage), gov't exp represents government expenditure and it is log of general government final consumption expenditure per capita, education is log of secondary school enrolment, trade share is a measure of openness proxied with total trade (export plus import of goods and services) as a ratio of GDP, trade*manuf is an interaction term of trade share and the log of manufacturing (value added) per capita, export share is the ratio of export (of goods and services) and GDP, export*manuf is an interaction term of export share and the log of manufacturing (value added) per capita, trade*industry is an interaction term of trade share and the log of industry (value added) per capita, export*industry is an interaction term of export share and the log of industry (value added) per capita. All monetary variables are expressed in constant U.S. 2010 dollars. In this table we only report results for the SSA countries in our sample.
Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Industrialization and Economics Growth in SSA. Results based on Industry

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
L. GDP	0.639***	0.674***	0.724***	0.651***	0.704***	0.555***
	(0.219)	(0.088)	(0.096)	(0.074)	(0.097)	(0.090)
Industry	0.260**	0.223***	0.148***	0.187***	0.168***	0.201***
	(0.104)	(0.036)	(0.048)	(0.036)	(0.047)	(0.037)
Dom. Invest.	0.222***	0.200***	0.214***	0.223***	0.209***	0.227***
	(0.060)	(0.049)	(0.041)	(0.041)	(0.048)	(0.041)
Population	-0.088	-0.109*	-0.066	-0.094**	-0.090	-0.162**
	(0.064)	(0.062)	(0.051)	(0.045)	(0.064)	(0.063)
Inflation	0.000	-0.000	-0.001	0.001	-0.000	0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Gov't Exp	-0.165	-0.161**	-0.140**	-0.122*	-0.142*	-0.088
	(0.099)	(0.076)	(0.055)	(0.066)	(0.070)	(0.069)
Education		0.055	0.052	0.068	0.059	0.109**
		(0.041)	(0.045)	(0.040)	(0.045)	(0.052)
Trade Share			0.182*	0.008		
			(0.107)	(0.068)		
Trade* indus				0.039		
				(0.027)		
Export Share					0.212	0.069
					(0.199)	(0.169)
Export* indus						0.058
						(0.084)
Constant	2.229	1.906*	1.040	1.524***	1.427	2.469***
	(1.529)	(0.981)	(0.655)	(0.503)	(0.932)	(0.839)
ar2	-0.987	-1.043	-1.375	-0.915	-1.206	-0.472
ar2p	0.324	0.297	0.169	0.360	0.228	0.637
hansen	5.176	8.166	7.864	14.815	9.520	14.757
hansenp	0.521	0.318	0.447	0.100	0.300	0.100
No. of Insts	18	20	22	24	22	24

NB: The dependent variable in all the estimated models is economic growth measured as log of real GDP per capita. L. GDP is lag of the dependent variable, industry is log of industry (value added) per capita, manufacturing is log of manufacturing (value added) per capita, dom. invest represents domestic investment and it is log of gross capital formation per capita, population is log of population, inflation is GDP deflator (annual percentage), gov't exp represents government expenditure and it is log of general government final consumption expenditure per capita, education is log of secondary school enrolment, trade share is a measure of openness proxied with total trade (export plus import of goods and services) as a ratio of GDP, trade*manuf is an interaction term of trade share and the log of manufacturing (value added) per capita, export share is the ratio of export (of goods and services) and GDP, export*manuf is an interaction term of export share and the log of manufacturing (value added) per capita, trade*industry is an interaction term of trade share and the log of industry (value added) per capita, export*industry is an interaction term of export share and the log of industry (value added) per capita. All monetary variables are expressed in constant U.S. 2010 dollars. In this table we only report results for the SSA countries in our sample.
Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In Tables 3 and 4 we present results for the sub-Saharan African region based on both manufacturing value added (Table 3) and industry value added (Table 4). Akin to the whole Africa estimates (in Table 1) manufacturing value added enters positive and statistically significant. Similarly both measures of trade openness are positive but statistically insignificant. Regarding the interaction effect, only the total trade measure enters as positive and statistically significant, as the other measure (export) is positive however statistically insignificant. The other estimates are qualitatively similar to those for the whole Africa (Table 1).

For the sub-Saharan African region, industry value added also enters positive and statistically significant (Table 4) comparable to the whole of Africa sample (Table 2). Both interaction terms remain positive but statistically insignificant. The other estimates are qualitatively akin to those for the whole Africa (Table 2) except that the population variable turns statistically significant in some of the models.

Considering that South Africa and Nigeria are the largest sub-Saharan African economies and also major manufacturing powerhouses in the region, we re-estimate the sub-Saharan African sample excluding these two countries. We find the estimates of our measures of industrialization- manufacturing and industry value added- still positive and highly statistically significant.[8] The effect of industrialization therefore remains robust with differing samples.

Concluding Remarks

Among other things, industrialization remains one of the important tools of economic transformation for developing countries of which Africa is no exception. As a result the drive towards industrialization by developing countries is increasingly been recommended and

[8] To conserve space we do not report these results, they shall however be made available upon request.

supported by the World Bank, United Nations and other international organizations. Industrialization is the number nine goal of the Sustainable Development Goals. The call for industrialization in developing countries has become more pressing following the successful industrialization trajectories of the East Asian countries.

In this study we employ data on 37 African countries over the period 1980-2014 to empirically examine the effect of industrialization on economic growth. We also assess how trade openness augments the impact of industrialization on economic growth. Employing the generalized method of moments (System GMM), we find that industrialization has on its own boosted economic growth in Africa, and also generally trade openness further augments the effect of industrialization on economic growth in Africa. The results are robust to alternative measures of industrialization (manufacturing and industry value added) and subsampling analyses.

Regardless of the fact that the main results of this study are parallel with other studies in the literature, our results merit meticulous deliberations for policy. It should be noted that the sample period considered is associated with dwindling industrial activities in Africa, and a great signal of deindustrialization. As a result, the positive impact of industrialization on economic growth that we find is promising, and buttresses the agenda of policy makers as a major antidote for economic transformation and development. Considering the results we have, if industrialization is transformed from its current deplorable status, its effect on economic growth shall be tremendous. In this view we discuss a number of policy measures that can help revamp the industrial sector in Africa.

In view of the potential transformational effect of industrialization, African governments have to enact policies that will promote industrialization. A very remarkable policy that other governments can emulate is the One District One Factory Policy that the Government of Ghana has initiated.

This policy aims at establishing factories in all districts of the country within a period of four years. With such a policy, the governments can then set up attractive packages to lure investors into potential areas. In each district, the factory/industry that will be setup will produce goods that the district has comparative advantage in. In addition to promoting industrialization, it will also help increase employment in these districts and the country at large. This will lessen the burden on the government to provide jobs. With increasing jobs, and also booming industrial output, aggregate demand will be boosted and this will in the long-run have a positive impact on economic growth.

In Africa, the government has been the main actor in the industrialization drive, and in many instances the private sector is ignored in very relevant industrialization deliberations. Considering the bureaucratic nature and the propensity for government officials/institutions to be corrupt, produce inefficient outcomes, and also the frequent changes in governments in democratic states, the government alone remains ineffective in the quest for industrialization. An alternative way forward is for the governments to empower the private sector and provide the enabling environment. One way of doing this is promoting entrepreneurship. The government can do this by creating an environment that supports domestic and foreign investment. Particularly important is providing training and start-up support for the willing youth to venture entrepreneurship. This does not only help boost industrialization but employment as well.

One of the main tasks required from governments is providing an appropriate springboard for the private sector to act. This springboard can be provided in the form of governments i) boosting infrastructure; i.e. power, telecommunication, transportation among others, ii) strengthening institutions iii) improving access to finance through financial sector development iv) ensuring political stability. Inadequacy and the malfunctioning of these measures are bane to industrialization in a number of African countries.

Both theoretically and from the results of the study, one major way of promoting industrialization is to embark on an export promotion expedition. Industrialization will help add value to exports and hence generate more revenue for the government and the exporters. Increasing exportation of manufactured goods implies booming industries. Opening up the economy also helps in attracting foreign investors into the economy. Caution must however be taken since if an economy does not have value to offer, opening up an economy for trade may be detrimental. Usually if goods produced in an economy are not competitive in terms of price and quality, opening up such an economy may lead to dumping and the stifling of existing industries.

The regional groupings- the African Development Bank, African Union and all the sub-regional blocs- should work to strengthen the integration process in the region as this can help stimulate industrialization. The establishment of infrastructure that improve the ease of connectivity can help widen intra-regional market and increase avenues for intra-regional trade. Improving intra-regional trade is critical in promoting manufacturing development.

References

Adams, S. (2009). Foreign Direct investment, domestic investment, and economic growth in Sub-Saharan Africa. *Journal of Policy Modeling*, *31*(6), 939–949. https://doi.org/10.1016/j.jpolmod.2009.03.003

Adams, S., & Opoku, E. E. O. (2015). Foreign direct investment, regulations and growth in sub-Saharan Africa. *Economic Analysis and Policy*, *47*, 48–56. https://doi.org/10.1016/j.eap.2015.07.001

African Development Bank (2016). African Development Bank accelerates pace with 'High 5' priorities. African Development Bank Group. https://www.afdb.org/en/news-and-events/african-development-bank-accelerates-pace-with-high-5-priorities-15879/. <Accessed on September 29, 2017>

Africa Growth Initiative (2016). *Foresight Africa: Top priorities for the continent in 2016*. Africa Growth Initiative at Brookings.

Africa Development Bank (2017). Africa Development Indicators. World Bank. http://databank.worldbank.org/data/reports.aspx?source=africa-development-indicators <Accessed on October 1, 2017>

African Economic Outlook (2017). Entrepreneurship and industrialization. African Development Bank, Organisation for Economic Co-operation and Development, United Nations Development Programme. http://dx.doi.org/10.1787/aeo-2017-en

Agbloyor, E. K., Abor, J. Y., Adjasi, C. K. D., & Yawson, A. (2014). Private capital flows and economic growth in Africa: The role of domestic financial markets. *Journal of International Financial Markets, Institutions and Money*, *30*(1), 137–152. https://doi.org/10.1016/j.intfin.2014.02.003

Akinlo, A. E. (2004). Foreign direct investment and growth in Nigeria: An empirical investigation. *Journal of Policy Modeling*, *26*(5), 627–639. https://doi.org/10.1016/j.jpolmod.2004.04.011

Alexiou, C., & Tsaliki, P. (2010). An Empirical Investigation of Kaldor's Growth Laws. *The Indian Economic Journal*, *58*(3), 144–155. https://doi.org/10.1177/0019466220100309

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, *58*(2), 277. https://doi.org/10.2307/2297968

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, *68*(1), 29–51. https://doi.org/10.1016/0304-4076(94)01642-D

Atesoglu, H. S. (1993). Manufacturing and economic growth in the United States. *Applied Economics*, *25*(1), 67–69. https://doi.org/10.1080/00036849300000114

Azman-Saini, W. N. W., Baharumshah, A. Z., & Law, S. H. (2010). Foreign direct investment, economic freedom and economic growth: International evidence. *Economic Modelling*, *27*(5), 1079–1089. https://doi.org/10.1016/j.econmod.2010.04.001

Barro, R. J. (1991). Economic growth in a cross section of countries. *Quarterly Journal of Economics*, *106*(2), 407. https://doi.org/10.2307/2937943

Bazzi, S., & Clemens, M. A. (2013). Blunt instruments: Avoiding common pitfalls in identifying the causes of economic growth. *American Economic Journal: Macroeconomics*, *5*(2), 152–186. https://doi.org/10.1257/mac.5.2.152

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*(1), 115–143. https://doi.org/10.1016/S0304-

4076(98)00009-8
Bound, J., Jaeger, D. A., & Baker, R. M. (1995). Problems with Instrumental Variables Estimation when the Correlation between the Instruments and the Endogenous Explanatory Variable is Weak. *Journal of the American Statistical Association*, *90*(430), 443–450. https://doi.org/10.1080/01621459.1995.10476536
Darlington, R. (1990). *Regression and linear models*. McGraw-Hill, New York
Durlauf, S., Johnson, P., Temple, J., Durlauf, S., Johnson, P., & Temple, J. (2005). *Growth Econometrics* (Vol. 1, Part A,). Chapter 08 in Handbook of Economic Growth Elsevier.
Durlauf, S. N., Johnson, P., Temple, J., Durlauf, S., Johnson, P., & Temple, J. (2005). Growth Econometrics, *1*, *Part A*, 555–677.
Fischer, S. (1991). *Growth, Macroeconomics, and Development*. *NBER Macroeconomics Annual 1991, Volume 6* (Vol. 6). https://doi.org/10.1038/sj.bjc.6606058
Garrison, C. B., & Lee, F.-Y. (1995). The Effect of Macroeconomic Variables on Economic Growth Rates: A Cross-Country Study. *Journal of Macroeconomics*, *17*(2), 303–317.
Güçlü, M. (2013). Manufacturing and Regional Economic Growth in Turkey: A Spatial Econometric View of Kaldor's Laws. *European Planning Studies*, *21*(6), 854–866. https://doi.org/10.1080/09654313.2012.722929
Gui-Diby, S. L. (2014). Impact of foreign direct investments on economic growth in Africa: Evidence from three decades of panel data analysis. *Research in Economics*, *60*, 248–256.
Gui-Diby, S. L., & Renard, M. F. (2015). Foreign Direct Investment Inflows and the Industrialization of African Countries. *World Development*, *74*, 43–57. https://doi.org/10.1016/j.worlddev.2015.04.005
Hansen, J., & Zhang, J. (1996). A Kaldorian approach to regional economic growth in China. *Applied Economics*, *28*(September), 679–685. https://doi.org/10.1080/000368496328425
Hanushek, E. A. (2013). Economic growth in developing countries: The role of human capital. *Economics of Education Review*, *37*, 204–212. https://doi.org/10.1016/j.econedurev.2013.04.005
Haraguchi, N., Cheng, C. F. C., & Smeets, E. (2017). The Importance of Manufacturing in Economic Development: Has This Changed? *World Development*, *93*, 293–315. https://doi.org/10.1016/j.worlddev.2016.12.013
Holtz-Eakin, D., Newey, W., & Rosen, H. S. (1988). Estimating Vector Autoregressions with Panel Data. *Econometrica*, *56*(6), 1371–1395.
ILOSTAT (2017). International Labour Organization Statistics. http://www.ilo.org/ilostat/faces/wcnav_defaultSelection?_afrLoop=89708981443563&_afrWindowMode=0&_afrWindowId=article#!%40%40%3F_afrWindowId%3Darticle%26_afrLoop%3D89708981443563%26_afrWindowMode%3D0%26_adf.ctrl-state%3D1cs9y70qko_4 <Accessed on October 1, 2017>
Islam, N. (1995). Growth Empirics: a Panel Data Approach. *The Quarterly Journal of Economics*, *110*(4), 1127–1170. https://doi.org/10.2307/2946651
Kaldor, N. (1966). *Causes of the Slow Rate of Growth of the United Kingdom*, Cambridge University Press, Cambridge.
Kaldor, N. (1967). Strategic factors in economic development. Ithaca: New York State School of Industrial and Labor Relations, Cornell University.
Kaldor, N. (1970). The case for regional policies. *Scottish Journal of Political Economy*, 17, 337-*3*48.

Kaldor, N. (1975). Economic growth and Verdoorn's law: a comment on Mr Rowthorn's article. *Economic Journal*, 85, 891-*8* 96.

Kaplinsky, R., & Morris, M. (2008). Do the Asian Drivers Undermine Export-oriented Industrialization in SSA? *World Development*, *36*(2), 254–273. https://doi.org/10.1016/j.worlddev.2007.06.007

Karunaratne, N. D. (1980). Export oriented industrialization strategies. *Intereconomics*, *15*(5), 217-223.

Lewis, W. A. (1954). Economic Development with Unlim . ited Supplies of Labour. *The Manchester School of Economic and Social Studies*, *22*, 139–191. 10.1111/j.1467-9957.1954.tb00021.x

Lin, J.Y. & C. Monga (2013). "Comparative advantage: The silver bullet of industrial policy", in J.E.S. Stiglitz and J.Y. Lin (eds.), *The Industrial Policy Revolution I: The Role of Government beyond Ideology*, pp. 19-38, Palgrave Macmillan, London, http://doi.org/10.1057/9781137335173_2.

Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, *22*(February), 3–42. https://doi.org/10.1016/0304-3932(88)90168-7

Marconi, N., Reis, C. F. de B., & Araújo, E. C. de. (2016). Manufacturing and economic development: The actuality of Kaldor's first and second laws. *Structural Change and Economic Dynamics*, *37*, 75–89. https://doi.org/10.1016/j.strueco.2015.12.002

Marshall, M.G., Gurr, T.R., & Jaggers, K. (2017). Polity IV project: Political regime characteristics and transitions, 1800–2016. Center for Systemic Peace and Colorado State University. Retrieved from http://www.systemicpeace.org/inscrdata.html.

McCausland, W. D., & Theodossiou, I. (2012). Is manufacturing still the engine of growth? *Journal of Post Keynesian Economics*, *35*(1), 79–92. https://doi.org/10.2753/PKE0160-3477350105

Necmi, S. (1999). Kaldor ' s growth analysis revisited. *Applied Economics*, *31*(5), 653–660. https://doi.org/10.1080/000368499324093

Nkrumah, K. (1965). *Neo-Colonialism the last stage of imperialism*. International Publishers. New York.

Nyerere, J. K. (1968). *Freedom and socialism: Uhuru na ujamaa; a selection from writings and speeches, 1965-1967*. Oxford University Press.

Onafowora, O. a., & Owoye, O. (1998). Can Trade Liberalization Stimulate Economic Growth in Africa? *World Development*, *26*(3), 497–506. https://doi.org/10.1016/S0305-750X(97)10058-4

Owens, T., & Wood, A. (1997). Export-oriented industrialization through primary processing? *World Development*, *25*(9), 1453–1470. https://doi.org/10.1016/S0305-750X(97)00042-9

Page, J. (2011). Should Africa industrialize? UNU-WIDER Working Paper No. 2011/47.

Romer, P. M. (1986). Increasing Returns and Long-Run Growth. *Journal of Political Economy*, *94*(5), 1002–1037.

Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy*, *98*(5), S71–S102. https://doi.org/10.1086/261725

Roodman, D. (2007). The anarchy of numbers: Aid, development, and cross-country empirics. *World Bank Economic Review*, *21*(2), 255–277. https://doi.org/10.1093/wber/lhm004

Roodman, D. (2009). Practitioners' corner: A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics*, *71*(1), 135–158. https://doi.org/10.1111/j.1468-0084.2008.00542.x

Sakyi, D., Commodore, R., & Opoku, E. E. O. (2015). Foreign Direct Investment, Trade Openness and Economic Growth in Ghana: An Empirical Investigation. *Journal of African Business*, *16*(1–2), 1–15. https://doi.org/10.1080/15228916.2015.1061283

Szirmai, A., & Verspagen, B. (2015). Manufacturing and economic growth in developing countries, 1950-2005. *Structural Change and Economic Dynamics*, *34*, 46–59. https://doi.org/10.1016/j.strueco.2015.06.002

Thirlwall, A.P. &Pacheco-López, P. (2017). *Economics of development: theory and evidence*. 10th Edition. Palgrave, London.

UNCTAD (2015). Unlocking the potential of Africa's services trade for growth and development. Economic Development in Africa Report 2015. United Nations, New York and Geneva.

UNCTADStat (2017). United Nations Conference on Trade and Development database. http://unctadstat.unctad.org/wds/TableViewer/tableView.aspx. <Accessed on October 1, 2017>

UNIDO (2013) Sustaining Employment Growth: The Role of Manufacturing and Structural Change. Industrial Development Report 2013. United Nations Industrial Development Organization

Wells, H., & Thirlwall, A. (2003). Testing Kaldor's Growth Laws across the Countries of Africa. *African Development Review*, *15*(2–3), 89–105.

Wintoki, M. B., Linck, J. S., & Netter, J. M. (2012). Endogeneity and the dynamics of internal corporate governance. *Journal of Financial Economics*, *105*(3), 581–606. https://doi.org/10.1016/j.jfineco.2012.03.005

Wong, K., & Yip, C. K. (1999). Industrialization , Economic Growth , and International Trade. *Review of International Economics*, *7*(January 1998), 522–540.

World Bank. (2012). *Global economic prospects. Sub-Saharan Africa Region*. June 2012. The World Bank.

World Bank. (2013). An Analysis of issues shaping Africa's economic future. Africa's Pulse, Vol 7, April 2013. The World Bank

World Bank (2017a). *World Development Indicators*. International Bank for Reconstruction and Development/The World Bank, Washington DC.

World Bank (2017b). World Development Indicators (Data). World Bank. http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators <Accessed on September 1, 2017>

Zahonogo, P. (2017). Trade and economic growth in developing countries: Evidence from sub-Saharan Africa. *Journal of African Trade*, *3*(1–2), 41–56. https://doi.org/10.1016/j.joat.2017.02.001

Zamfir, I. (2016). Africa's economic growth. Taking off or slowing down? European Parliamentary Research Service, European Union.

Zhao, J., & Tang, J. (2017). Industrial structure change and economic growth: A China-Russia comparison. *China Economic Review*, (August), 0–1. https://doi.org/10.1016/j.chieco.2017.08.008

Table A.1: List of Sampled Countries

Botswana	Guinea	Uganda	Gambia	South Africa
Burkina Faso	Mauritius	Zimbabwe	Kenya	Zambia
Cameroon	Mozambique	Benin	Lesotho	Sudan
Central Africa Rep	Niger	Burundi	Malawi	Rwanda
Chad	Namibia	Comoros	Mauritania	Tunisia
Ethiopia	Senegal	Congo Republic	Morocco	
Gabon	Swaziland	Cote d'Ivoire	Nigeria	
Ghana	Togo	Egypt	Sierra Leone	

Source: Authors' (2017)

Table A.2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
GDP	258	6.908	0.979	5.003	9.411
Industry	237	5.462	1.451	2.756	9.128
Manufacturing	229	4.549	1.247	2.072	7.105
Dom. Invest.	258	4.806	1.226	1.831	8.040
Population	259	15.811	1.309	12.700	18.941
Inflation	258	12.310	17.076	-5.903	148.805
Gov't Exp	258	4.564	1.121	2.551	7.292
Education	250	12.480	1.482	9.309	16.019
Trade Share	250	0.701	0.338	0.129	1.911
Trade*manuf	221	0.000	0.462	-2.272	1.414
Export Share	250	0.300	0.168	0.042	0.882
Export*manuf	221	6.313	3.459	0.887	18.470
Trade*industry	229	0.000	0.509	-2.505	1.746
Export*industry	229	0.000	0.228	-0.835	0.854

NB: GDP, a proxy for economic growth, is the log of real GDP per capita, industry is log of industry (value added) per capita, manufacturing is log of manufacturing (value added) per capita, dom. invest represents domestic investment and it is log of gross capital formation per capita, population is log of population, inflation is GDP deflator (annual percentage), gov't exp represents government expenditure and it is log of general government final consumption expenditure per capita, education is log of secondary school enrolment, trade share is a measure of openness proxied with total trade (export plus import of goods and services) as a ratio of GDP, trade*manuf is an interaction term of trade share and the log of manufacturing (value added) per capita, export share is the ratio of export (of goods and services) and GDP, export*manuf is an interaction term of export share and the log of manufacturing (value added) per capita, trade*industry is an interaction term of trade share and the log of industry (value added) per capita, export*industry is an interaction term of export share and the log of industry (value added) per capita.
All monetary variables are expressed in constant U.S. 2010 dollars.
Source: Authors' (2017) with data from the World Bank (2017b)

Table A3. Correlation Coefficients

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. GDP	1.000													
2. Industry	0.956	1.000												
3. Manufacturing	0.834	0.827	1.000											
4. Dom. Invest.	0.865	0.826	0.728	1.000										
5. Population	-0.126	-0.088	0.001	-0.136	1.000									
6. Inflation	-0.165	-0.176	-0.203	-0.273	0.147	1.000								
7. Gov't Exp	0.888	0.833	0.790	0.928	-0.223	-0.280	1.000							
8. Education	0.174	0.180	0.257	0.143	0.913	0.046	0.062	1.000						
9. Trade Share	0.413	0.416	0.369	0.478	-0.553	-0.182	0.493	-0.373	1.000					
10. Trade*manuf	0.053	0.032	0.169	0.024	-0.145	-0.080	0.109	-0.105	-0.011	1.000				
11. Export Share	0.640	0.668	0.530	0.576	-0.436	-0.163	0.602	-0.222	0.840	0.189	1.000			
12. Export*manuf	0.696	0.722	0.624	0.620	-0.332	-0.168	0.647	-0.104	0.808	0.227	0.988	1.000		
13. Trade*industry	0.166	0.208	0.048	0.130	-0.180	-0.096	0.184	-0.135	0.014	0.776	0.306	0.308	1.000	
14. Export*industry	0.092	0.109	-0.134	0.039	-0.096	-0.037	0.067	-0.098	-0.074	0.350	0.007	0.013	0.672	1.000

NB: GDP, a proxy for economic growth, is the log of real GDP per capita, industry is log of industry (value added) per capita, manufacturing is log of manufacturing (value added) per capita, dom. invest represents domestic investment and it is log of gross capital formation per capita, population is log of population, inflation is GDP deflator (annual percentage), gov't exp represents government expenditure and it is log of general government final consumption expenditure per capita, education is log of secondary school enrolment, trade share is a measure of openness proxied with total trade (export plus import of goods and services) as a ratio of GDP, trade*manuf is an interaction term of trade share and the log of manufacturing (value added) per capita, export share is the ratio of export (of goods and services) and GDP, export*manuf is an interaction term of export share and the log of manufacturing (value added) per capita, trade*industry is an interaction term of trade share and the log of industry (value added) per capita, export*industry is an interaction term of export share and the log of industry (value added) per capita. All monetary variables are expressed in constant U.S. 2010 dollars.

Source: Authors' (2017) with data from the World Bank (2017b).

Table A.4: Industrialization and Economic Growth in Africa (Fixed Effect Model)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
L. GDP	0.541***	0.539***	0.556***	0.556***	0.562***	0.562***
	(0.073)	(0.077)	(0.079)	(0.077)	(0.077)	(0.077)
Manufacturing	0.190***	0.189***	0.162***	0.162***	0.145**	0.144**
	(0.050)	(0.051)	(0.048)	(0.048)	(0.056)	(0.057)
Dom. Invest.	0.098***	0.098***	0.095***	0.096***	0.099***	0.099***
	(0.015)	(0.017)	(0.018)	(0.018)	(0.018)	(0.018)
Population	0.048	0.027	0.000	0.010	-0.017	-0.020
	(0.120)	(0.148)	(0.141)	(0.150)	(0.133)	(0.135)
Inflation	-0.000	0.000	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Gov't Exp	0.028	0.028	0.036	0.035	0.035	0.035
	(0.029)	(0.031)	(0.030)	(0.030)	(0.029)	(0.030)
Education		0.008	-0.002	-0.000	0.002	0.001
		(0.031)	(0.031)	(0.031)	(0.032)	(0.032)
Trade Share			0.009	0.006		
			(0.052)	(0.053)		
Trade*manuf				0.012		
				(0.030)		
Export Share					0.102	0.100
					(0.113)	(0.113)
Export*manuf						-0.011
						(0.058)
Constant	0.771	1.020	1.576	1.403	1.835	1.891
L. GDP	(2.118)	(2.419)	(2.288)	(2.451)	(2.107)	(2.157)
r2	0.902	0.900	0.903	0.903	0.904	0.904
r2_a	0.897	0.893	0.896	0.895	0.897	0.896
sigma_u	0.135	0.127	0.125	0.125	0.129	0.131
sigma_e	0.067	0.068	0.066	0.066	0.066	0.066

NB: The dependent variable in all the estimated models is economic growth measured as log of real GDP per capita. L. GDP is lag of the dependent variable, industry is log of industry (value added) per capita, manufacturing is log of manufacturing (value added) per capita, dom. invest represents domestic investment and it is log of gross capital formation per capita, population is log of population, inflation is GDP deflator (annual percentage), gov't exp represents government expenditure and it is log of general government final consumption expenditure per capita, education is log of secondary school enrolment, trade share is a measure of openness proxied with total trade (export plus import of goods and services) as a ratio of GDP, trade*manuf is an interaction term of trade share and the log of manufacturing (value added) per capita, export share is the ratio of export (of goods and services) and GDP, export*manuf is an interaction term of export share and the log of manufacturing (value added) per capita, trade*industry is an interaction term of trade share and the log of industry (value added) per capita, export*industry is an interaction term of export share and the log of industry (value added) per capita. All monetary variables are expressed in constant U.S. 2010 dollars. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.