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Structural transformation in the presence of trade and financial integration in sub–Saharan Africa

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ABSTRACT

This study examines the impact of trade and financial integration on structural transformation relying on data from 28 countries in sub-Saharan Africa (SSA) over the period 1985–2015. Results from our system generalized method of moments (GMM) show that, trade and financial integration significantly spur manufacturing and agricultural sector value additions. However, for the industrial sector, only financial integration robustly influences industrial growth with no effect on the service sector. Further evidence also suggests that trade and financial integration are complementary to each other and do not operate independently to influence structural transformation in SSA.

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1. Introduction

According to UNCTAD (2014), international trade guarantees the movement of goods and services and factors of production across national borders. Through this, trade acts as an important conduit to economic growth. Given this, many countries including those in Africa have instituted policies to foster cross-border trade between and among nations. In the case of Africa, available data from the World Development Indicators of the World Bank suggests that, trade openness as a percentage of GDP consistently increased from 50.51% in 1981–1985 to 67.77% in 2006–2010 before decreasing to 61.37% in 2011–2015. This notwithstanding, average openness stands at 59.97% over the period 1981 to 2015. Indeed, international trade is an important factor for every country's development process. Following this, extant studies have aimed at identifying critical factors influencing trade (see Sare, 2019; Sare et al., 2019a,b; Osei et al., 2019). International trade is predicted to enhance economic growth via technology spill-overs, knowledge transfers and heightening competition, among others (see Ben-David and Loewy, 1998, 2000; 2003; Grossman and Helpman, 1991).

However, international trade costs are substantially large for developing countries such as those in Africa. The reduction of trade and financial barriers has significantly reduced the costs of international transactions (Bos et al., 2011). Abor et al. (2014) argue that firms' access to finance improves their likelihood to trade internationally. According to the authors, such financial access allows firms to pay for the high fixed costs of exporting, international marketing and branding, and as well meet higher quality standards required in the foreign markets. Ekpo and Chuku (2017) assess progress and experience towards financial integration in Africa in addition to the effect of financial integration on economic activity. Their finding shows contemporary patterns toward increasing financial globalization relative to regionalization. Ekpo and Chuku (2017) also find that higher level of financial integration is associated with higher levels of growth and investment, but not necessarily total factor productivity.

Indeed, opening countries to international markets result in enhanced mobility of production factors and facilitates the relocation of production across sectors and geographical spaces. The past few decades have witnessed an accelerated pace of economic integration, reflected by a rapid growth in cross-border commercial trade and capital flows.[1] At the same time, countries

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[1] By economic integration, we refer to trade and financial integration.

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are experiencing some waves in their structural transformation process. According to UNCTAD (2016), structural transformation can be measured using two key measures: (i) employment shares of sectors in total employment and (ii) value added shares of sectors. The gradual and sustained process of reallocation of labour and other productive resources across economic activities is taken to denote structural transformation (UNECA, 2017). Historically, majority of the developed economies today were able to diversify away from agriculture and heavy reliance on natural resources to the production of manufactured goods with value additions resulting in higher overall productivity and incomes. Thus, sustained economic growth and development for most part, is linked to productivity growth across sectors. Thanks to structural transformation. An interesting question that arises is, what are the linkages between economic integration, in particular trade and financial integration, and structural transformation? However, given the above discussion, what we do not know so far is how trade and financial integration influence structural transformation and whether they serve as complements or substitutes in structural transformation.

Hitherto, studies examining the relationship between economic integration and structural transformation in sub-Saharan Africa (SSA) is almost non-existent. The few existing ones have examined the role of structural reforms (Mensah et al., 2016) or aid and aid volatility in structural transformation (Kumi et al., 2017). More tellingly, the majority of the existing studies have typically examined the roles of trade and financial development in isolation. For instance, Mensah et al.,'s (2016) study reveals that country-specific fundamentals such as natural resource and human capital endowments are important determinants of differences in structural transformation within SSA. Similarly, Kumi et al. (2017) find that, trade openness positively and robustly drive economic transformation proxied by value additions in agricultural, service and manufactural sectors.

Although the existing studies acknowledge and control for the potential impact of trade openness on economic transformation, to the best of our knowledge, we are yet to know the effect of trade integration in conjunction with financial integration as joint determinants of structural transformation. To the extent that trade and financial integration are most latent typically described by time trend (Longhi et al., 2003), our paper explicitly considers both forms of integration and allows for interaction of the two. In addition, none of the existing studies has considered the interactive effect of trade and financial integration in examining how they influence structural transformation. In this essence, the present study differs significantly from the earlier studies. Given the failure of earlier research efforts to re-engage economic integration–structural transformation nexus in a way that this study proposes to do, we bridge important gaps in the literature by investigating the impact of trade and financial integration in SSA's structural transformation process in a comprehensive manner. In this endeavour, the objectives of the study are two-folds: (i) to examine the precise impact of trade and financial integration on structural transformation and; (ii) to examine the interactive effect of trade and financial integration on structural transformation in SSA. By pursuing these objectives, our paper departs from earlier studies and contributes to existing literature in three ways. First, we treat trade and financial integration as multilateral rather than bilateral phenomena. In this essence, we are able to show their differential effects on structural transformation. Second, our paper shows whether trade and financial integration act as complements or substitutes in structural transformation process. In other words, beyond the direct effect of economic integration, we unearth the conditional impact of trade (financial) integration on structural transformation given the degree of countries' financial (trade) integration. Third, we control for endogeneity eminent in existing studies by relying on an approach that controls for endogeneity and reverse causality. In this case, our study produces efficient and consistent results which can be used for policy making.

By employing data from 28 countries in SSA over the period spanning 1985 to 2015, findings from our system generalized method of moments (GMM) reveal that, while trade and financial integration significantly spurs manufacturing and agricultural sector value additions, in the case of the industrial sector, only financial integration robustly matters for industrial growth with no apparent effect of economic integration on the service sector. In addition, both trade and financial integration act as moderators to their relationship with structural transformation. Specifically, our evidence suggests that the role of financial (trade) integration in the manufacturing and agricultural sectors is further enhanced by the level of trade (financial) integration. Thus, trade and financial integration act as complements to each other and for most part, do not evolve independently given their effect on structural transformation.

The rest of this paper is organized as follows: Section 2 presents a brief overview of the literature while Section 3 outlines our methodology. In Section 4, we present and discuss the findings from the empirical study while Section 5 concludes with key implications for policy.

2. Brief overview of the literature

Despite efforts to improve economic performance in the past few decades by policy makers in Africa, the continent's trade performance has not been impressive. According to Gupta and Yang (2006), while trade has increased at about three-fourths of the world rate, Africa's performance lags behind compared to other developing countries with primary commodities and fuels accounting for the largest share of exports. Sakyi and Egyir (2017) argue that the extent to which a country gains or losses from trade largely depends on several country–specific factors. Key among these factors are poor design and implementation of national trade policies (UNECA, 2004); weak institutions (Dollar and Kraay, 2003; Matthew and Adegboye, 2014) and trade structure resulting from poor diversification of production and exports (UNCTAD, 2008). Furthermore, UNCTAD (2005) opines that the low level of international trade in developing countries can be attributed to the lack of focus by policymakers on what exactly drives trade.

Iwanow and Kirkpatrick (2009) show that the percentage share of manufacturing exports in total exports in Africa is less than half of the world average and revolves around 30% over the past decades with improved share of 35.4% in 2002. Indeed, the pattern of African exports is strongly influenced by the continent's historical links with the outside world (Geda, 2002). Specifically, more than 80% of exports from Africa are destined to the USA and the European Union accounting for only a small proportion of the total exports. However, Geda (2013) documents that the last few decades have seen a considerable shift from these traditional trading partners to the emerging economies of China, Brazil and India.

Interestingly, despite the common features among economies undergoing structural transformation, evidence suggests marked differences across regions and income in terms of the process and pace of the transformation (Dabla-Norris et al., 2013). For instance, most Western economies (especially Europe), were characterized by transition from agrarian to industrial-based economies, and further transitioned towards service-oriented economies. The transformation in Asia has also been bolstered by a burgeoning manufacturing sector. On the contrary, the transformation in most SSA economies has been marked with not only a decline in the

agriculture sector shares in output and employment, but also with an ailing manufacturing/industrial sector; thus, leapfrogging the middle stage of the transformation ladder – industrialization – towards a service sector dominated economies (IMF, 2012). The African Union has explicitly emphasized structural transformation as the overarching objective of its agenda 2063. Value additions of the real sector are also paramount and worth noting. Blunch and Verner (2006) have reported strong evidence of strong interdependencies in sectoral growth in selected SSA countries. Available data from the World Development Indicators of the World Bank suggests that, between 1980 and 2015, manufacturing sector's value additions is the lowest, averaging 15.80% followed by agricultural value additions which measures at 15.87% of GDP. Value additions in the service sector are the highest averaging 50.39% (see Appendix, Table 1A). Indeed, according to UNCTAD (2015), the service sector is the dominant sector in most African countries on the back of declining agricultural sector as more exploratory mineral resources are discovered on the continent over time.

Undoubtedly, increased structural transformation enhances efficiency and competitiveness with crucial implications for welfare (Eckel, 2008). However, trade and financial integration can both shape the trajectory of economic transformation as it potentially creates asymmetric responses to shocks in addition to lowering its ramification through risk diversification. For instance, financial integration can facilitate industrial sector specialization as firms in each sector such as industry, manufacturing, service and agriculture can borrow from abroad to differentiate their production and at the same time, facilitates better risk sharing opportunities as the borrowing risk is shared across different countries. Thus, an understanding of the nature and relationship between economic integration and structural transformation is crucial for policy makers. This is particularly important for SSA given the relatively lower economic integration and structural transformation.

On the theories regarding structural transformation, Kuznets (1955) argues that structural transformation is often associated with the canonical shift in the economic structure as countries transition from developing to developed economies. Other theoretical writers suggest that, technological change and innovations (Schumpeter, 1934), physical and human capital (Romer, 1990) are key drivers of transition to industrialized economies.

Christiaensen et al. (2006) and Diao et al. (2007) argue that technology, rapid accumulation of human and physical capital, and the roles of market, institutions, and governments are key drivers of transformation. From the empirical perspective, studies such as Timmer et al. (2012), McMillan and Rodrik (2011), and Dabla-Norris et al. (2013) are notable. For instance, by using data from 168 countries for the period spanning 1970–2010 and relying on real value additions in agriculture, manufacturing and services as proxies of structural transformation, Dabla-Norris et al. (2013) evidence suggests that policy and institutional variables such as trade openness, product market reforms and human capital are key drivers of structural transformation across countries. Using both quantile and ordinary least squares regressions, Jha and Afrin (2016) examine the evolution and determinants of the shares of agricultural, manufacturing and service sectors' value additions for 53 African countries over the period 1970–2014. Results from their study show that FDI increases (decreases) the share of manufacturing (services) sectors while greater openness lowers the share of agriculture with no apparent effect on manufacturing and services sectors.

From the foregoing, there is dearth of studies exclusively examining the impact of trade and financial integration on structural transformation in SSA in a holistic manner. More tellingly, how trade and financial integration interact with each other in influencing structural transformation is yet to be explored. Meanwhile, knowledge of these relationships is extremely crucial in guiding policy especially for countries in SSA where structural transformation is nascent. In addition to examining the precise effect of trade and financial integration on structural transformation, this study investigates the interactive roles of trade and financial integration on countries' level of structural transformation in SSA. We do this by first presenting our methodology in the next section.

3. Methodology

3.1. Data and preliminary statistics

We use annual panel data for 28 countries in SSA over the period 1985–2015.[2] The choice of this time period and countries is based on data availability. With regard to economic integration, we concentrate on trade and financial integration. For trade integration, our primary measure is the ratio of imports plus exports to GDP. This measure has been used extensively in the literature (see Yucel, 2009; Kim et al., 2010; Menyah et al., 2014; Zahonogo, 2016) to measure countries' integration with the international markets. For financial integration, following Bos et al. (2011), we construct a stock-based measure following Lane and Milesi–Ferretti (2018) by using the ratio of total foreign assets and total foreign liabilities as a percentage of GDP.

Indeed, trade and financial openness are complex processes that require time to develop. In measuring trade and financial integration, we face the choice between *de facto* measures of trade and financial integration, which quantify a country's actual degree of openness through realized trade and financial flows, or *de jure* measures, which indicate the extent of government restrictions on trade and capital flows. Arguably, *de facto* measures are more suitable for our study than *de jure* measures. First, *de facto* measures capture the actual effects of liberalization policies. A country with very liberal (that is no capital restrictions) does not necessarily engage heavily in international transactions. Likewise, a country with tight capital controls may find them ineffective in the presence of a capital flight (Kose et al., 2006, 2009). Second, *de facto* measures provide variations across countries and over time and hence are suitable for panel-based analysis. Third, although *de jure* measures may be preferred because they are theoretically grounded and reflect the decision to 'open up' more closely than the *de facto* measures, the weakness of the latter is also their strength as they are less susceptible to endogeneity. This paper therefore focuses largely on *de facto* measures of trade and financial integration.

Structural transformation is proxied by value additions in the four sectors which include; (i) agriculture; (ii) services; (iii) manufacturing; and (iv) industrial sectors. Following earlier studies (Ibrahim and Alagidede, 2018; Kumi et al., 2017; Sare et al., 2018), we use their respective value additions as a percentage of GDP to proxy each sector. On this basis, agriculture sector is proxied by its value addition defined as net output of the sector (after adding up all outputs and subtracting intermediate inputs). To the extent that this sector provides raw materials which are either consumed directly or used as input in the manufacturing of other finished goods, the agricultural sector is also taken to represent the primary sector. The service sector value addition includes value addition in

[2] These countries are Algeria, Angola, Botswana, Burkina Faso, Cameroon, Republic of Congo, Côte d'Ivoire, Egypt, Ethiopia, Gabon, Ghana, Kenya, Libya, Malawi, Mali, Morocco, Mozambique, Namibia, Niger, Nigeria, Senegal, South Africa, Sudan, Tanzania, Togo, Tunisia, Uganda and Zambia.

wholesale and retail trade (including hotels and restaurants), transport, professional, and personal services such as education, health care, and real estate services. The manufacturing sector is denoted by its value addition defined as the net output of the sector after adding up all outputs and subtracting intermediate inputs. The industrial sector is measured by the value addition in among others, mining, construction and electricity and comprise of net all output of these less intermediate input. These definitions are obtained from the World Development Indicators of the World Bank. Indeed, both the manufacturing and industrial sectors present the secondary sector because they process the primary products into semi-finished or finished goods. In addition to using the different sectoral value additions, as a robustness test, we also rely on a composite measure of structural transformation constructed based on the principal component analysis. With regard to the control variables, we measure financial development by a more nuanced composite financial development index proposed by Svirydzenka (2016). By extending the work of Čihák et al. (2012), Svirydzenka (2016) developed a broad–based measure of financial development relying on a number of indicators that reflect the depth, accessibility and efficiency of financial markets and institutions. More specifically, Svirydzenka (2016) constructs six sub–indices [namely (i) financial institutions depth, (ii) financial market depth, (iii) financial institutions access, (iv) financial markets access, (v) financial institutions efficiency and (vi) financial markets efficiency] which reflect the level of development of financial institutions and markets. These sub-indices which are aggregated based on weighted linear average of the underlying series are subsequently winsorized and normalized to range between 0 and 1 where countries with financial development index closer to 1 have well–developed financial sectors and those closer to 0 have underdeveloped financial sectors. This measure of financial development has also been used in recent literature (see for instance Ibrahim and Alagidede, 2019; Opoku et al., 2019; Aluko and Ibrahim, 2020).

Following the literature, we also include control of corruption and real GDP per capita (at constant 2005 U.S. dollars) to examine how they influence structural transformation. The control of corruption variable shows how countries are committed to fighting corruption. This measure ranges from 0 (most corrupt) to 6 (least corrupt). Data on financial integration is sourced from Lane and Milesi-Ferretti (2018) while control of corruption is gleaned from International Country Risk Guide (ICRG) of the Political Risk Service (PRS). Data on trade integration, sectoral value additions and real GDP per capita are taken from the World Development Indicators of the World Bank. We present the descriptive statistics in Table 1.

3.2. Empirical strategy

The overarching aim of this study is to empirically examine the impact of trade and financial integration on structural transformation. In this endeavour, we set a baseline model where structural transformation is conditioned on its lag, trade and financial integration together with the control variables. We also examine the conditional effect of trade and financial integration on structural transformation. In other words, we examine the extent to which financial (trade) integration acts as a moderator to the effect of trade (financial) integration on structural transformation. In doing this, we include a multiplicative interactive term of trade and financial integration in the structural transformation equation as shown below:

$$SET_{it} = \varpi_o SET_{it-1} + \varpi_1 TI_{it} + \varpi_2 FI_{it} + \varpi_3 CON_{it} + \psi(TI_{it} \times FI_{it}) + \varepsilon_{it} \quad (1)$$

$$\varepsilon_{it} = \beta_i + \nu_t + \mu_{it}$$

where SET_{it} is the vector of structural transformation; SET_{it-1} is its lag of structural transformation; TI_{it} and FI_{it} denote trade and financial integration respectively; CON_{it} denotes a vector of controls comprising financial development, control of corruption and real GDP per capita; ε_{it} is the idiosyncratic error term; i and t represent country and time indices respectively; β_i is unobserved country–specific fixed effects; ν_t is the time effects while μ_{it} is the error term.

Thus, from equation (1), the coefficient of SET_{it-1} which is given as ϖ_o is used to measure the initial conditions or convergence of structural transformation among the countries. More specifically, if $\varpi_o < 0$, it means there is convergence in structural transformation suggesting countries with lower initial sectoral value additions (% of GDP) will eventually catch-up with countries with higher initial sectoral value additions (% of GDP). However, the vice versa holds if $\varpi_o > 0$ suggesting divergence of structural transformation.

Furthermore, the coefficients of trade and financial integration support structural transformation when their respective coefficients (ϖ_1 and ϖ_2) are positive and significant at conventional levels. From equation (1), the interactive effect is measured by ψ and this is expected to shed light on the effect on structural transformation of simultaneous deepening of trade and financial integration. Here, we allow the relationship of one type of integration with structural transformation to be moderated by the other integration. The marginal effect of trade (financial) integration then becomes the partial derivative of structural transformation with respect to trade (financial) integrations as shown in equations (2) and (3) respectively:

$$\frac{\partial SET_{it}}{\partial TI_{it}} = \varpi_1 + \psi FI_{it} \quad (2)$$

$$\frac{\partial SET_{it}}{\partial FI_{it}} = \varpi_2 + \psi TI_{it} \quad (3)$$

From equations (2) and (3) above, we find whether there are complementarity or substitutability effect given the sign of ψ. For complementarity effect, we expect $\psi > 0$ implying that, the impact of trade (financial) integration on structural transformation to spur given higher degree of financial (trade) integration otherwise there is substitutability effect.

Indeed, from equation (1) above, including the lagged dependent variable suggests a potential correlation between the factors driving structural transformation and the error term since the lagged structural transformation depends on ε_{it-1} which is a function of the country–specific effect (β_i). Thus, our specified equations suffer from Nickell (1981) bias due to the correlation. We therefore estimate the equations relying on the generalized method of moments (GMM) proposed by Arellano and Bond (1991) which eliminates β_i or any related time invariant country–specific variable eminent in the data. According to Baltagi et al. (2009), taking the first difference in the use of GMM has added advantage. First, this procedure removes any endogeneity stemming from the correlation of these β_i and the right–hand side regressors. Second, by differencing, the GMM estimation approach helps to ensure that all the regressors are stationary. In this study, we rely on the system GMM which combines both a regression in its first difference and in levels (Arellano and Bover, 1995; Blundell and Bond, 1998).

Roodman (2009) cautions on the use of the system GMM especially when T is small on the back of higher number of internally determined instruments. To the extent that too many instruments potentially over fit our instrumented variables, for the

Table 1
Descriptive statistics.

	Financial integration [1]	Trade integration [2]	Manufacturing [3]	Industry [4]	Service [5]	Agric [6]	Financial development [7]	Control of corruption [8]	Real GDPPC [9]
Mean	140.095	56.640	11.279	27.317	36.488	22.384	0.138	2.673	1947.755
St. dev.	64.626	29.915	6.997	15.166	20.637	14.453	0.074	0.974	2332.597
CV	0.461	0.528	0.620	0.555	0.566	0.646	0.536	0.364	1.198
Min	34.670	11.087	2.541	6.094	20.744	2.260	0.024	0.000	131.646
Max	499.080	156.861	51.596	83.602	138.981	63.831	0.492	6.000	12,042.6
Skewness	1.150	0.273	1.287	0.917	−0.222	0.344	1.717	0.354	2.427
Kurtosis	5.560	3.397	7.502	3.935	4.558	2.092	7.401	3.151	9.193
Correlations									
[1]	1.000								
[2]	0.245	1.000							
[3]	−0.004	−0.101	1.000						
[4]	0.260	0.404	0.296	1.000					
[5]	0.073	0.037	0.404	0.097	1.000				
[6]	−0.079	−0.405	−0.011	−0.410	0.208	1.000			
[7]	−0.141	0.104	0.301	0.149	0.075	−0.431	1.000		
[8]	−0.059	0.030	−0.032	−0.059	−0.050	−0.175	0.232	1.000	
[9]	−0.039	0.390	−0.063	0.513	−0.004	−0.564	0.356	−0.035	1.000

Notes: St. dev. = Standard deviation; CV = Coefficient of variation; Min = Minimum; Max = Maximum; Real GDPPC = Real GDP per capita.

lagged structural transformation, we use as instruments in the first difference lagged one period for the equations in levels. However, for the equations in first difference, we rely on the first lagged value. With regard to the other regressors which are assumed to be endogenous, we use the second lagged value as instruments. Based on this, we adopt the two–step system GMM. The validity of our instruments is checked using the Sargan test of over–identifying restrictions which examines whether our set of instruments, as a group, are exogenous. In addition, we also test for the absence of serial correlation of the residuals. The next section discusses the findings.

4. Findings and discussions

This section presents and discusses the main findings of the study. In the analysis, the estimations are done for each sector separately. We begin with the model adequacy of the estimations. With regard to the Wald test, the high (low) Wald χ^2 (p–value) shows that our overall models are significant at 1%. Our Sargan test statistics also show that the instruments are valid while we reject the null hypothesis of the presence of first order serial correlation [AR(1)]. However, given the high p–values, we find evidence of second order serial correlation [AR(2)].

From Tables 2–5, we find that the coefficients of the lagged term of sectoral value additions are positive and statistically significant (at 1%) suggesting divergence of sectoral growth. The implication is that, countries with high initial levels of sectoral value additions will continue to have higher sectoral value additions relative to those with low initial structural transformation. The precise values of the coefficients show that such divergence is faster with the industrial sector relative to the agricultural, service and the manufacturing sectors which have similar rate of divergence.

We examine the unconditional effect of trade integration by including it as the only independent variable in the first regression (column 1). As the results show, we find that trade integration is positively and significantly (at 1%) related to sectoral value additions implying that further openness to international trade spurs structural transformation. Thus, de–restricting foreign trade increases sectoral productivity and value additions. This finding is consistent with Kumi et al. (2017) who argue that, in addition to promoting keen competition, trade integration permits the transfer of sound technology and spillover hence permitting sectors to produce at relatively lower costs. Fujita et al. (2001) observe that, higher trade integration spurs creation of new opportunities for exporting industries culminating into expansion of overall aggregate production in those sectors. Indeed, these processes leading to higher sectoral value additions may be motivated by agglomeration forces including forward–backward linkages driven by the new economic markets. Interestingly, in terms of magnitude, the size of the impact is homogenous for all the sectors except the service sector which has a lower coefficient.

We replace trade integration with financial integration in column 2 to examine its impact on sectoral value additions. Our results show that, while the coefficient is positive for all the sectors, the impact is robustly positive for the industrial sector with relatively huge magnitudes. In column 2 for instance, a 10% rise in financial integration increases industrial, manufacturing and agricultural sector value additions by 0.21%, 0.02% and 0.03% respectively. Thus, the positive impact of financial integration on industrial value addition is about 11 and 7 times larger than that of the manufacturing and agricultural sector respectively. This notwithstanding, we observe that, compared to the real sector, the effect of financial integration on the service sector is statistically insignificant. By permitting access to international markets, financial integration opens avenues for a multitude of investment opportunities and financial resources in addition to facilitating risk sharing instruments. In this endeavour, by deepening financial integration, countries are able to spur domestic production across sectors at lower cost relative to financially-closed economies. In column 3 of Tables 2–5, we include both trade and financial integration in the regression equation. We find that, both trade and financial integration are positive and statistically significant at 1% for the industrial and service sectors with trade integration consistently dominating. Further evidence also shows that, even though both forms of integration spurs industrial and service sector growth, the impact is huge for industrial sector relative to the service sector. The size of the tradable goods market, productivity, easy access to credits and trade cost in this sector may result in such an outcome.[3] For the manufacturing and agricultural sectors, financial integration loses significance although it enters with a positive sign. The robust effect of financial openness confirms the earlier theoretical

[3] We are grateful to one of the reviewers for pointing this out.

Table 2
Manufacturing sector, trade and financial integration.

	1	2	3	4	5	6	7
Constant	4.249203	2.591376	4.208912	5.324696	4.254272	5.119719	5.015789
	(0.308068)	(0.084134)	(0.231016)	(0.526999)	(0.663767)	(0.663416)	(1.154753)
Lagged Manu	0.742177***	0.787181***	0.739616***	0.734771***	0.737406***	0.7280167***	0.735805***
	(0.009071)	(0.007225)	(0.010422)	(0.01009)	(0.012168)	(0.016651)	(0.017733)
TI	0.024693***	–	0.025198***	0.044848***	0.045482***	0.048254	0.043797***
	(0.003145)		(0.001828)	(0.006579)	(0.006059)	(0.006355)	(0.008427)
FI	–	0.001742***	0.000495	0.004743	0.004692***	0.005292***	0.005139***
		(0.000386)	(0.000379)	(0.001056)	(0.001016)	(0.001171)	(0.001207)
Indirect/Interactive effect: TI and FI				0.000094***	0.000086***	0.000103***	0.000093***
				(0.000013)	(0.000015)	(0.000022)	(0.000028)
FD					8.815223***	7.287295**	5.629225
					(1.463481)	(3.001371)	(4.737258)
CC						0.167489*	−0.188399
						(0.094944)	(0.158768)
RGDPPC							0.000031
							(0.000089)
Net effects:							
Net effect of TI				0.058017	0.057530	NA	0.056826
Net effect of FI				NA	0.009563	0.011126	0.010407
Diagnostics							
Wald χ^2[p−value]	735.79*** [0.000]	925.56*** [0.000]	650.69*** [0.000]	594.80*** [0.000]	721.59*** [0.000]	973.79*** [0.000]	1114.20*** [0.000]
Sargan test	26.203***	27.516***	24.192***	21.893***	26.218***	21.448***	21.812***
AR(1) [p−value]	−2.074** [0.038]	−2.045** [0.040]	−2.049** [0.040]	−2.068** [0.038]	−2.043** [0.041]	−2.054** [0.039]	−2.059** [0.039]
AR(2) [p−value]	0.103 [0.917]	0.020 [0.983]	0.120 [0.903]	0.036 [0.970]	−0.178 [0.858]	−0.168 [0.865]	−0.132 [0.894]

Notes: *, ** and *** represents significance at 10%, 5% and 1% respectively. Values in parentheses are the standard errors; Manu = Manufacturing value addition; TI = Trade integration; FI = Financial integration; FD = Financial development; CC = Control of corruption; RGDPPC = Real GDP per capita. NA is not available which is used when the coefficient of either trade or financial integration or both is insignificant in a particular regression.

Table 3
Agricultural sector, trade and financial integration.

	1	2	3	4	5	6	7
Constant	7.469959	5.895213	7.489926	10.775977	13.49132	10.336170	12.09597
	(0.490891)	(0.329690)	(0.669151)	(0.600019)	(1.075034)	(1.244339)	(2.502179)
Lagged Agric	0.710843***	0.742629***	0.714049***	0.670472***	0.664657***	0.6984641***	0.640535***
	(0.006983)	(0.009104)	(0.011317)	(0.016752)	(0.027008)	(0.020667)	(0.050213)
TI	0.031845***	–	0.030358***	0.071673***	0.077181***	0.064672***	0.070274***
	(0.002216)		(0.003846)	(0.007355)	(0.010945)	(0.010811)	(0.022882)
FI		0.003031***	0.000579	0.011360***	0.012528***	0.008863***	0.012517**
		(0.000269)	(0.000762)	(0.001459)	(0.002417)	(0.001684)	(0.005129)
Indirect/Interactive effect: TI and FI				0.000185***	0.000205***	0.000160***	0.000185***
				(0.000017)	(0.000033)	(0.000019)	(0.000067)
FD					15.98270***	14.067390*	7.654912
					(3.564498)	(7.453964)	(8.824556)
CC						0.498042***	0.553491***
						(0.072325)	(0.075081)
RGDPPC							−0.000442**
							(0.000186)
Net effects:							
Net effect of TI	–	–	–	0.097591	0.105900	0.087087	0.096192
Net effect of FI	–	–	–	0.021838	0.024139	0.017925	0.022995
Diagnostics							
Wald χ^2[p−value]	124.68*** [0.000]	279.43*** [0.000]	344.91*** [0.000]	383.60*** [0.000]	293.08*** [0.000]	314.16*** [0.000]	518.93*** [0.000]
Sargan test	23.539***	26.751***	24.060***	23.572***	22.462***	24.874***	22.168***
AR(1) [p−value]	−2.844*** [0.004]	−2.895*** [0.003]	−2.845*** [0.004]	−2.853*** [0.004]	−2.853*** [0.004]	−2.838*** [0.004]	−2.923*** [0.003]
AR(2) [p−value]	0.863 [0.387]	0.878 [0.379]	0.862 [0.388]	0.731 [0.464]	0.706 [0.480]	0.817 [0.413]	0.763 [0.444]

Notes: *, ** and *** represent significance at 10%, 5% and 1% respectively. Values in parentheses are the standard errors; Manu = Manufacturing value addition; TI = Trade integration; FI = Financial integration; FD = Financial development; CC = Control of corruption; RGDPPC = Real GDP per capita. NA is not available which is used when the coefficient of either trade or financial integration or both is insignificant in a particular regression.

literature that higher industrial growth could be achieved with financial integration (Saint-Paul, 1992; Devereux and Smith, 1994; Obstfeld, 1994). More recently, Udegbunam (2002) examines the link between openness and stock market integration and finds that greater openness to world trade and international financial markets positively and significantly influences the industrial output growth in Nigeria. Our finding is therefore consistent with Udegbunam (2002).

We examine whether trade and financial integration moderate each other's relationship with structural transformation by

Table 4
Industrial sector, trade and financial integration.

	1	2	3	4	5	6	7
Constant	3.881270	0.146863	2.073268	0.327266	0.844207	1.238545	2.303535
	(0.445401)	(0.301114)	(0.514874)	(0.830734)	(0.997571)	(1.913953)	(1.478226)
Lagged Indus	0.904720***	0.880732***	0.889210***	0.883454***	0.877585***	0.874986***	0.863824***
	(0.010663)	(0.006311)	(0.008401)	(0.010156)	(0.010665)	(0.010616)	(0.009704)
TI	0.028096***	–	0.036205***	0.004468 (0.008447)	0.005086 (0.013971)	0.008301 (0.014262)	0.002880 (0.010201)
	(0.002316)		(0.003841)				
FI		0.021067***	0.019238***	0.027409***	0.025266***	0.024001***	0.026940***
		(0.001144)	(0.002841)	(0.004402)	(0.005432)	(0.006575)	(0.005798)
TI and FI				0.000177***	0.000154***	0.000144**	0.000179***
				(0.000037)	(0.000049)	(0.000055)	(0.000048)
FD					1.527901 (7.194618)	2.509466 (12.27809)	−8.217574
							(7.569765)
CC						−0.080866	−0.245907
						(0.350531)	(0.267219)
RGDPPC							0.000476***
							(0.000149)
Net effects:							
Net effect of TI	–	–	–	NA	NA	NA	NA
Net effect of FI	–	–	–	0.037434	0.033989	0.032157	0.037079
Diagnostics							
Wald χ^2[p −value]	194.91*** [0.000]	199.40*** [0.000]	236.05*** [0.000]	364.96*** [0.000]	420.53*** [0.000]	426.25*** [0.000]	487.35*** [0.000]
Sargan test	23.465***	26.633***	19.678***	19.055***	18.772***	18.369***	19.309***
AR(1) [p−value]	−2.056** [0.039]	−2.053** [0.040]	−2.057** [0.039]	−2.035** [0.041]	−2.017** [0.043]	−2.015** [0.043]	−2.051** [0.040]
AR(2) [p−value]	−0.757 [0.448]	−0.648 [0.516]	−1.091 [0.275]	−0.871 [0.383]	−0.923 [0.356]	−0.932 [0.351]	−0.866 [0.386]

Notes: ** and *** represent significance at 5% and 1% respectively. Values in parentheses are the standard errors; Manu = Manufacturing value addition; TI = Trade integration; FI = Financial integration; FD = Financial development; CC = Control of corruption; RGDPPC = Real GDP per capita. NA is not available which is used when the coefficient of either trade or financial integration or both is insignificant in a particular regression.

including a multiplicative interactive term of trade and financial integration in the sectoral value addition equations (see columns 4 to 7). Beginning with the manufacturing sector, the coefficient of the interactive term is positive and statistically significant at 1%. This finding holds for the agricultural and industrial sectors but not for the service sector. The implication is that, trade integration on one hand, and financial integration on the other hand complement each other in spurring manufacturing sector value addition. Thus, the impact of financial (trade) integration is further enhanced following higher trade (financial) integration. Given the direct

Table 5
Service sector, trade and financial integration.

	1	2	3	4	5	6	7
Constant	8.344152	6.558278	7.696617	8.367035	5.287983	5.564837	6.706741
	(0.883690)	(0.792728)	(0.573311)	(2.105406)	(2.329735)	(1.274886)	(2.806594)
Lagged Serv	0.769552***	0.789565***	0.776400***	0.778889***	0.765893***	0.762783***	0.762089***
	(0.013051)	(0.009275)	(0.004533)	(0.031853)	(0.031833)	(0.021999)	(0.032201)
TI	0.012583***	–	0.012573***	0.005778	0.0109853	0.0116654	0.0165668
	(0.001294)		(0.000398)	(0.030975)	(0.030687)	(0.012110)	(0.032115)
FI		0.0016025	0.001899***	0.003903	0.002206	0.002991	0.001667
		(0.0015002)	(0.000698)	(0.008679)	(0.008603)	(0.002281)	(0.008640)
Indirect/Interactive effect:				0.000033	3.91e−06	1.46e−06	9.17e−06
TI and FI				(0.000126)	(0.000125)	(0.000025)	(0.000127)
FD					27.691720***	22.590010***	26.539270***
					(9.454729)	(6.443915)	(9.785613)
CC						0.230357***	0.338267
						(0.069027)	(0.369630)
RGDPPC							0.000032
							(0.000345)
Net effects:							
Net effect of TI				NA	NA	NA	NA
Net effect of FI				NA	NA	NA	NA
Diagnostics:							
Wald χ^2[p−value]	220.55*** [0.000]	141.08*** [0.000]	434.65*** [0.000]	645.71*** [0.000]	670.40*** [0.000]	624.83*** [0.000]	670.55*** [0.000]
Sargan test	23.216***	23.939***	23.700***	24.017***	31.454***	22.880***	30.473***
AR(1) [p−value]	−2.743*** [0.006]	−2.831*** [0.004]	−2.788*** [0.005]	−2.764*** [0.003]	−2.754** [0.035]	−2.806*** [0.005]	−2.549*** [0.003]
AR(2) [p−value]	−0.761 [0.446]	−0.664 [0.506]	−0.737 [0.461]	−0.623 [0.523]	−0.723 [0.632]	−0.636 [0.524]	−0.645 [0.532]

Notes: *** represents significance at 1% respectively. Values in parentheses are the standard errors; Manu = Manufacturing value addition; TI = Trade integration; FI = Financial integration; FD = Financial development; CC = Control of corruption; RGDPPC = Real GDP per capita. NA is not available which is used when the coefficient of either trade or financial integration or both is insignificant in a particular regression.

effect of trade integration (0.044848) and the coefficient of the interactive term (0.000094), we compute the net effect of trade integration on financial integration for manufacturing sector as 0.058017% when evaluated at the mean of financial integration. At the minimum and maximum levels of financial integration, the marginal effects of trade integration are 0.048107% and 0.091762% respectively. For the agricultural value additions, the net effects of trade and financial integration are 0.097591% and 0.021838% respectively (see column 4, Table 3). Turning to the industrial sector, the net effect of financial integration on the sector following an improved trade integration is 0.037434%. Similarly, when evaluated at the minimum of trade integration, the marginal effect of financial integration is 0.029371%, while it increases to 0.055173% when the level of trade integration reaches its maximum. We do not however, compute the net effect of financial integration for the manufacturing sector and the net effect of trade integration for the industrial sector since their respective direct effects in column 4 are insignificant.

To examine the robustness of the coefficients of trade and financial integration in addition to their moderation effects, we sequentially introduce our control variables. We begin with financial development in column 5. Here, we find a positive and significant effect of financial development on sectoral growth except the industrial sector which is insignificant. This suggests that, well-developed financial markets spur sectoral productivity as it alleviates the credit constraints of producers. The coefficients of the trade and financial integration in addition to the interactive terms remain robust to the inclusion of financial development confirming the earlier evidence of complementarity (see columns 4 and 5). However, while this complementarity fashion partially holds for the industrial sector, in the case of the service sector, it is flatly rejected. Interestingly, we observe that, the net effect of trade integration on the agricultural value addition slightly reduces while that of the agriculture sector improves by 0.008309%. This evidence also holds for the net effect of financial integration on the agricultural sector while the industrial sector records a slight decrease in the net effect of financial integration. In column 6 where we include the control of corruption variable, we find that except for the industrial sector, control of corruption is positively and significantly associated with higher value additions with huge effect in the agricultural sector. Indeed, enforcing regulations that limit opportunities for rent-seeking and making corruption unattractive potentially aid in reallocating resources to productive sectors thereby increasing sectoral growth. Interestingly, in this regression, the effect of trade integration on the manufacturing sector loses significance while financial integration and the moderation effects remain significant with improved coefficients and net effect. While the coefficients of the interactive term and financial integration maintain the direction of effect and level of significance for both the agricultural and industrial sectors, with regard to economic integration, trade integration does not matter for industrial growth. For the service sector, economic integration and the moderation effect are not significant at conventional levels although the coefficients are positive. Indeed, for the agriculture sector, the net effects of trade and financial integration are 0.087087% and 0.017925% respectively suggesting that the complementarity effect of trade integration is exceedingly higher and measures about 4.9 times higher than that of financial integration. Similarly, the net effect of financial integration is 0.032157% with no apparent net effect of trade integration on the industrial sector given the insignificance of the direct effect of trade integration. However, both moderation effects are benign to the service sector. These findings are largely qualitatively similar even when real GDP per capita is controlled for in column 7. The net effects of financial integration on the agricultural and industrial sectors have improved while that of the manufacturing sector slightly decreased. Interestingly, there are differential effects of real GDP per capita on sectoral value additions. For instance, the coefficients are insignificant for the both the manufacturing and service sectors. In the case of the agricultural sector, higher real GDP per capita is associated with lower value additions. This evidence is not far-fetched. By using real GDP per capita to proxy economic growth, as the economy grows, countries become increasingly industrialized with less focus on the primary sector driving down agricultural output. For the industrial sector however, real GDP per capita significantly spurs value additions. Remarkably, the deleterious effect of real GDP per capita on the agricultural sector is virtually the same as its industrial output-enhancing effect although the latter is slightly higher. Consistent with Udegbunam (2002), the level of individual's income in the economy drives demand for industrial output.

In summary, a key finding emanating from the study is that, for most part, trade and financial integration individually spurs sectoral value additions especially with regard to the manufacturing and agricultural sectors with weak impact on the service sector. For the industrial sector, only the impact of financial integration is robust. On the moderation effect, we also observe that, beyond their direct effect, trade and financial integration also act as complements in explaining variations in cross-country sectoral value additions.

4.1. Sensitivity check

We conduct robustness checks based on three sectoral value additions [industry, service and agriculture] by constructing an index of structural transformation using principal component analysis. We do not include the manufacturing sector since by construction, it is already part of the industrial sector. Indeed, the intuition behind the use composite indicator is to pull all the relevant sectors together in examining how trade and financial integration affect structural transformation beyond the individual sectoral effects as illustrated above. Table 6 presents results on the impact of trade and financial integration on the composite structural transformation in addition to their moderation effects. From the Table, we find that, while the coefficient of economic integration is positive, the effect of financial integration is robust relative to that of trade integration. Thus, for most part, higher financial integration matters more for structural transformation. This conclusion holds even after including the control variables. In column 5 for instance, relying on the unconditional effect of economic integration and the conditional effect, the net effect of trade integration on financial integration for structural transformation evaluated at the mean of financial integration is 0.001400% while that of financial integration on trade integration for structural transformation is 0.001115%. The same derivative appraised at the lowest level of financial integration is 0.001338% while its highest level takes a value of 0.001612%. At the end of the continuum, when evaluated at the minimum and maximum levels of trade integration, the marginal effects of financial integration are 0.001094% and 0.001161% respectively. With regard to the control variables, consistent with the earlier evidence, financial development and control of corruption are all positively and significantly (at 1%) related to structural transformation although the impact of financial development is consistently larger. It however loses significance once we control for real GDP per capita which also enters into the regression with a positive sign suggesting that, higher economic growth enhances cross-country structural transformation in SSA. The model diagnostics are also sound and free from over-identifying restrictions and serial correlations.

Table 6
Structural transformation index, trade and financial integration.

	1	2	3	4	5	6	7
Constant	0.120724	0.101589	0.032833	−0.064506	−0.280047	−0.229124	−0.322471
	(0.01585)	(0.020241)	(0.022052)	(0.052516)	(0.090292)	(0.073200)	(0.102185)
Lagged SETI	0.885741***	0.871589***	0.872850***	0.863108***	0.879164***	0.883900***	0.849779***
	(0.003711)	(0.001558)	(0.003034)	(0.009415)	(0.006104)	(0.013419)	(0.011037)
TI	0.001707***	–	0.002269***	0.0006876	0.001317*	0.0011282	0.000402
	(0.000281)		(0.000179)	(0.000644)	(0.000789)	(0.000919)	(0.001004)
FI		0.000740***	0.000796***	0.001179***	0.001089***	0.001163***	0.001676***
		(0.000142)	(0.000128)	(0.000231)	(0.000209)	(0.000237)	(0.000309)
Indirect/Interactive effect: TI and FI				5.89e−06*** (1.80e−06)	4.63e−06** (2.28e−06)	4.81e−06* (2.65e−06)	7.61e−06*** (2.84e−06)
FD					1.721943***	2.471022***	0.8880967
					(0.510366)	(0.355112)	(0.9827003)
CC						0.065027***	0.043644***
						(0.014614)	(0.015093)
RGDPPC							0.000058*** (4.47e−06)
Net effects:							
Net effect of TI				NA	0.001400	NA	NA
Net effect of FI				0.001212	0.001115	0.001191	0.001718
Diagnostics							
Wald χ^2[p−value]	129.46*** [0.000]	123.73*** [0.000]	151.88*** [0.000]	285.36*** [0.000]	191.04*** [0.000]	155.31*** [0.000]	223.22*** [0.000]
Sargan test	20.000***	25.362***	20.633***	22.283***	23.376***	21.125***	20.944***
AR(1) [p−value]	−2.471** [0.013]	−2.419** [0.015]	−2.462** [0.013]	−2.423** [0.015]	−2.451** [0.014]	−2.453** [0.014]	−2.394** [0.016]
AR(2) [p−value]	0.365 [0.714]	0.547 [0.584]	0.391 [0.695]	0.479 [0.637]	0.155 [0.876]	0.078 [0.937]	0.416 [0.677]

Notes: *, ** and *** represents significance at 10%, 5% and 1% respectively. Values in parentheses are the standard errors; Manu = Manufacturing value addition; TI = Trade integration; FI = Financial integration; FD = Financial development; CC = Control of corruption; RGDPPC = Real GDP per capita. NA is not available which is used when the coefficient of either trade or financial integration or both is insignificant in a particular regression.

5. Conclusion and policy implications

Improving structural transformation is one of the major issues discussed at the policy level in many sub-Saharan African (SSA) countries. However, whether countries' level of trade and financial integration matter for structural transformation is yet to be rigorously examined. More importantly, whether trade and financial integration complement each other in influencing structural transformation has not been studied in the literature. Indeed, following calls for countries to integrate with the international markets and how that influence structural transformation need far more nuanced and in-depth analysis particularly in SSA given the region's nascent structural transformation process. Against this backdrop, the present study examines the impact of economic integration – trade and financial integration – on structural transformation and their interactive effect on structural transformation by employing data from 28 countries in SSA over the period spanning 1985–2015. Results from our system generalized method of moments (GMM) show that, trade and financial integration significantly promote manufacturing and agricultural sector value additions. However, only financial integration robustly influence industrial value additions with no apparent effect of trade and financial integration on the service sector. With regard to the interactive effects of trade and financial integration, our study reveals that, both trade and financial integration moderate their relationship with structural transformation. In particular, our evidence suggests that the impact of financial (trade) integration in the manufacturing and agricultural sectors is further enhanced by the level of trade (financial) integration. Thus, trade and financial integration act as complements to each other and for most part, they do not operate independently with regard to their effect on structural transformation. Indeed, growing trade flows among countries potentially generate additional demands for international insurances and risk sharing opportunities thereby broadening the scope for financial integration to have a higher impact on structural transformation. However, while this holds, financial integration improves industrial sector value addition if countries are sufficiently open to international trade.

At the policy level, our evidence highlights the significance of simultaneous trade and financial openness for sectoral growth in SSA. With economic integration in the form of higher trade openness and financial integration, there is free mobility of capital across borders to equalize the price of risk. Indeed, the overall effect is that, economies that engage in both forms of integration can enjoy enhanced efficiency, technology spillover, opportunities for risk diversification and insurance against shocks. However, for the manufacturing and agricultural sector, the overall effect of trade (financial) integration is conditioned on countries' degree of financial (trade) openness. For the industrial sector, only the degree of trade openness matter for the net effect of financial integration. By improving on capital flows across countries and risk diversification strategies, trade openness and financial integration allow for growth–enhancing industrial projects to be adequately financed. In the case of developing economies such as those in SSA, openness to trade and finance permit easy access foreign savings, enhances domestic liquidity and reduces cost of capital all of which are essential conduits for improved structural transformation.

Given the findings of this study, it is possible for trade and financial integration to exhibit some threshold effects where the impact may depend on countries achieving some minimum level of trade and/or financial integration. It would therefore be interesting for future studies to examine the threshold effects of trade and financial integration on structural transformation. It would also be interesting for future research efforts to employ a different measure of structural transformation (such as employment shares of sectors in total employment) in identifying whether the impact of trade and financial integration is contingent on the measure of structural transformation.

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Appendix

Table 1A
Sectoral value additions and international trade in Africa

Year	Agriculture, value added (% of GDP)	Services, etc. value added (% of GDP)	Industry, value added (% of GDP)	Manufacturing, value added (% of GDP)
1980–1987	17.38	46.89	35.89	15.92
1988–1995	17.56	49.43	33.05	16.65
1996–2003	16.46	50.83	32.71	15.10
2004–2011	13.51	50.53	35.86	13.13
2012–2015	12.98	58.12	34.66	15.03
1980–2015	15.87	50.39	34.41	15.18

Source: Authors' computation using World Development Indicators (WDI).

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