

# Financial development, sectoral effects, and international trade in Africa: An application of pooled mean group (PMG) estimation approach

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JEL Classification: F13; G21

## Abstract

Existing studies on financial development–international trade nexus have centred on the implications of finance for trade without investigating the transmission channels of finance on trade. More importantly, how financial sector development mediates the relationship between sectoral value additions and trade remains an unexplored area. This study addresses these gaps in the literature relying on panel data from 46 countries in Africa spanning 1980–2016. Our evidence based on the pooled mean group estimations suggest that, for both the long and short run, although the impact of sectoral value additions is contingent on the proxy of trade, financial sector development does not have a significant effect on international trade. This holds irrespective of the measure of finance and international trade. However, after controlling for the transmission channels, a coexistence of a negative long run substitutionarity between finance and trade is found, and this is invariant of the indicator of finance and trade. On the mediation role, we find that higher sectoral value additions dampen the deleterious effect of finance on trade with huge impact emanating from the service sector. We discuss some key implications for policy.

## KEYWORDS

exports, financial development, sectoral value additions, trade, trade openness

## 1 | INTRODUCTION

Undoubtedly, the importance of domestic financial development cannot be overemphasized. This importance is largely evident on its impact on economic growth (Alexiou, Vogiazas, & Nellis, 2018; Ibrahim & Alagidede, 2016; Ibrahim & Alagidede, 2017a; Swamy & Dharani, 2018), economic volatility (Dabla-Norris & Srivisal, 2013; Ibrahim & Alagidede, 2017b), and sectoral value additions (Kumi, Ibrahim, & Yeboah, 2017). More recently, Gyeke-Dako, Agbloyor, Turkson, and Baffour (2018) observe that financial development lowers the

social costs of financial intermediation. Indeed, evidence abound of the significant relationship between countries' level of financial development and international trade flows (see Beck, 2002; Hur, Raj, & Riyanto, 2006; Kim, 2011; Kim, Lin, & Suen, 2010; Svaleryd & Vlachos, 2005). However, the current studies on financial development–international trade nexus have left much lacuna in the literature necessitating further research efforts in at least two areas: (a) re-engaging the debate where trade flows, sectoral value additions, and domestic financial development are lower and (b) investigating the mediating role of finance in influencing sectoral growth for

improved international trade flows. This study significantly contributes to the existing finance–trade literature in several avenues. First, although discussions on the impact of finance on trade have received much attention, sectoral contributions to trade flows have been under studied. We re-engage the literature by empirically examining how domestic levels of financial development and sectoral value additions influence countries' level of international trade. Second, this study also examines the mediating role of finance in sectoral value additions–trade nexus. Through this, we are able to show whether sectoral value additions magnify or dampen the impact of finance on trade. Third, by explicitly distinguishing between the long and short run effects, we are able to empirically show which sector significantly contributes to trade given the level of domestic financial sector at different time periods. To the best of our knowledge, this is the first study in Africa to investigate such linkages. This study, therefore, makes a case for introducing such crucial linkages into the finance–trade literature that has been hitherto neglected.

Indeed, the UNCTAD (2014) report argues that international trade facilitates the cross-border flow of goods and services and production factors with the conclusion that trade spurs economic growth. In the case of Africa, although the continent's shambolic growth performance is often attributed to several factors, barriers to international trade and financial sector underdevelopment are the main factors perpetuating the low economic growth (see, for instance, Beck, Maimbo, Faye, & Triki, 2011; Ndulu, Chakraborti, Lijane, Ramachandran, & Wolgin, 2007). Even for the most part, rigorous financial reforms in Africa and attempts at international market integration have not yielded the desired economic performance.<sup>1</sup> Realizing the importance of domestic financial development for trade, developing countries initiated policies to increase their levels of financial development (Demir & Dahi, 2011). UNCTAD (2005, 2007), however, suggests that limited level of financial systems exacerbates the transaction costs as a trade barrier if none of the trading partners are able to offer the trade financing. Sadly, despite efforts at improving the continent's financial sector development, the effect of this on international trade has not yet been reaped. Meanwhile, a growing number of studies have confirmed the trade-enhancing effect of finance (see Beck, 2002; Kim, Lin, & Suen, 2012).

By augmenting the Heckscher–Ohlin's model of factor endowment, Kletzer and Bardhan (1987) theoretically reveal that, relative to those with under-developed financial sector, economies with higher domestic financial system benefit from easier access to external financing, hence specializing in industries that require more external source of finance. This view is further supported by

Beck (2002) and Svaleryd and Vlachos (2005) where a positive link between financial development and the specialization pattern of international trade and comparative advantage is established. Evidence abound that industries that are more dependent on external finance grow faster in countries with better developed financial systems. Consequently, those economies with under-developed financial sector have lower export share in industries with higher external finance dependence (Demirguc-Kunt & Maksimovic, 1998; Rajan & Zingales, 1998). Thus, financial development regulates the degree of credit availability for enhanced trade.

Apart from financial development, cross-border trade has become an essential tool driving economic growth and development. Indeed, several studies (see, for instance, Rajan & Zingales, 2003; Braun & Raddatz, 2008; Do & Levchenko, 2007) have argued that international trade is strongly related to countries' domestic level of financial sector development. The reasoning is that, if higher international trade spurs economies' exposure to the vagaries of the world market, then well-developed domestic financial sector acts as a powerful insurance instrument that dampens barriers to trade. Theoretically, Feeney and Hillman (2004) establish how capital market incompleteness affects trade. They argue that there is no inducement for special interest groups to lobby for protection if risks can be fully diversified. Therefore, improvement in financial sector in a way that eliminates asymmetric information and rigidities could potentially lead to higher trade flows between and among countries.

The contribution of Rajan and Zingales (2003) to the literature is situated within a framework where countries openness to international trade improves domestic financial development by waning the influence of economic and political incumbencies that inhibit financial liberalization. Kim et al. (2010) investigate the long and short run relationships between financial development and international trade using a panel data for 87 OECD and non-OECD countries over 1960–2005. The authors find a positive (negative) long (short) run nexus between trade and finance, suggesting that, in the long run, finance and trade are complements. However, after bifurcating the sample into OECD and non-OECD countries, these findings only hold for the non-OECD countries where majority of the African countries fall. For the OECD countries, financial development has insignificant effects on trade. Thus, the overall effect of finance on international trade is country-specific. Kim et al. (2012) find a positive impact of financial development on trade, whereas the effect of trade on domestic financial development is unclear for a sample of 63 countries over the period 1960–2007.

Indeed, from the foregoing, empirical literature on finance–trade nexus has centred on the impact of finance

(trade) on aggregate trade (finance) without examining how domestic financial development at the sectoral level play out with trade especially at the developing countries perspective. More tellingly, beyond these traditional studies involving the unconditional effect of finance, what are the indirect effects of finance at the sectoral level? Studies on the transmission channels of finance are scanty although few are notable.<sup>2</sup>

In the field of international trade, Becker and Greenberg (2004) explore the linkage between exports and financial development. They opine that exporting firms are faced with significant upfront fixed cost in the product design, production, marketing, and transportation, and this is influenced by the level of financial development. Empirically testing their hypothesis reveals that the marginal impact of finance on exports is higher for industries and country pairs facing heavy upfront investment largely driven by either product features or economic distance between the importer and exporter. Closely linked to this work is Hur et al. (2006) where the authors show that domestic financial development and asset tangibility are essential drivers of international trade structure of manufacturing sectors across a wide group of economies. Compared with Becker and Greenberg (2004), the thrust of Hur et al.'s (2006) study is based on the premise that there exists substitutability between the level of financial development and asset tangibility. Using industry-level data on firms' dependence on external finance and firms' asset tangibility for 27 industries of 42 countries, Hur et al. (2006) find that countries with relatively well-developed domestic financial sectors have a higher export share, trade balance, and a comparative advantage in industries characterized by more intangible assets, whereas countries with a poorer financial development have a comparative advantage in industries characterized by tangible assets.

Following Beck (2002), Susanto, Rosson, and Costa (2011) rely on two sectors (manufacturing and agriculture) with different levels of economies of scale in analysing how these sectors respond to changes in financial development. On the whole, their findings show that well-developed financial sector positively and significantly affect bilateral trade flows with the manufacturing sector enjoying a larger effect relative to the agricultural sector. However, after disaggregating the data along regional lines, finance-sectoral effects differ. For the most part, developing countries including those in SSA reap greater benefits of financial development on exports in both sectors than the developed economies.

Sare, Aboagye, Mensah, and Bokpin (2018) examine the impact of financial development on international trade in 46 African countries over the period 1980–2015. Evidence from their study shows differential effects of finance on trade. For instance, whereas private credit

inhibits trade, domestic credit significantly spurs international trade flows. Further findings from their study reveal a U-shaped relationship between private credit and trade measures. This suggests that financial sector development may be detrimental (helpful) to trade for economies with low (high) level of private credit.

Notwithstanding these studies, what we do not know is how financial sector development impacts on trade through the various sectors of the economy, namely, agriculture, manufacturing, industrial, and service sectors. Indeed, firms to a large extent in the various sectors of African countries pursuing the production and exportation of goods and services face several challenges, and the attention of this article is to address one of those key bottlenecks that is the level of domestic financial sector development. Whereas Ibrahim and Alagidede (2016) argue that growth elasticity to variations in either size of the industrial or financial sector is (lower) higher under (un)balanced sectoral growth, like Beck (2002), Hur et al. (2006), Susanto et al. (2011), and Kim et al. (2012), these studies failed to empirically examine whether sectoral value additions interacted with domestic financial sector to significantly promote or inhibit trade. Thus, results produced by earlier literature are not instructive. To the extent that improving international trade by boosting sectoral value additions and financial sector is one of the major preoccupations of many countries in Africa, trade-sectoral growth-finance nexus needs far more nuanced and in-depth analysis. Indeed, existing studies have centred on the implications of finance for trade without investigating the transmission channels of finance on trade. More importantly, how financial development mediates the relationship between sectoral growth and trade remains an unexplored area in Africa.

Using recent data, this study aims to uncover the precise sectoral transmission channels through which domestic financial sector impacts on trade in Africa. From a policy perspective, efforts targeted at reforming domestic financial sector may have important implications for each sector and ultimately trade if the level of finance is a critical driver of economies' comparative advantage. We therefore address these gaps in the literature relying on panel data from 46 countries in Africa spanning 1980–2016. Our evidence suggests that, for both the long and short run, although the impact of sectoral value additions is contingent on the proxy of trade, financial sector development does not have a significant effect on international trade. This holds irrespective of the measure of finance and international trade. However, after controlling for the transmission channels, a coexistence of a negative long run substitutionarity between finance and trade is found and this is invariant of the indicator of finance and trade. On the mediation role, we find that

higher sectoral value additions dampen the deleterious effect of finance on trade with huge impact emanating from the service sector.

The rest of the paper is organized as follows: The next section outlines the methodology, whereas Section 5 presents the findings and discussions with Section 4 providing some key policy implications and recommendations. Section 5 presents the concluding remarks.

## 2 | METHODOLOGY

### 2.1 | Data and preliminary findings

We construct a panel dataset of 46 countries over the period spanning 1980–2016.<sup>3</sup> Selection of these countries is entirely based on availability of data for our variables for longer time span. Annual data for the variables were sourced from the World Development Indicators of the World Bank. Our first trade variable is proxied by trade openness that is measured by the sum of exports and imports of goods and services as a share of GDP. This measure has been used extensively in the literature (see Kim et al., 2010; Menyah, Nazlioglu, & Wolde-Rufael, 2014; Yucel, 2009; Zahonogo, 2016) to measure countries' integration with the international markets. For robustness analysis, we also measure trade by the volume of exports of goods and services that represent the value of all goods and other market services provided to the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, licence fees, and other services, such as communication, construction, financial, information, business, personal, and government services. This measure of trade has also been used in earlier studies (see, for instance, Fosu, 1990; Zahonogo, 2016; Sakyi & Egyir, 2017) to proxy international trade.

With regard to financial sector development, we measure financial development by private sector credit as percentage of GDP, which has been extensively used in the finance literature (Ibrahim & Alagidede, 2016; Kim et al., 2010; Levine, Loayza, & Beck, 2000). This is a qualitatively based indicator that measures credit advanced to the private sector thus capturing the utilization and allocation of funds to more efficient and productive activities. Apart from private credit, the study also used domestic credit provided by the financial sector to proxy financial development. This measure refers to financial resources provided to the private sector by financial corporations, such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable, that establish a claim for repayment.

We include other standard controls and sectoral value additions for the purpose of checking the transmission

paths or channels that finance can possibly affect international trade through those channels. As a result, we chose four areas that include agriculture, service, manufacturing, and industry; these were chosen following the lacuna identified in the standard literature. All the sectoral value additions are measured using the definition provided by World Development Indicators. On this basis, agriculture value added is defined as net output of the sector after adding up all outputs and subtracting intermediate inputs. Service value added in wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services such as education, health care, and real estate services while manufacturing value added is the net output of the sector after adding up all outputs and subtracting intermediate inputs, and industry value added in mining, manufacturing, construction, electricity, water, and gas and compose of net output of these less intermediate output. We use real GDP per capita (constant 2005 U.S. dollars) to measure economic growth. Table 1 below presents results on the descriptive statistics of our variables and are categorized into four thematic areas that include financial development, trade, sectoral value additions, and economic growth.

Table 1 shows the summary statistics of the variables averaged over the period 1980–2016. With regard to financial development, the mean private credit is 19.21% relative to domestic credit that measures at 31.99% of GDP. Thus, domestic credit is higher than private credit and has a standard deviation of 63.59. We notice that our proxies of international trade that are exports and trade openness record average values of 30.92% and 72.68%, respectively, with standard deviations of 18.93 and 46.05. Given the values of trade openness and exports, it is vivid that the continent is relatively more integrated with international market. Average real GDP per capita is \$1,847.28 with maximum and minimum values of \$20,333.94 and \$115.79, respectively. This finding supports the low income nature of the countries under consideration with high standard deviation suggesting high volatility. The four sectoral value additions agriculture, service, manufacturing, and industry recorded averages of 27.89%, 44.43%, 11.63%, and 27.79%, respectively. The high sectoral value addition is inconsistent with the popular view that countries in Africa are largely agrarian. Our finding here suggests the service sector as the dominant sector in the economy. This evidence is in sync with UNCTAD (2015). This does not show a promising prospect for a continent that wants to industrialize. It is also in sync with most studies, which indicate that African economies have gradually replaced their manufacturing potentials with services. To permit comparison across the variables, we compute the

**TABLE 1** Descriptive statistics

	Financial development		Trade		Sectoral value additions				Economic growth Real GDP per capita
	Private credit	Domestic credit	Exports	Trade openness	Agric	Service	Manufacturing	Industry	
Mean	19.21	31.99	30.92	72.68	27.89	44.43	11.63	27.79	1,847.28
St. dev.	20.82	63.59	18.93	46.05	16.56	11.29	6.87	14.19	2,593.02
CV	1.08	1.99	0.61	0.63	0.59	0.25	0.59	0.51	1.40
Minimum	0.16	-114.69	2.52	6.32	0.89	4.14	0.23	1.88	115.79
Maximum	160.12	2,066.18	124.39	531.74	93.99	74.77	39.46	84.28	20,333.94
Skewness	3.37	22.28	1.27	3.62	0.40	-0.15	1.33	1.18	3.10
Kurtosis	17.75	703.07	5.17	25.96	2.59	2.86	5.28	4.59	14.71
Percentiles									
25th	7.70	11.93	17.48	45.89	13.68	36.65	6.59	17.20	468.69
50th	13.68	21.34	25.87	60.36	27.27	45.05	10.10	25.17	861.25
75th	22.57	39.33	41.18	90.61	39.39	52.16	14.98	33.57	1,976.71
Obs.	1,490	1,494	1,517	1,517	1,370	1,362	1,252	1,360	1,575

Note. CV = coefficient of variation; Obs.: number of observations; St. dev.: standard deviation.

coefficient of variation (CV) as the ratio of standard deviation to mean where higher (lower) CV implies higher (lower) variability. Indeed, despite being the largest sector, the service sector is the least volatile relative to the other sectors with the agricultural sector being the most volatile sector. Anecdotally, the higher volatility in the agricultural sector is expected given the intrinsic nature of the sector where output is heavily depended on weather that is unpredictable compounding to their spatial challenges such as pest and diseases.

## 2.2 | Empirical strategy

### 2.2.1 | Panel unit roots and cointegration tests

In this study, our main aim is to examine the short and long run direct impact of financial development on international trade as well as the transmission channels through which finance affects trade. However, determining the dynamic effects in finance–trade nexus entails investigating for the existence or otherwise of a cointegration relationship. Analysing the stationarity properties of the series is the first step in determining the cointegration level that requires examining the stationarity properties of the series using panel unit root tests. We investigate the unit root property of our variables using five difference panel unit root tests: (a) Levine et al. (LLC; 2002), (b) Breitung's (2000)  $t$  statistic, (c) Hadri (2000)  $Z$  statistic, (d) augmented Dickey–Fuller (ADF)–Fisher test, and (e) Harris and Tzavalis's (1999)  $Z$  statistic. We include

a deterministic time trend in all the tests. The choice for these tests is based on their individual unique construct where the flaws of one approach are potentially addressed by an added advantage of the other test(s). For instance, the LLC, Breitung, Harris–Tzavalis, and Hadri's tests are estimated based on the assumption of a common panel unit root with identical autocorrelation coefficients. On the other hand, the ADF–Fisher test allows the autocorrelation coefficients of the variables to differ across the cross sections and at the same time assuming individual unit root process. More so, although the Hadri panel unit root test permits cross-sectional dependence, LLC, Breitung, Harris–Tzavalis, and the ADF–Fisher tests eliminate the potential problems regarding cross-sectional dependence by subtracting the cross-sectional means.<sup>4</sup>

These panel unit root tests are used to determine the stationarity property of the series. If our variables are found to be stationary, we proceed to investigate for the existence of cointegration or long run relationship among the variables. On this score, the study relies on two cointegration tests: Westerlund (2007) and Pedroni (1999). With regard to the Westerlund (2007), it is based on structural rather than residual dynamics and allows for a large degree of heterogeneity. Westerlund (2007) developed four different tests of cointegration: two of these tests are panel statistics while the remaining two are group mean statistics. For each of these tests, once the null hypothesis is rejected at conventional significance levels, we find evidence of cointegration suggesting the existence of long run relationship for the panel; otherwise, there is no cointegration.

In addition to the Westerlund (2007), we also apply the Pedroni (1999) cointegration test that suggests seven alternative test statistics in examining the presence of long run relationship in a heterogeneous panel. These tests are categorized into “between dimension” and “within dimension” test statistics. Whereas the former are called the group mean panel cointegration test statistics, the latter is taken as the panel cointegration statistics. Pedroni (1999) developed these test statistics by extending the two-step residual-based cointegration approach of Engle and Granger (1987). Indeed, all the test statistics of Pedroni (1999) investigates the null hypothesis of no cointegration against the existence of cointegration for the alternative hypothesis.

### 2.2.2 | Estimating the long and short run relationships among finance, trade, and sectoral growth

Beyond the direct effect of finance and sectoral growth, the aim of this paper is also to examine how financial development plays out in influencing international trade via sectoral value additions using a panel dataset. We depart from the use of traditional approaches (pooled ordinary least squares [POLS] and fixed and random effects). For instance, Asteriou and Hall (2011) and Gujarati and Porter (2009) argue that the POLS imposes homogenous intercept and slope parameters that obscure heterogeneity among countries and thus potentially allowing the error term to correlate with some regressors. On the other hand, the fixed effects pose significant bias (Baltagi, 2008) especially when some regressors are endogenous and correlated with the error terms (Campos & Kinoshita, 2008). The random effects models are time invariant implying that the error term at any period potentially exhibits strict exogeneity and does not correlate with the past, present, and future series (Arellano, 2003). This stringent assumption is however less practicable in real life and does not distinguish between short and long run effects (Loayza & Ranciere, 2006). Given these problems, we employ Pesaran, Shin, and Smith (1999) dynamic panel that addresses the challenges of the traditional approaches. Pesaran et al. (1999) suggest the use of mean group (MG) that averages the different country estimates or the pooled mean group (PMG) that pools the long run parameters.

Although the long run estimates of the MG are consistent, they are inefficient particularly when homogeneity is eminent. Furthermore, relative to the MG, the PMG also yields parameter estimates that are insensitive to data outliers. This study thus adopts the PMG estimation approach. According to Pesaran et al. (1999), the PMG allows the intercept, the error variances, and the short

run estimators to vary significantly while confining the equality of the long run coefficients among the countries. In other words, the PMG forces homogeneity in the long run parameters and at the same time allowing heterogeneity among the short run estimates. Thus, relative to the traditional approaches, the PMG has important advantages. First, apart from being independently distributed among the regressors, the error terms are not serially correlated. Second, the PMG produces consistent and efficient long run estimates in the face of parameter homogeneity. Third, it maintains constant long run parameters across all the cross-sectional units. Fourth, unlike the dynamic panel generalized method of moments (GMM), which is largely not suitable under long  $T$ , the PMG is particularly apt when dealing with dynamic heterogeneous panel involving large  $N = 46$  and long  $T = 37$ . Indeed, the GMM estimation approach controls for the endogeneity and produces relatively consistent estimates. However, this approach does not also reveal both the short and long run estimates of our variables of interest in addition to its failure to show the error correction mechanism at which the system clears following a shock.

To examine the impact of finance on international trade in addition to standard controls, we set up a panel data specification of the following:

$$TRA_{it} = \partial_i + \tau FD_{it} + \varpi EG_{it} + \varphi_1 AGR_{it} + \varphi_2 SER_{it} + \varphi_3 MAN_{it} + \varphi_4 IND_{it} + \varepsilon_{it} \quad (1)$$

$$i = 1, 2, \dots, N = 46; t = 1, 2, \dots, T = 37.$$

$TRA_{it}$  is the vector of international trade;  $FD_{it}$  is vector of financial development indicators;  $EG_{it}$  is economic growth proxied by real GDP per capita;  $AGR_{it}$ ,  $SER_{it}$ ,  $MAN_{it}$ , and  $IND_{it}$  respectively represents sectoral value additions in the agricultural, service, manufacturing, and industrial sectors;  $\partial_i$  is the fixed country-specific effect; and  $i$  and  $t$  are country and time indices, respectively.

It is imperative to note that, from Equation (1) above,  $\tau$ ,  $\varpi$ , and  $\varphi$  respectively measure the direct impact of finance, economic growth, and sectoral value additions on trade. To examine the transmission channels of finance–trade nexus, we introduce an interactive term of  $FD_{it}$  and each of the sectoral value addition into the trade equation in (1) above. Specifically, we formulate the following where the indirect effect of finance is measured by  $\psi$ :

$$TR_{it} = \partial_i + \xi FD_{it} + \vartheta EG_{it} + \gamma_1 AGR_{it} + \gamma_2 SER_{it} + \gamma_3 MAN_{it} + \gamma_4 IND_{it} + \psi(FD_{it} \times SV_{it}) + \varepsilon_{it} \quad (2)$$

Whereas the other variables remain as previously defined,  $SV$  represents the indicators of the sectoral value

additions. We formulate Equation (2) above in an autoregressive distributed lag (ARDL) framework to permit our dependent variable, trade, to adjust to variations in finance and other changes in the independent variables. Specifically, we estimate the PMG of the Pesaran et al. (1999) by fitting error correction model in an ARDL ( $p, q$ ) technique specified as

$$\begin{aligned} \Delta(\text{TR}_i)_t = & \delta_i \left[ (\text{TR}_i)_{t-1} - \{ \theta_{0,i} + \theta_{1,i}(\text{Q}_i)_{t-1} \} \right] \\ & + \sum_{j=1}^{p-1} \alpha_{i,j} \Delta(\text{TR}_i)_{t-j} + \sum_{j=0}^{q-1} \gamma_{i,j} \Delta(\text{Q}_i)_{t-j} \\ & + \varepsilon_{i,t} \end{aligned} \quad (3)$$

$$i = 1, 2, \dots, N = 46; t = 1, 2, \dots, T = 37,$$

where  $TR$  is a vector of international trade;  $Q$  is a vector of regressors including the multiplicative interactive term of  $FD$  and  $SV$ ;  $\alpha$  and  $\gamma$  are the short run coefficients related to international trade and its drivers;  $\theta$  are long run coefficients;  $\delta$  is the speed of adjustment to long run equilibrium; and  $\varepsilon$  represents the time-varying disturbance.

Indeed, from the ARDL framework above, provided that there is a unique presence of a long run relationship among variables involved based on the cointegration tests, the PMG estimations, with the lag orders  $p$  and  $q$  suitably chosen, produces consistent estimates whether or not our series are integrated of order zero [ $I(0)$ ] or integrated of order one [ $I(1)$ ]. Meanwhile, Loayza and Ranciere (2006) opine that, when the main interest is on the long run estimates, the lag structure of the ARDL should be selected using appropriate information criteria on a country-by-country basis. Conversely, when there is also an attention in exploring the short run effects like in this study, it is suggested that a common lag structure be enforced for all countries. Thus, for easier exposition, in this study, we set both  $p$  and  $q$  at 1. We present our findings and discussions in the next section.

### 3 | FINDINGS AND DISCUSSIONS

#### 3.1 | Panel unit root tests

We discuss our empirical findings by first analysing the panel unit root results aimed at determining the stationary property of our series. We determine the lag structure relying on the Bayesian information criterion where a maximum lag of 3 is selected for the Breitung, Fisher, and LLC tests. For the LLC test, we estimate the long run variance with an automatic maximum lag length of 10 determined by the Bartlett kernel approach. Table 2 below reports results on the panel unit root for the five tests.

Results from the LLC test provide strong evidence that both indicators of international trade—exports and trade openness—are stationary as we flatly reject the null hypotheses at 1% level. The LLC test also rejected the existence of panel unit root for all the sectors except the service sector. It however fails to reject the non-stationary property of real GDP per capita. Consistent with the LLC test, the Breitung test indicates that none of the proxies of finance are stationary and so are real GDP, the service, manufacturing, and industrial value additions. Only the unit root property of exports, trade openness, and agricultural value additions are rejected at conventional levels. Interestingly, for the Hadri test that has the null hypothesis that all the panels are stationary is rejected at 1% level for all the series thus providing strong support that all the variables have unit roots. However, results from the Harris–Tzavalis tests reveal that all the series are stationary except real GDP, service, and manufacturing value additions. For the ADF–Fisher test, only real GDP per capita, manufacturing value additions, and private credit have unit roots given the high  $p$  values, hence our failure to reject the null hypothesis. From Table 2, we notice mixed findings on the stationarity property of our series as dictated by the different panel unit root tests. For those non-stationary panel, shocks to those series largely have permanent effect with low possibility of mean reverting relative to the stationary series. Meanwhile, estimating OLS on non-stationary panel produces spurious and biased results except when the series are cointegrated under strict exogeneity (Pesaran et al., 1999). However, as argued earlier, our estimation approach—the ARDL—is valid whether the series are stationary or non-stationary as it does not require the regressors to be strictly exogenous.

#### 3.2 | Panel cointegration tests

Beyond the panel unit root tests, we conduct cointegration tests to examine the long run relationship of our variables relying on two cointegration tests: Westerlund and Pedroni. Whereas the Westerlund test investigates the significance of the adjustment coefficient in an error correction model structure, the Pedroni test is estimated relying on the residuals of the long run static regression where an appropriate lag length is selected based on the Bayesian information criterion. Here, we specify a maximum lag length of 10 and conducted the estimations under Bartlett kernel where the bandwidth is selected by Newey–West algorithm. In this study, both the Pedroni and Westerlund cointegration tests are done with a deterministic time trend with a null hypothesis of no cointegration against the alternative hypothesis of cointegration. We conclude on the existence of a stable

**TABLE 2**  
Panel unit root tests

Series	LLC-stat $H_0$ : Panels contain unit root	Breitung $t$ stat $H_0$ : Panels contain unit root	Hadri $Z$ stat $H_0$ : All panels are stationary	ADF-Fisher $H_0$ : All panels contain unit root	Harris-Tzavalis $Z$ stat $H_0$ : Panels contain unit root
Domestic credit	0.092 [0.537]	1.721 [0.957]	21.510*** [0.000]	2.964*** [0.002]	0.134*** [0.000]
Private credit	-0.171 [0.432]	3.485 [0.100]	61.158*** [0.000]	-2.441 [0.993]	0.734*** [0.000]
Exports	-2.646*** [0.004]	-1.806** [0.036]	51.957*** [0.000]	4.265*** [0.000]	0.741*** [0.001]
Trade openness	-3.945*** [0.000]	-1.785** [0.037]	52.034*** [0.000]	4.807*** [0.000]	0.732*** [0.000]
Agriculture	-3.392*** [0.000]	-1.393* [0.082]	61.753*** [0.000]	14.388*** [0.000]	0.700*** [0.000]
Service	-0.462 [0.322]	-0.188 [0.426]	62.713*** [0.000]	6.374*** [0.000]	0.768** [0.033]
Manufacturing	-1.367* [0.086]	0.138 [0.555]	59.864*** [0.000]	0.436 [0.332]	0.802 [0.487]
Industry	-2.171** [0.015]	-0.173 [0.431]	56.217*** [0.000]	2.023** [0.022]	0.785 [0.173]
Real GDP per capita	-1.197 [0.116]	7.565 [1.000]	55.497*** [0.000]	-2.410 [0.992]	0.917 [1.000]

\*Significance at 10%.

\*\*Significance at 5%.

\*\*\*Significance at 1%. Values in [] are the  $p$  values.

long run equilibrium when we reject the null hypothesis; otherwise, there is no long run relationship among our variables concerned. Table 3 presents findings on the cointegration tests.

With regard to the Westerlund tests and with exports as the dependent variable, all the four test statistics of the Westerlund tests show strong evidence of cointegration between trade and the independent variables. All the test statistics reject the null hypothesis at 1% except  $G_a$ , which is significant at 5% level. For trade openness as the dependent variable, we observe the existence of cointegration where the null hypothesis of no cointegration is clearly rejected at 1% for all the tests except  $G_a$ , which has a  $p$  value of 0.162. The rather high

$p$  value does not show the evidence of cointegration as we fail to reject the null hypothesis.

Findings from Pedroni tests are consistent with Westerlund as we find evidence of cointegration for both exports and trade openness. All the four Pedroni test statistics flatly reject the null hypothesis of no cointegration in support of the existent of a common long run relationship between international trade and the independent variables. On the whole, results from the two cointegration tests largely reveal evidence of cointegration suggesting that exports, on one hand, and trade openness, on the other hand, share common stochastic trends among the variables towards a long run path. Given this evidence, we estimate the short

**TABLE 3** Panel cointegration tests

Approach	Test statistics	Exports		Trade openness	
		$z$ value	$p$ value	$z$ value	$p$ value
Westerlund	$G_t$	-4.292***	0.000	-4.607***	0.000
	$G_a$	-1.821**	0.034	-0.987	0.162
	$P_t$	-3.463***	0.000	-3.777***	0.000
	$P_a$	-3.009***	0.001	-2.961***	0.002
Pedroni	Panel- $v$	2.220**	0.025	1.949*	0.051
	Panel- $\rho$	-3.523***	0.000	-3.136***	0.000
	Panel- $t$	-3.752***	0.000	-3.442***	0.000
	Panel-ADF	-3.107***	0.000	-2.305***	0.002

Note. Pedroni's panel statistics and that of Westerlund's are weighted. We do not bootstrap the critical values of the Westerlund.

\*Significance at 10%.

\*\*Significance at 5%.

\*\*\*Significance at 1%.

and long run relationships of our series in order to examine how financial development, real GDP per capita and sectoral value additions influence international trade. We do this relying on the PMG where the findings are discussed in the next section.

### 3.3 | Estimations of long and short run relationships among finance, sectoral value additions, and trade

Having found evidence of cointegration, in this section, we present findings on the short and long run relationships between international trade and the independent variables. This is done separately for the two proxies of international trade (exports and trade openness) and financial sector development (private and domestic credit). Our estimation approach is the PMG that is built on the panel extension of a single equation in ARDL structure where a contemporaneous effect and an error correction framework towards long run equilibrium are examined. Because all the variables are in logarithmic form, we interpret their coefficients as elasticities. Table 4 presents findings on the estimations of the PMG.

The results from Table 4 above shows that, in both the short and long run, financial development irrespective of the indicator has an insignificant effect on international trade in the short run. What is intriguing in these findings is that there is inverse relationship between financial development and international trade as can be seen with all the negative coefficients across all the finance–trade measures except the private credit–trade openness with positive coefficients though insignificant irrespective of model specification. This implies that financial development to a large extent dampens trade in Africa, which is inconsistent with Beck (2002) and Kim et al. (2010). One intuitive expectation is a positive effect of finance on trade where well-developed financial sector spurs international trade. Our data do not however support this view given the insignificance effect of finance. In fact, if finance is to have any effect on trade, our finding suggests that such effect will be a dampening one given consistent negative coefficients of private and domestic credit. It also holds for all the proxies of international trade.

In column 2, real GDP per capita that measures economic growth has positive and significant effect on international trade. Whereas higher real GDP per capita spurs trade in both the short and long run, its long run effect is exceedingly higher. For instance, 1% increase in financial sector development increases short run trade by a magnitude ranging between 0.329% and 0.508% and corresponding long run effect of 0.503% to 0.587%. Indeed, Alesina and Wacziarg (1998) argue that the cost

of self-sufficiency is lower for large than small economies. Thus, countries with large (small) domestic markets should therefore be less (more) open to international trade. Consequently, GDP per capita is expected to increase international trade as the demand for variety in the choice of goods is likely to increase with wealth. On the supply side, increases in income may lead to higher domestic production available for exports. This finding is therefore expected.

With sectoral value addition, agriculture is one such important sector that cannot be ignored and is negative in our findings here though insignificant in the short run. However, this effect turns positive in the long run and significant at conventional levels for only agricultural–export nexus. When agriculture value addition is increased by 1%, exports increase by 0.092% and 0.199%, respectively, when finance is proxied by private and domestic credit. The service sector does not appear to influence trade in the short run given the insignificant coefficients suggesting that, in the short run, well-developed service sector does not matter in international trade irrespective of the model specification and measures of finance and trade. Interestingly, in the long run, service sector negatively and significantly affects exports. Here, the magnitude of effect is huge once we omit agricultural sector in the trade equation. However, for trade openness, we notice that changes in the service sector does not significantly influence trade.

Turning to the impact of manufacturing sector on trade, we find that higher manufacturing value additions inhibits trade. However, in the short run, this effect is only significant when trade is proxied by exports for both measures of finance. In the long run, manufacturing value additions negatively and significantly drive international trade irrespective of the measure of finance and trade. Beyond this, we observe that the deleterious effect of manufacturing is huge on exports relative to trade openness. As a priori, countries with appreciable level of manufacturing capacities are expected to export more boosting international trade. However, we do not find evidence for this in the case of Africa. A conjectural explanation is that the rather high inflationary nature of the African countries in addition to high transaction costs (due to under-developed financial markets) potentially increases prices of manufactured goods that could lower exports from the demand side as prices become expensive. On the supply side, higher tariffs on manufactured exports could also discourage exports.

With regard to the industrial sector, we observe a short run complementary effect between the industrial value additions and international trade given the positive and significant coefficients. More specifically, a unit–percentage increase in industrial value added raises international

TABLE 4 Finance, sectoral value additions, and international trade

Variables	Exports							
	Private credit				Trade openness			
	1	2	3	4	5	6	7	8
Short run								
Finance	-0.033 [0.546]	-0.0358 [0.529]	-0.037 [0.311]	-0.041 [0.211]	0.022 [0.719]	0.019 [0.763]	-0.006 [0.858]	-0.004 [0.910]
Real GDP	0.453** [0.028]	0.370* [0.054]	0.406** [0.031]	0.329* [0.068]	0.508** [0.018]	0.464** [0.031]	0.455** [0.015]	0.411** [0.027]
Agriculture	-0.280 [0.453]	-	-0.291 [0.290]	-	-0.455 [0.327]	-	-0.461 [0.330]	-
Service	0.332 [0.405]	-0.363 [0.212]	0.356 [0.366]	-0.359 [0.191]	0.472 [0.302]	-0.227 [0.588]	0.500 [0.253]	-0.187 [0.639]
Manufacturing	-0.210** [0.035]	-0.165* [0.092]	-0.185* [0.074]	-0.142 [0.158]	-0.210 [0.118]	-0.101 [0.386]	-0.190 [0.176]	-0.081 [0.507]
Industry	0.681*** [0.004]	0.530*** [0.002]	0.646*** [0.005]	0.524*** [0.004]	0.572** [0.011]	0.466** [0.027]	0.563** [0.010]	0.476** [0.023]
Long run								
Finance	-0.032 [0.110]	-0.022 [0.202]	-0.017 [0.338]	-0.014 [0.409]	0.005 [0.656]	0.007 [0.484]	0.002 [0.861]	0.003 [0.768]
Real GDP	0.533*** [0.000]	0.555*** [0.000]	0.503*** [0.000]	0.538*** [0.000]	0.587*** [0.000]	0.557*** [0.000]	0.551*** [0.000]	0.521*** [0.000]
Agriculture	0.092* [0.096]	-	0.199*** [0.000]	-	-0.001 [0.982]	-	0.008 [0.851]	-
Service	-0.102* [0.052]	-0.208*** [0.000]	-0.094* [0.056]	-0.151*** [0.002]	0.019 [0.662]	-0.013 [0.721]	0.014 [0.756]	-0.010 [0.784]
Manufacturing	-0.186*** [0.000]	-0.168*** [0.000]	-0.203*** [0.000]	-0.170*** [0.000]	-0.060*** [0.005]	-0.055*** [0.007]	-0.067*** [0.003]	-0.059*** [0.007]
Industry	0.135** [0.010]	0.257*** [0.000]	0.084* [0.096]	0.210*** [0.000]	-0.006 [0.869]	0.029 [0.407]	-0.004 [0.909]	0.026 [0.468]
Error Correction Term	-0.203*** [0.000]	-0.231*** [0.000]	-0.201*** [0.000]	-0.225*** [0.000]	-0.195*** [0.000]	-0.203*** [0.000]	-0.190*** [0.000]	-0.206*** [0.000]
Constant	-0.098 [0.000]	-0.105 [0.000]	-0.086 [0.001]	-0.085 [0.001]	-0.027 [0.360]	0.019 [0.509]	0.031 [0.270]	0.079 [0.011]
Diagnostics								
Log Likelihood	881.834	826.798	839.498	779.967	1000.993	951.532	960.524	986.110
Observations	1,610	1,610	1,610	1,610	1,610	1,610	1,610	1,610
Number of groups	46	46	46	46	46	46	46	46
Mean reverting period (in years)	4.9	4.3	5.0	4.4	5.1	4.9	5.0	4.9

\*Significance at 10%.

\*\*Significance at 5%.

\*\*\*Significance at 1%.

trade with a coefficient ranging between 0.466% and 0.681%. A closed examination of the results reveal that the impact of the industrial sector is consistently higher for exports relative to trade openness. The long run effect is however mixed. Although the coefficients of the industrial sector remain positive albeit reduced coefficients, the effect is only significant for exports. Thus, the long run effects of industry on trade openness is imaginary.

The coefficients of the error correction terms in all the models are correctly signed. The negative and significant coefficients indicate that the models return to their long run equilibrium following a shock to the system that causes deviation from its steady state. Our estimation of the mean reverting period suggests that it will take approximately 4.3 to 5.1 years for all disequilibrium to be cleared and the system fully restore to its long run equilibrium.

So far, our evidence presented above reveals that development of domestic financial sector does not appear to influence international trade both in the short and long run. This effect holds irrespective of the measure of finance and trade. However, the earlier analysis is mute on the transmission channels through which the various sectors of the economy may potentially mediate the relationship between international trade and domestic financial system. We address this in the next section.

### 3.4 | Finance, sectoral value additions, transmission channels, and international trade

This section determines the interactive effect of sectoral growth in finance–trade nexus by examining how sectoral value additions arbitrate the relationship between financial development and international trade. This is done by sequentially introducing two sectors into the trade equation while alternating the measure of finance. Findings are presented in Table 5.

With regard to the impact of finance on exports, our findings from Table 5 reveal that financial development whether measured by private or domestic credit does not have any effect on trade in the short run. However, in the long run, finance significantly hurts exports. For instance, when proxied by private credit, we find that a unit–percentage rise in finance significantly reduces long run exports by 0.412%. This deleterious impact is huge when we drop the agricultural and service sectors. Turning to domestic credit as an indicator of finance, our evidence suggests that financial development negatively affects exports in the long run with a coefficient of  $-0.475$ . Similar to the private credit, we observe that the dampening effect of finance on exports is more negative when the agricultural and service sectors are

omitted (column 4). The implication is that, although well-developed financial sectors do not influence exports in the short run, in the long run their effect is rather not export-enhancing at least based on our sample evidence. Importantly, we observe that the deleterious impact of finance on exports is huge measuring at least 1.45 times larger when proxied by domestic credit relative to private credit.

Interestingly, we find mixed impact of finance on trade when the latter is measured by trade openness. In other words, although both private and domestic credits do not affect trade openness in the short run, in the long run their effect is inconclusive. For instance, when proxied by private credit, our findings show that financial sector development positively and significantly influences trade openness, whereas domestic credit does not enhance trade. More precisely, a 1% increase in private credit spurs trade openness by 0.332% (column 5) although this effect reduces to 0.179% (column 6) when agricultural and service sectors are dropped. This notwithstanding, a unit–percentage rise in domestic credit reduces long run trade openness by 0.218%. The export-damaging effect of domestic credit raises to 0.455% and remains significant at 1% when we control for manufacturing and industrial sectors. This evidence largely reveals that the precise impact of finance on trade depends on the time period, measures of finance, and trade. This finding is consistent with Kim et al. (2010). Nonetheless, we find sufficient evidence to suggest that financial sector development is not trade-enhancing for Africa based on our sample. The intuition is that to the extent that countries in the continent have fragile and weak financial institutions, a potential attendant consequence of such financial under-development is the rising transaction costs and risks resulting from financial liberalization thus inhibiting international market integration in the long run.

With regard to the impact of economic growth on trade, the results show that irrespective of the measure of trade, real GDP per capita positively and significantly at 1% influences international trade in the long run with a consistently huge impact for exports relative to trade openness. However, the short run effect is model-specific. In particular, for all models including the agricultural and service sectors, the effect of economic growth on trade is positive and statistically significant at conventional levels. Interestingly, real GDP per capita–trade nexus losses significance once we include the manufacturing and industrial sectors.

Turning to the sectoral effects on trade, results from our estimations show that, in the short run, none of the sectors has any significant impact on trade although the coefficients of agriculture, service and manufacturing sectors have been consistent. In the long run, only the

TABLE 5 Finance, sectoral value additions, transmission channels, and trade

Variables	Exports							
	Private credit				Trade openness			
	1	2	3	4	5	6	7	8
Short run								
Finance	0.939 [0.469]	-0.853 [0.106]	-0.036 [0.982]	-0.454 [0.355]	0.104 [0.938]	-0.445 [0.290]	0.115 [0.892]	-0.089 [0.822]
Real GDP	0.334* [0.091]	0.202 [0.288]	0.450** [0.034]	0.258 [0.144]	0.361* [0.094]	0.208 [0.291]	0.511** [0.031]	0.252 [0.196]
Agriculture	5.679 [0.299]	-	11.092 [0.322]	-	7.909 [0.284]	-	-	-
Service	-3.072 [0.309]	-	-6.827 [0.271]	-	-4.503 [0.266]	-	-0.240 [0.748]	-
Manufacturing	-	-0.167 [0.786]	-	-1.134 [0.108]	-	-0.171 [0.778]	-	-1.139 [0.177]
Industry	-	-0.238 [0.758]	-	0.413 [0.661]	-	-0.009 [0.987]	-	0.623 [0.542]
Transmissions								
<i>FIN</i> × <i>AGRI</i>	-1.578 [0.273]	-	-2.505 [0.350]	-	-2.130 [0.270]	-	-	-
<i>FIN</i> × <i>SERV</i>	0.627 [0.437]	-	1.341 [0.371]	-	1.172 [0.272]	-	0.025 [0.912]	-
<i>FIN</i> × <i>MANU</i>	-	0.016 [0.941]	-	0.292 [0.153]	-	0.058 [0.782]	-	0.321 [0.191]
<i>FIN</i> × <i>INDU</i>	-	0.238 [0.373]	-	-0.033 [0.893]	-	0.118 [0.531]	-	-0.118 [0.667]
Long run								
Finance	-0.412*** [0.000]	-0.501*** [0.000]	-0.475*** [0.000]	-0.598*** [0.000]	0.332*** [0.009]	0.179** [0.034]	-0.218*** [0.001]	-0.455*** [0.000]
Real GDP	0.651*** [0.000]	0.668*** [0.000]	0.662*** [0.000]	0.639*** [0.000]	0.436*** [0.000]	0.498*** [0.000]	0.568*** [0.000]	0.387*** [0.000]
Agriculture	0.130* [0.087]	-	0.292*** [0.000]	-	-0.059 [0.343]	-	-	-
Service	-0.286*** [0.000]	-	-0.451*** [0.000]	-	-0.299*** [0.001]	-	-0.160*** [0.002]	-
Manufacturing	-	-0.379*** [0.000]	-	-0.277*** [0.000]	-	-0.048 [0.331]	-	-0.230*** [0.000]
Industry	-	-0.107 [0.180]	-	-0.150*** [0.007]	-	-0.201*** [0.009]	-	-0.320*** [0.000]
Error Correction Term	-0.199*** [0.000]	-0.195*** [0.000]	-0.208*** [0.000]	-0.210*** [0.000]	-0.199*** [0.000]	-0.192*** [0.000]	-0.202*** [0.000]	-0.156*** [0.001]
Transmissions								
<i>FIN</i> × <i>AGRI</i>	-0.006 [0.727]	-	-0.034** [0.020]	-	-0.017 [0.201]	-	-	-
<i>FIN</i> × <i>SERV</i>	0.103*** [0.000]	-	0.133*** [0.000]	-	0.070** [0.017]	-	0.055*** [0.001]	-
<i>FIN</i> × <i>MANU</i>	-	0.078** [0.022]	-	0.027 [0.158]	-	-0.017 [0.375]	-	0.009 [0.536]
<i>FIN</i> × <i>INDU</i>	-	0.075** [0.022]	-	0.151*** [0.000]	-	-0.035 [0.241]	-	0.126 [0.000]
Constant	-0.124 [0.000]	-0.046 [0.163]	-0.105 [0.000]	-0.029 [0.452]	0.010 [0.643]	-0.014 [0.599]	0.119 [0.011]	0.407 [0.010]

(Continues)

TABLE 5 (Continued)

Variables	Exports							
	Private credit				Trade openness			
	1	2	3	4	5	6	7	8
Log Likelihood	832.178	902.224	791.890	874.421	948.322	994.782	789.982	970.936
Observations	1,610	1,610	1,610	1,610	1,610	1,610	1,610	1,610
Number of groups	46	46	46	46	46	46	46	46
Mean reverting period (in years)	5.0	5.1	4.8	4.8	5.0	5.2	4.9	6.4

\*Significance at 10%.

\*\*Significance at 5%.

\*\*\*Significance at 1%.

agricultural sector enhances exports with a dampening impact on trade openness albeit insignificantly. Specifically, when only the agricultural and service sectors are controlled for, the coefficient of agriculture is positive and marginally significant at 10% (column 1). For the service sector, the impact on exports is negative and significant at 1%. In this estimation, the negative effect of the service sector is 2.2 times larger than the positive effect of the agricultural sector. With regard to trade openness, we find that a unit-percentage rise in private and domestic credit significantly decreases trade openness by 0.299% and 0.160%, respectively. We further control for manufacturing and industrial sectors as well dropping agricultural and service sectors. We find that increases in manufacturing value additions significantly hurts long run exports with elasticities ranging between  $-0.277\%$  and  $-0.379\%$ . Similar conclusion is reached for trade openness although manufacturing-trade nexus is only significant in the model when finance is measured by domestic credit. The industrial sector also does not appear to promote trade given the negative and largely significant coefficients.

We now turn to transmission channel of sectoral growth on international trade via financial sector development. In other words, we empirically determine whether growth of the various sectors of the economy interact with finance to influence international trade. Although finance may not directly influence trade in both the short and long run, improvement in domestic financial system may serve as a conduit through which both the tradable and non-tradable sectors of the economy affects cross-border trade. Specifically, we hypothesize that sectoral value additions positively impacts on trade through its effects on the domestic financial sector. We examine this by including a multiplicative interactive terms of the various proxies of finance with each sector in the trade equation while controlling for our standard covariates. From Equation (2), four possibilities can be found from the conditional impact of finance. First, if both  $\xi$  and  $\psi < 0$ , then development of the domestic financial sector does not enhance international trade and sectoral growth exacerbates the negative effect. Second, if both  $\xi$  and  $\psi > 0$ , then financial sector development spurs international trade and sectoral growth magnifies the positive effect. Third, if  $\xi < 0$  and  $\psi > 0$ , then development of the domestic financial sector does not enhance international trade and sectoral growth dampens the negative sectoral effect. Finally, if  $\xi > 0$  and  $\psi < 0$ , this study concludes that domestic financial sector promotes international trade and sectoral growth dampens the positive effect on trade. Results from our short run effects show for most part, a positive coefficient of the interactive terms except for agricultural sector. However, none of them is statistically

significant at conventional levels suggesting that the short run conditional financial sector development effect is imaginary. This finding may be unsurprising. Anecdotally, higher well-developed financial sector is expected to boost sectoral growth through its efficient allocation of resources, diversifying risk and ameliorating information asymmetry. Consequently, growth in sectoral value addition is presumed to influence cross-border trade. However, we do not find evidence for this in the short run. Perhaps, the relatively under-developed financial systems of the countries under consideration are insignificant to drive trade through its indirect effect on the sectors of the economy.

Conversely, in the long run, when finance proxied by private credit, we find a negative direct effect of finance and positive and significant interactive term of finance and service sector (column 1). The implication is that, whereas financial development does not enhance long run trade, development of the service sector dampens the negative effect of finance on exports although the direct effect of private credit is exceedingly higher. This finding is robust when domestic credit is used to measure finance with a marginal rise in the conditional impact. Interestingly, Although the impact of the interactive term of finance and agricultural sector on trade is negative, it is only significant for domestic credit (column 3). In particular, both the direct and indirect impacts of finance are negative suggesting that, although finance hurts exports, development of the agricultural sector exacerbates the deleterious effect of finance (column 3). Given the coefficients of  $-0.034$  and  $0.133$  for joint conditional effect of private credit and agriculture, and private credit and service, we compute their net effects as  $-1.423$  and  $5.434$ , respectively.<sup>5</sup>

With regard to the transmission channel of finance via manufacturing sector, our findings show that, in the long run, booming manufacturing sector dampens the negative impact of private credit on exports with a net effect of  $0.406$  given the positive and statistically significant coefficient of  $0.078$ . Similarly, our evidence also suggests that a well-developed industrial sector also makes the negative impact of private credit on exports less malignant given its positive and significant interactive term with a huge net effect of  $1.583$ . A possible elucidation of the dampening impact of the manufacturing and industrial sectors can be drawn from the demand-following hypothesis that contends that the growth of real economic activities spurs demand for financial services and consequently the development of financial sector thus causing a uni-directional causality from finance to real sector (see Odhiambo, 2004). Although finance does not promote trade, the growing manufacturing and industrial sectors invariably use resources provided by the financial sector in their

production process and as such, growth of the real sectors of the economy heightens the demand for these financial resources. As a consequence, the domestic financial sector improves in their financial intermediation roles, efficient resource allocation, and screening of ex ante and ex post investments. In the long run, these indirect effects jointly work to increase export on the back of higher value additions facilitated in part by the financial system.

Turning to the conditional impact of finance on trade openness, we do not find evidence that finance—whether proxied by private or domestic credit—interacted with the real sectors improve countries' integration with the international markets. Thus, the joint impact of finance and real sectors of the economy do not matter in trade openness whether in the short or long run. Only the conditional impact of service and financial development matter for long run trade openness. This holds true for both proxies of finance although the indirect effect via private credit is greater (column 5). Interestingly, given the long run unconditional impact of private and domestic credit, our findings suggest that only the indirect effect of the service sector on trade is significant. More precisely, we find that, when interacted with the service sector, development of the private credit amplifies its positive conditional impact while improving domestic credit dampens its negative unconditional effect on trade openness. This notwithstanding, heightening impact of private credit is 1.3 times larger than the dampening role of domestic credit on trade with a net effect of  $3.442$  and  $2.226$  for private and domestic credit, respectively.

Beyond the coefficients, we examine the error correction behaviour of our models relying on the error correction terms produced by the PMG. Consistent with theory, all the error correction terms are negative and highly significant at 1% suggesting a mean reverting process. A practical implication is that disequilibrium in the system following a shock eventually diverting the steady state track tend to be corrected towards a long run path. We determine the number of years for disequilibrium to be cleared by taking the ratio of unit to the coefficients of the error correction term at each estimation results. Our findings based on the sample evidence show a minimum of 4.8 years and a maximum of 6.4 years for all disequilibrium to be cleared and the system fully reverts to its long run equilibrium.

Apart from the net effects and mean reverting period, we examine for the marginal effect of a percentage increase in sectoral value addition (financial development) on international trade when financial development is at its mean. On this score, from Equation (2) above, we take the partial derivative of trade with respect to each sector and the result is assessed at  $FD = 0$  and  $= \overline{FD}$ . Results for the marginal effect are presented in Table 6.

**TABLE 6** Marginal effects of finance, sectoral value additions, and their interaction effects

Indicators	Panel A: Exports			
	Agriculture		Service	
	Private credit Column 1	Domestic credit Column 2	Private credit Column 3	Domestic credit Column 4
Zero	0.130	0.292	-0.286	-0.451
Mean	0.015	-0.796	1.692	3.804
Unconditional impact	$\xi = 0.130^*$	$\xi = 0.292^{***}$	$\widehat{\varphi}\xi = -0.286^{***}$	$\xi = -0.451^{***}$
Conditional impact	$\psi = -0.006$	$\psi = -0.034^{**}$	$\psi = 0.103^{***}$	$\psi = 0.133^{***}$
Mean of finance	$\overline{PC}_{it} = 19.21$	$\overline{DC}_{it} = 31.99$	$\overline{PC}_{it} = 19.21$	$\overline{DC}_{it} = 31.99$
Indicators	Panel B: Trade openness			
	Agriculture		Service	
	Private credit Column 1	Domestic credit Column 2	Private credit Column 3	Domestic credit Column 4
Zero	-0.379	-0.277	-0.107	-0.150
Mean	1.119	0.587	1.334	4.680
Unconditional impact	$\xi = -0.379^{***}$	$\xi = -0.277^{***}$	$\xi = -0.107$	$\xi = -0.150^{***}$
Conditional impact	$\psi = 0.078^{**}$	$\psi = 0.027$	$\psi = 0.075^{**}$	$\psi = 0.151^{***}$
Mean of finance	$\overline{PC}_{it} = 19.21$	$\overline{DC}_{it} = 31.99$	$\overline{PC}_{it} = 19.21$	$\overline{DC}_{it} = 31.99$
Indicators	Panel B: Trade openness			
	Agriculture		Service	
	Private credit Column 1	Domestic credit Column 2	Private credit Column 3	Domestic credit Column 4
Zero	-0.048	-0.230	-0.201	-0.320
Mean	-0.375	0.058	-0.873	3.711
Unconditional impact	$\xi = -0.048$	$\xi = -0.230^{***}$	$\xi = -0.201^{***}$	$\xi = -0.320^{***}$
Conditional impact	$\psi = -0.017$	$\psi = 0.009$	$\psi = -0.035$	$\psi = 0.126$
Mean of finance	$\overline{PC}_{it} = 19.21$	$\overline{DC}_{it} = 31.99$	$\overline{PC}_{it} = 19.21$	$\overline{DC}_{it} = 31.99$

Note. PC is private credit, whereas DC is domestic credit.

\*Significance at 10%.

\*\*Significance at 5%.

\*\*\*Significance at 1%.

From Table 6, Panel A presents results on the partial derivative of international trade proxied by exports with respect to each sector, whereas Panel B also shows the partial derivative of trade measured by trade openness. For all the sectors, notice that irrespective of the proxy

of finance evaluated at zero (that is private credit = domestic credit = 0), their marginal effects are equal to their unconditional long run effect at their respective indicators of finance. However, after interacting agriculture and private credit, on one hand, and agriculture and

domestic credit, on the other hand (columns 1 and 2), the marginal effect of the conditional impact of agriculture decreases from 0.130 to 0.015 when private credit is evaluated at its mean of 19.21% of GDP. Similarly, on the back of domestic credit, the marginal effect of agriculture falls to  $-0.796$  when domestic credit rises from zero to its mean. For the service sector and financial development, we notice an increase in the marginal effect from  $-0.286$  to  $1.692$  for private credit and  $-0.451$  to  $3.804$  for domestic credit. Thus, although the service sector dampens the negative effect of finance on exports, the conditional impact of the service sector via domestic credit is higher when domestic credit is evaluated at its mean of 31.99%. With regard to the manufacturing sector in the presence of mediation effect on the back of higher financial development, the marginal effect is  $1.119$  for private credit (column 5) and  $0.587$  for domestic credit (column 6). Interestingly, when both finance indicators are evaluated at their means, we find that although the marginal effect of the interactive terms of private credit and manufacturing sector is higher than manufacturing and domestic credit, we observe an opposite trend for industrial sector and private credit, and industrial sector and domestic credit (columns 7 and 8).

In Panel B where trade openness is used to measure international trade, at zero mean of both indicators of finance, the marginal effects of sectoral value additions on trade are the same as their long run unconditional impacts. However, apart from the interactive effect of service sector and private credit, which positively impact on trade openness, private credit interacted with the other sectors of the economy does not enhance trade as the marginal effects are more negative when private credit is evaluated at its mean. Interestingly, the marginal effect on trade openness increased for the indicators of financial development when they both increased from zero to their respective means (columns 3 and 4), from  $-0.299$  to  $1.046$  for private credit and  $-0.160$  to  $1.599$  for domestic credit, respectively. However, the marginal impact of the service sector on the back of higher domestic credit is huge and measures at least 1.5 times larger than private credit. For the manufacturing and industrial sector, their interactive terms are insignificant (see Table 5 above) so their marginal impacts may not matter for trade openness owing from well-developed domestic financial sector.

#### 4 | POLICY IMPLICATIONS AND RECOMMENDATIONS

Drawing from the findings of the study, we highlight the key implications for policy while offering crucial

recommendations. The past three decades have seen restructuring in both the financial and real sectors of many countries in Africa in a way that support countries' integration at the work market. This study examined the impact of financial sector development and sectoral contributions to international trade in Africa over the period spanning 1980–2016. We find that irrespective of the indicator of finance and trade, higher finance does not appear to significantly support trade. This holds both in the long and short run. For the sectoral value additions, we observe that while the industrial sector positively influences international trade in the short run irrespective of the proxy of finance and trade, in the long run, only the impact of finance on exports is significant. We also find that both manufacturing and service sectors drags trade. However, in the long run, only the manufacturing–trade nexus is robust. After including the indirect effect, we notice that the impact of finance on trade is largely negative and significant in the long run. In the short run, finance effect on trade is benign. On the transmission channels, our evidence suggests that well-developed service, industrial, and manufacturing sectors significantly dampen the negative effect on finance on long run trade. However, only the transmission channels via service sector is robust. For the other sectors, the indirect effect is only significant for exports.

Indeed, theoretically, well-developed financial development spurs international trade, either by serving as insurance instrument or leading in countries' comparative advantage. Country with less (more) credit market restrictions specializes in sectors that draw on heavy (low) external finance. Thus, higher finance lead to comparative advantage in industries that relatively depend on external financing and this can be a potential source of differences in trade regimes of countries. Conversely, the risk-diversification role of higher domestic financial sector holds that countries with well-developed financial system are able to produce risky goods and services with lower risk premiums. Consequently, such economies are better able to diversity their risk and well-integrated with the international markets. Therefore, finance and trade have potential long run complementarity. However, we do not find evidence for this even in the presence of sectoral value additions. Rather, a coexistence of negative long run substitutionarity between finance and trade is found and this holds irrespective of the proxy of finance and trade. For low financial development countries such as those in Africa, improvement in the financial sector has an insignificant short run effect on both exports and trade openness.

In fact, provision of the right and optimal level of finance to firms should improve trade as constraint to access to finance is eliminated in such a way that firms

are better able to cover fixed entry cost hence higher exports by incumbent firms. Consequently, this is expected to spur bilateral trade at the aggregated level. In terms of its manifestations, as trade barriers are lifted and countries open their economies to trade, the nascent financial sectors move to channel resource to finance new economic ventures of the real sector. Indeed, following from the supply-leading hypothesis which holds that finance leads economic activity, the higher financial intermediation is critical in countries' transition towards a higher growth trajectory. Beyond this transition stage, finance-trade nexus may move to a new stable equilibrium where relationship may well be mediated by sectoral value additions rather than finance and trade mutually reinforcing each other. As espoused by Kim et al. (2010), because the path towards better development of the financial sector is often characterized by both long run financial deepening and short run financial instability, especially for developing countries such as Africa, as such, financial development may be deleterious to international trade at cyclical frequencies.

Indeed, financial underdevelopment potentially inhibits financial intermediation; thus it increases transaction cost, all of which drags trade, especially if trading parties and financial intermediaries do not provide the necessary financing. It is on record that many countries in Africa have comparative advantage in agriculture owing to the abundant factor endowments, productivity, as well differences in costs from dynamic economies of scale (Collier & Venables, 2007; Wood & Mayer, 2001). However, the spatial and risky nature of the sector creates unique challenges for the financial sector (Meyer, 2011). Relative to the other real sectors of the economy, the inability of financial intermediaries to offer financial resources to the agricultural sector stemming from the risk-averse commercial financial institutions have led to limited credit availability to support the agricultural sector's production. As such, the demand for finance and better financial intermediation by the agents in the agricultural sector is not strong enough to improve the relationship between finance and trade. Consequently, if agricultural sector will have any impact on trade through finance, such effect would rather be magnifying the deleterious impact of finance on trade. However, the manufacturing, service and industrial sectors are seen as a safe destination for bank credit largely because they are immune from the spatial problems of the agricultural sector. For these sectors, their growth and hence demand for better financial intermediation is expected to improve on long term financial development based on the demand-following hypothesis. Our evidence suggests that, although the manufacturing, industrial and service sectors dampen the negative effect of finance, this

dynamic is more pronounced with the service sector. This finding is not far-fetched. According to UNCTAD (2015) report, Africa's services sector contributes to almost half of the continent's output and measures more than twice the average rate for the world during 2009–2012. The report also argues that the agricultural, industrial, manufacturing and service sectors respectively contribute 16%, 35%, 11%, and 49% to the continent's real output. Given the higher contribution of the service sector, it is more likely for the financial sector to support the activities of the service sector (such as telecommunications, transport and energy among others) through provision of improved financial services. Thus, to the extent that the service sector is highest contributor to output and trade, when complemented with better finance will by far dampen the possible negative effect of finance on overall trade.

From our findings, improving on domestic financial services as well as cross-border supervision and regulation are exceedingly important to ensuring the healthy and sufficient liquidity of finance that is consistent with international trade. Given the increasing internationalization of financial intermediation, the emerging regulatory framework should be agile to respond to financial fragility. There is still room for better regulation of domestic financial sector to help improve financial institutions' risk-taking behaviour. However, given the low financial sector development in spite of the rigorous financial sector reforms, some sort of industrial policy may be important in supporting the diversification and expansion of production across the various sectors. Indeed, to ensure improved international trade in Africa, building complementarity in a way that strengthens input-output and demand linkages among the industrial, agricultural, manufacturing, services and financial sectors should be crucial goal for policymakers in Africa.

## 5 | CONCLUSION

Despite the importance of domestic level of financial sector and sectoral value additions to international trade, existing studies on finance-trade nexus have failed to (a) re-engage the debate where trade flows, sectoral value additions, and domestic financial development are lower and (b) investigate the mediating role of finance in influencing sectoral growth for improved international trade flows. Earlier literature has considered panel dataset that combined both developed and developing economies as a single case without considering the unique effect of Africa. More importantly, the extent to which financial development referees the link between sectoral growth

and trade remains an unexplored area. In this study, we re-examine the impact of finance on trade as well as sectoral channels through which finance influences international trade. By invoking the PMG on a panel data comprising 46 countries in Africa spanning 1980–2016, our findings show that, for both the long and short run, although the impact of financial development does not have a significant effect on trade, the effect of sectoral value additions is contingent on the proxy of trade. On the pass-through effect of finance, we observe that whereas financial development negatively affects long run trade, sectoral value additions dampen the deleterious effect of finance on trade with huge impact recorded in the service sector. We argue that such conditional impact of finance via sectoral growth may be guided by the demand-following hypothesis in the finance-growth literature. As a key policy prescription, building complementarity among the various sectors of the economy including the financial sector while maintaining cross-border oversight in financial intermediation should be pursued by policymakers in within the continent.

## ENDNOTES

- <sup>1</sup> See Senbet and Otchere (2006) for a survey of some financial sector reforms in Africa.
- <sup>2</sup> Kumi et al. (2017) note that, whereas finance improves sectoral growth in sub-Saharan Africa, aid volatility weakens sectoral value additions. However, the negative impact of aid volatility on sectoral value additions is dampened by a well-developed financial system. Similarly, Ibrahim and Alagidede (2017b) find that well-developed financial sector dampens (magnifies) the effect of real shocks (monetary shocks) on the economic volatility.
- <sup>3</sup> The countries are Algeria, Angola, Benin, Botswana, Burundi, Burkina Faso, Cabo Verde, Cameroon, Central African Republic, Chad, Congo, Dem. Rep., Congo, Rep., Cote d'Ivoire, Ethiopia, Egypt, Arab Rep., Equatorial Guinea, Gabon, Ghana, The Gambia, Guinea-Bissau, Guinea, Kenya, Liberia, Libya, Lesotho, Mali, Malawi, Mauritania, Mauritius, Morocco, Niger, Nigeria, Namibia, Mozambique, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Tunisia, Uganda, Zambia, and Zimbabwe.
- <sup>4</sup> For problems associated with cross-sectional dependence, see Chudik and Pesaran (2015).
- <sup>5</sup> The net effect is computed as [(coefficient of the interactive term × mean of sectoral value addition) + coefficient of finance].

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**How to cite this article:** Sare YA, Aboagye AQQ, Mensah L. Financial development, sectoral effects, and international trade in Africa: An application of pooled mean group (PMG) estimation approach. *Int J Fin Econ*. 2019;24:328–347. <https://doi.org/10.1002/ijfe.1665>