

Agricultural Export, Growth and the Poor in Africa: A Meta Analysis

Journal of Interdisciplinary Economics

1–20

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DOI: 10.1177/02601079221132145

journals.sagepub.com/home/jie

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Abstract

Over the past decade, a growing number of studies have examined the role of agricultural export in economic growth in Africa. The literature, however, provides conflicting results about the agricultural export-led growth hypothesis. In this study, we aim to re-examine the impact of agricultural export on economic growth by performing a meta-analysis. There are two questions of interest, namely, (a) whether publication bias is present in the agricultural export-growth literature in Africa, and (b) if there is an overall effect of agricultural export on economic growth. Our meta-analysis finds significant negative publication bias in the literature. Moreover, after correction for publication bias, the results show that agricultural export leads to growth in low-income and lower middle-income African countries. These results are consistent with the agricultural export-led growth hypothesis. By this, we provide empirical basis that may enhance policy decisions on resource allocation to areas of comparative advantage. Additionally, the existence of an income differential effect on the agricultural export-led growth nexus implies that agricultural export-growth strategy has a pronounced effect on the poor in Africa. The result suggests that the poor in Africa could follow an agricultural growth strategy because it is a promising means to increase per capita wealth.

Keywords

Africa, export-led growth, agricultural export, meta-analysis

JEL Classification: C10; C40; I30; N50; O55

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Introduction

There has been an intense debate in the literature over whether export leads to growth for the poor. One stance of the literature argues in favour of the export-led growth hypothesis (Dorosh & Mellor, 2013; Foster, 2006; Fosu, 1990; Sanjuán-López & Dawson, 2010). Another stance of the literature rejects the export-led growth hypothesis for the poor because of the deleterious effect of export instability (Abu-Qarn & Abu-Bader, 2004; Dreger & Herzer, 2013; Furuoka, 2018). Thus, the literature provides conflicting results regarding the growth effect of export on the poor. We contribute to this debate in the literature by re-examining whether agricultural export leads to growth for the poor in Africa. The African context is important because economic growth has implications for improvements in living standards due to the high incidence of poverty (Dollar et al., 2016; Seok & Moon, 2021; Tchamyou et al., 2019a; 2019b). At the same time, recent studies and policy documents appear to downplay the latent potential of agricultural export to increase per capita wealth in Africa. For example, UNCTAD (2005) bemoaned the heavy reliance on primary commodity export, suggesting that many economies would fail to generate the required externalities for sustained growth from agricultural export. Yet, for most African economies, the agricultural sector still contributes a relatively large share of their GDP (Awokuse & Xie, 2015; Fosu, 1990; Ssozi et al., 2019). Thus, understanding the agricultural path of development and growth is paramount and represents an optimal resource allocation strategy (Dawson, 2005).

Moreover, to the best of our knowledge, Mookerjee (2006) is the only meta-analysis study in the extant literature that specifies the export-growth effect on Africa in the perspective of manufactured exports, oil exports and total exports, excluding agricultural exports and found that after correcting for publication bias, exports do not spur growth in Africa on average. Mookerjee (2006) explains that there are not enough studies on the agricultural export-led growth hypothesis at the time of the study. Other meta-analysis studies on the export-growth hypothesis, such as Tingvall and Ljungwall (2012) and Sannassee et al. (2014) also focus on total (aggregate) export. However, African countries have a relatively high reliance on agricultural exports when compared to other developing countries (Fosu, 1990). Thus, whether agricultural export is growth for the poor in Africa is still an open empirical question. Consequently, we seek to quantitatively examine: (a) whether there is publication bias in the agricultural export-growth literature, (b) what the true effect of agricultural export on economic growth is, after correction for publication bias, if any and (c) what factors account for the mixed and varying results in the literature.

To this end, we perform a meta regression analysis on 68 estimates for agricultural export elasticity of GDP collected from 16 empirical studies. Using mixed-effect multilevel meta-regression, our results suggest that the mean reported estimate of elasticity of agricultural export to GDP is moderate, after correcting for publication selection bias for both the rich and poor in Africa. We find evidence for publication selection bias in favour of the deleterious effect of export instability hypothesis, where agricultural exports retire growth. To provide an understanding of the factors

that matter in explaining the varying empirical results, our results indicate that publication characteristics and methodology matter for the reported elasticity of agricultural export on growth. Researchers who use vector error correction model (VECM) and publish in high impact journals tend to obtain larger estimates. The effect of agricultural export-led growth is larger in low- and lower-income countries relative to upper-middle income countries in Africa. We also find that researchers who account for trade openness tend to report larger estimates of agricultural export-led growth. In contrast, researchers who account for labour force participation in the agricultural export-growth model report smaller estimates.

This study contributes to the literature in the following ways. First, we complement prior meta-analysis on the export-led growth hypothesis (Mookerjee, 2006; Sannassee et al., 2014; Tingvall & Ljungwall, 2012) by examining agricultural export-led growth in Africa; a region where the agricultural path of development and growth is paramount because of the relative high reliance on agricultural exports (Fosu, 1990). No study has made this distinction to understand the export-growth dynamics purely from an African perspective in a meta-analysis. Second, our sample of primary studies covers 29 African countries. Thus, we provide the first comprehensive analysis of the agricultural export-led growth hypothesis in Africa in recent decade from a meta-analysis perspective. Moreover, we employed recent meta-regression estimation techniques (i.e., mixed effect multilevel modelling) which help to deal with the likelihood of dependence in estimates from one primary study and between-study heterogeneity due to the use of data from different countries in the primary studies. Finally, we contribute to the extant literature by providing evidence on the factors that account for the varied empirical results reported in the literature concerning agricultural export-led growth in Africa. Although, several attempts have been made in the literature to explain the heterogeneity in the empirical evidence regarding export-led growth (Mookerjee, 2006; Sannassee et al., 2014; Tingvall & Ljungwall, 2012), our study is the first in the area of agricultural export with emphasis on Africa.

The remainder of the article is structured as follows. The second section presents the literature and hypothesis development. The third section discloses the methodology adopted. The fourth section covers the results and discussions. Finally, the fifth section concludes and outlines some policy implications.

Related Literature and Hypotheses Development

Export-led Growth: Theory and Arguments

The question of whether agricultural export is still a viable policy option to spur growth has received considerable attention in the literature. However, the empirical literature on the relationship between agricultural export and economic growth for the poor can be said to be mixed and inconclusive. We observe strong and compelling arguments being put forth in favour and against the theory of export-led growth for the poor. In the section that follows, we present a brief discussion of the arguments.

An export growth strategy is believed to engender an increase in wealth per capita for the poor in the world (Foster, 2006; Fosu, 1990). Fosu (1990, pp. 831–832) argues as follows:

first, export development allows the home country to concentrate investment in those sectors where it enjoys a comparative advantage. The resulting specialization is likely to augment overall productivity. Second, the larger international market permits economies of scale to be realized in the export sector. Third, worldwide competitive pressures are likely to reduce inefficiencies in the export area and results in the adoption of more efficient techniques in the overall traded-goods sector. Finally, a larger export sector would make available more of the resources necessary to import in a more-timely manner both physical and human capital, including advanced technologies in production and management, and for training higher quality labour.

This argument underscores the export-led growth hypothesis.

Another argument is that in an open economy, export growth leads to increase in employment, and thus reduces poverty in the non-farm sectors (Nicita, 2008). The implication is that skilled workers and urban areas benefit the most from export growth from the welfare perspective. Consequently, export-led growth only has a small effect on overall poverty (Nicita, 2008). Dorosh and Mellor (2013) argue that poverty reduction-growth indicators should focus on employment growth through agricultural export. Indeed, agricultural export, in particular, has been found to cure lower income (Dawson, 2005; Johnston & Mellor, 1961; Sanjuán-López & Dawson, 2010).

Another important argument sits within the empirical evidence of a mixed effect of agricultural export in the disaggregated form (Gilbert et al., 2013; Siaw et al., 2018; Yifru, 2015). The implication is that it is not all forms of agricultural export that prompt growth in Africa. For example, coffee, banana and oilseed exports spur growth while cocoa and pulses exports have a negative and insignificant effect on growth. The findings from this strand of the literature suggest that countries may need to concentrate investment in agricultural produce where they enjoy comparable advantage. In short, the evidence thus far points to highly mixed and inconclusive results on the agricultural elasticity of growth.

Agricultural Export-led Growth Hypothesis in Africa

Several studies have tested the agricultural export-led growth hypothesis in Africa but reported mixed and inconclusive results. The empirical evidence ranges from either the presence or absence of agricultural export-led growth to mixed results when agricultural exports are disaggregated into the various crop groups. The first strand of the literature provides a robust and consistent empirical support for the presence of agricultural export-led growth in Africa. For instance, Alam and Myovella (2016) examined the causality between agricultural export and economic growth using time series data for Tanzania over the period 1980–2010. According to the results of the vector autoregressive (VAR) model, agricultural exports Granger cause economic growth. Bakari (2017) investigated the long run

and the short run impacts of vegetable exports on economic growth. The author applied VECM on time series data for Tunisia over the period 1970–2015 and found that vegetable exports have a positive effect on economic growth in the long run and short run. In Nigeria, agricultural exports contribute positively to economic growth, supporting the agricultural exports-led growth hypothesis (Ijirshar, 2015; Ojo et al., 2014; Oluwatoyese et al., 2016). Moreover, in the presence of substantial mineral export, export-led growth through agriculture is found in Angola (Zayone et al., 2020).

Another strand of the literature showed that when agricultural exports are employed in a disaggregated form, the empirical results have mainly been mixed. For example, Gilbert et al. (2013) found that agricultural exports (i.e., coffee, banana and cocoa) have mixed effects on economic growth in Cameroon based on times series data for the period 1975–2009 using the VECM model. Importantly, coffee and banana exports have a positive and significant relationship with economic growth while cocoa export was found to have a negative and insignificant effect on economic growth. Similarly, Yifru (2015) provides empirical evidence from the VECM model which shows that agricultural exports (i.e., coffee, oilseed and pulses) had mixed effects on economic growth in Ethiopia during the period 1973–2013. Specifically, coffee export and oilseeds export have a positive and significant relationship with economic growth while pulses export was found to have negative and insignificant effect on economic growth in the short run and positive but insignificant in the long run. Using time series quarterly data for Ghana from 1990 to 2011, Siaw et al. (2018) examined the relationship between agricultural export (i.e., cocoa, pineapple and banana) and economic growth. The findings from the autoregressive distributed lag (ARDL) model demonstrated that cocoa export has a positive and significant impact on economic growth while the export of pineapple and banana has a negative effect on economic growth with an insignificant effect of pineapple export in both the long run and short run. Additionally, processed agricultural exports have a positive relationship with economic growth whereas unprocessed agricultural exports have a negative relationship with economic growth in South Africa under a VECM framework (Mlambo et al., 2019).

Other studies show no effect of agricultural export on economic growth. Using a panel dataset for 15 ECOWAS (i.e., the Economic Community of West African States) countries for the period 1980–2013, Edeme et al. (2016) evaluated the impact of agricultural exports on economic growth. The results from fixed effects and random effects models showed that agricultural exports have not impacted significantly on economic growth. Simasiku and Sheefeni (2017) analysed the relationship between agricultural export and economic growth in Namibia. Using time series quarterly data for the years 1990–2014 and the VECM, agricultural exports have a positive but insignificant effect on economic growth. In short, whether agricultural export is growth in Africa is still an open empirical question. We fill this gap by testing whether the elasticity estimate of agricultural export on economic growth varies systematically depending on the characteristics of the data and publication in a meta-analysis framework. We do this by testing the following null hypothesis:

H₁: There is no publication bias in the agricultural export-growth literature in Africa.

H₂: There is no overall effect of agricultural export on economic growth in Africa.

Methodology

The collection of primary studies from which metadata is extracted is the key cornerstone of meta-analysis. We started the collection of primary studies using the Google scholar search engine. Our motivation for using Google scholar stems from the broad range of papers that it covers, particularly, the rich mixture of peer-reviewed and non-peer-reviewed papers. This advantage is noted in contemporary meta-analysis practices (Asongu, 2015; Stanley & Doucouliagos, 2012), which argue for the inclusion of both published and unpublished studies as a principle of sound meta-analysis procedure that limit the impact of selection bias (Stanley & Doucouliagos, 2012).

Literature Search and Retrieval Strategy

To retrieve the relevant studies for inclusion and in-depth analysis, we adopted a two-stage process. We began the first stage by adjusting the number of search results per page from the default 10 to 20 articles. Following this, we inserted the keywords, ‘agricultural export’, ‘growth’, ‘economic growth’, ‘economic development’ and ‘Africa’ into the advanced search option where we required at least one of these terms in the Title, Abstract or Keywords of the studies. We reviewed the first 25 pages, yielding 500 hits for screening.

Our screening criteria for inclusion of an article in the final list for in-depth analysis are as follows. (a) The study should be empirical in nature and examine a sample of African countries in the broader sense of developing countries from a cross-country point of view or a single African country. (b) The study should examine the role of agricultural export in economic growth, not general export or aggregate export. (c) The study should report standard errors or contain sufficient information to compute standard errors (i.e., *t*-statistics and *p*-values). (d) The study should report at least one empirical estimate quantifying the effect of agricultural export on economic growth. Consequently, the final sample of relevant studies at the end of Stage 1 included 16 studies. Appendix A1 contains a list of these studies.

Meta Data Extraction Strategy

The search and retrieval process produced a total of 16 studies which are used for the extraction of meta data in the study. We only include regression estimates associated with the relationship between agricultural export and economic growth. Other regression estimates that examine (a) threshold effect and (b) conditional effect of agricultural export on economic growth are excluded to ensure a basic

level of homogeneity in our data sample (Havranek et al., 2016). This criterion produced a total of 68 estimates covering the period 2010–2020. In this meta-analysis, we focus on variants of the following model used in the literature to examine the agricultural export-led growth hypothesis:

$$\text{Growth}_t = \alpha + \beta_1 \text{Agricultural Export}_t + \sum_{j=1}^N \beta_j W_{j,t} + \varepsilon_t \quad (1)$$

where t is a time index and W is a vector of control variables which includes trade openness, capital investment, labour force participation rate, vector error correction model dummy, journal impact factor and income level dummy. The inclusion of these important variables is motivated by the neoclassical growth theory which criticises the simple bivariate causality analysis as prone to spurious correlations (Awokuse & Xie, 2015; Edwards, 1993). The neoclassical growth theory suggests that trade openness, capital investment and labour force are critical for economic growth (Ghazouani et al., 2020). As characteristics of the dataset, we classified the sample countries assessed in the primary study into low-income, lower middle-income and upper middle-income countries. Additionally, we control for journal quality by using RePEc's (Research Papers in Economics') recursive impact factor. We contend that this measure captures aspects of study quality that other characteristics of the studies included do not. We used the RePEc database for journal raking because it covers almost all economics journals and working paper series. It is important to clarify that the inclusion of income levels and journal quality or impact factor is to account for the unobserved heterogeneity and characteristics/determinants of publications which are also worthwhile in a robust assessment of publication bias. Accordingly, controlling for these characteristics enables the present study to also assess whether income levels and journal quality matter for the size of the reported agricultural export-led growth in Africa.

Estimating the Mean Effect Size

Consistent with previous meta-analysis studies (Mookerjee, 2006; Tingvall & Ljungwall, 2012), we adopted the partial correlation coefficient (PCC) to standardise the effect sizes collected from primary studies into a common metric as individual estimates collected are distinct in their measurement of agricultural export and economic growth, and thus, not comparable. PCC is a measure of the relationship between a dependent variable and an independent variable of interest, while holding all other variables constant (Stanley & Doucouliagos, 2012). We derived the PCC for each reported regression coefficient that examines the relationship between agricultural export and economic growth using the following equation.

$$\text{PCC}_{is} = \frac{t_{is}}{\sqrt{t_{is}^2 + df_{is}}} \quad (2)$$

where PCC_{is} represents the partial correlation coefficient from regression coefficient i in primary study s . t_{is} represents the t -statistic corresponding to the regression

coefficient, and df_{is} denotes the associated degrees of freedom. Following the conversion of each reported regression coefficient into PCC, we estimate the corresponding standard error using the following equation.

$$PCC\_SE_{is} = \frac{PCC_{is}}{t_{is}} \quad (3)$$

where PCC_SE_{is} represents the standard error of the partial correlation coefficient from regression coefficient i in primary study s , and t_{is} represents the t -statistic corresponding to the regression coefficient.

Assessing Publication Bias

Publication selection bias is a great concern in empirical literature because it conceals the true effect of policy variables and/or may cause distortion to the true effect of policy variables. Publication selection bias occurs when the various actors (i.e., authors, reviewers and editors) in the publishing process have preference for statistically significant results or those results that are consistent with mainstream theory (Stanley, 2008). Available meta-analysis literature shows a significant presence of publication selection bias in economics (Mookerjee, 2006; Stanley & Doucouliagos, 2012; Tingvall & Ljungwall, 2012).

Following previous meta-analysis literature (Doucouliagos & Stanley, 2009; Stanley & Doucouliagos, 2012), we present formal tests for potential publication selection bias using funnel plots and funnel asymmetry test (FAT). The funnel plot provides visual test of publication bias. In the case of the FAT, the relationship between PCC and its standard errors is examined by estimating the regression equation below.

$$PCC_i = \beta_0 + \beta_1 PCC\_SE_i + \varepsilon_i \quad (4)$$

where PCC reflects the partial correlation coefficient, PCC_SE denotes the standard errors of the PCC, ε_i represents the error term, β_0 measures the overall effect of agricultural export on economic growth and β_1 accounts for the presence of publication bias in the literature. We estimate the FAT equation using three main econometric approaches, namely, mixed effects (ME), weighted least squares (WLS) and fixed effects (FE) regression techniques. The ME regression is the primary estimation technique while WLS and FE are adopted to ensure consistency and robustness of the estimates to alternative estimation strategies. The WLS regression technique is principally adopted in meta-analysis studies to ensure that precise studies are given more weight and to correct for the presence of heteroscedasticity (Stanley, 2008). The use of the FE technique is driven primarily by the need to account for endogeneity emanating from the omission of study characteristics that have the potential to affect both the PCC and its standard errors. Following prior studies, we use the inverse of standard error of the PCC as

the primary weight (i.e., $1/PCC\_SE$), which is referred to as *precision*. Thus, the primary weighted regression is formalised as below.

$$\frac{PCC_i}{PCC\_SE_i} = \beta_1 + \beta_0 \frac{1}{PCC\_SE_i} + \varepsilon_i \frac{1}{PCC\_SE_i} \quad (5)$$

where $\frac{PCC_i}{PCC\_SE_i}$ denotes the reported *t*-statistics, PCC_SE represents the standard errors of the PCC, ε_i shows the error term, β_0 measures overall effect of agricultural export on economic growth and β_1 accounts for the presence of publication bias in the literature. Under FAT, the following hypotheses are examined: First, we test the null hypothesis of no publication bias (i.e., $H_0: \beta_1 = 0$). As such, a rejection of the null hypothesis implies the presence of publication bias in the literature while the sign depicts the direction of the publication bias. A positive sign implies a publication bias for the agricultural export growth hypothesis. If the sign is negative, that implies a publication bias for the deleterious effect of export hypothesis (Glezakos, 1973). Second, we test for the null hypothesis that there is no overall effect of agricultural export on economic growth in Africa (i.e., $H_0: \beta_0 = 0$) in line with the evidence in Mookerjee (2006). This test is called the precision effect test (PET) and measures whether the overall effect of agricultural export on economic growth is statistically and significantly different from zero after accounting for publication bias. As such, if the null hypothesis (i.e., $H_0: \beta_1 = 0$) is rejected, that signifies the presence of an overall true effect of agricultural export on economic growth in Africa.

Metadata Description

Table 1 presents a description of all the variables we collected from the selected primary studies. We followed previous studies and collected data relating to measures of PCC, measures of standard errors of PCC, *t*-statistics of the effect sizes, econometric estimation techniques adopted, control variables employed in primary studies to account for omitted variables bias and the publication characteristics. Table 1 reports the descriptive statistics of these variables.

In Table 1, we observe that the typical estimate of the effect of agricultural export on economic growth as a partial correlation coefficient is 0.160, which would be considered a moderate effect in line with the guidelines of Doucouliagos (2011) for the interpretation of PCC in economics. In our sample, labour force participation rate is controlled for in 41.2% of regressions, trade openness in 13.2% and capital investment in 57.4%. Also, in Table 2, we observed that out of the 29 African countries examined in the primary studies, 11.8% constitute upper middle-income countries, 14.7% are low-income countries while 73.5% belong to the lower middle-income countries. The mean impact factor of studies included in the meta-analysis is 0.338 with standard deviation of 0.477. Interestingly, more than half of the sampled effect size is estimated using VECM in time series dataset.

Table 1. Descriptive Statistics.

Variable	Definition	Obs.	Mean	Std. Dev.
PCC	Partial correlation coefficient.	68	0.160	0.420
PCC SE	Inverse standard error of PCC.	68	0.156	0.047
TSTAT	Estimated t-statistics of effect size.	68	1.656	4.281
LABOUR FORCE	Dummy, 1 if the agricultural export-growth model estimated in primary study controlled for labour force participation and zero otherwise.	68	0.412	0.496
TRADE	Dummy, 1 if the agricultural export-growth model estimated in primary study controlled for trade openness and zero otherwise.	68	0.132	0.341
CAPITAL	Dummy, 1 if the agricultural export-growth model estimated in primary study controlled for capital investment and zero otherwise.	68	0.574	0.498
UMI	Dummy, 1 if the primary study is based on a country classified as upper middle-income country by the World Bank country classification by income level and zero otherwise.	68	0.118	0.325
LMI	Dummy, 1 if the primary study is based on a country classified as lower middle-income country by the World Bank country classification by income level and zero otherwise.	68	0.735	0.444
IMPACT	Journal impact factor collected from IDEAS/RePEc as on 25 September 2021.	68	0.338	0.477
VECM	Dummy, 1 if research methodology adopted in primary study is vector error correction model and zero otherwise.	68	0.529	0.503

Source: The authors.

Table 2. List of African Countries Examined in the Primary Studies.

S/N	Countries Examined	Income Classification	References
1	Algeria	UMI	Sanjuán-López and Dawson (2010); Bakari and Mabrouki (2018)
2	Benin	LMI	Sanjuán-López and Dawson (2010); Ijuo and Andohol (2020); Edeme et al. (2016)
3	Burkina Faso	LI	Sanjuán-López and Dawson (2010); Edeme et al. (2016)
4	Cameroon	LMI	Sanjuán-López and Dawson (2010); Gilbert et al. (2013)
5	Cape Verde	LMI	Edeme et al. (2016)
6	Congo Republic	LMI	Sanjuán-López and Dawson (2010)
7	Cote d'Ivoire	LMI	Sanjuán-López and Dawson (2010); Ijuo and Andohol (2020); Edeme et al. (2016)
8	Egypt	LMI	Bakari and Mabrouki (2018)
9	Ethiopia	LI	Yifru (2015)
10	Gambia	LI	Sanjuán-López and Dawson (2010); Edeme et al. (2016)
11	Ghana	LMI	Sanjuán-López and Dawson (2010); Twumasi-Ankrah and Wiah (2016); Siaw et al. (2018); Ijuo and Andohol (2020); Edeme et al. (2016)
12	Guinea	LI	Edeme et al. (2016)
13	Guinea-Bissau	LI	Sanjuán-López and Dawson (2010)
14	Kenya	LMI	Sanjuán-López and Dawson (2010)
15	Lesotho	LMI	Sanjuán-López and Dawson (2010)
16	Liberia	LI	Edeme et al. (2016)
17	Madagascar	LI	Sanjuán-López and Dawson (2010)
18	Mali	LI	Edeme et al. (2016)
19	Morocco	LMI	Sanjuán-López and Dawson (2010); Bakari and Mabrouki (2018)
20	Namibia	UMI	Simasiku and Sheefeni (2017)
21	Niger	LI	Edeme et al. (2016)
22	Nigeria	LMI	Oluwatoyese et al. (2016); Ijuo and Andohol (2020); Ijirshar (2015); Ojo et al. (2014); Verter and Bečvářová (2016); Edeme et al. (2016)
23	Senegal	LMI	Sanjuán-López and Dawson (2010); Edeme et al. (2016)
24	Sierra Leone	LI	Edeme et al. (2016)
25	South Africa	UMI	Sanjuán-López and Dawson (2010); Mlambo et al. (2019)
26	Tanzanian	LMI	Alam and Myovella (2016)
27	Togo	LI	Edeme et al. (2016)
28	Tunisia	LMI	Sanjuán-López and Dawson (2010); Bakari (2017); Bakari and Mabrouki (2018)
29	Zambia	LI	Sanjuán-López and Dawson (2010)

Source: The authors.

Notes: Income classification is based on World Bank's country classification by income level in 2021. LI = Low-income countries; LMI = Lower middle-income countries; UMI = Upper middle-income countries.

Results and Discussion

Publication Bias for the Agricultural Export Elasticity of GDP

The funnel plot in Figure 1a displays the PCC of the average elasticity estimates of agricultural export on horizontal axis and the precision (i.e., the inverse of standard error of PCCs) on the vertical axis. The funnel plot provides visual test of publication bias (Stanley & Doucouliagos, 2010). We can observe the PCCs are relatively asymmetrically distributed around the mean PCC. This suggests that there will be publication bias with regards to mean elasticity estimates of agricultural export on growth.

The funnel plot in Figure 1b presents a simple meta-regression model. The vertical line shows agricultural export fixed effects on economic growth. Two

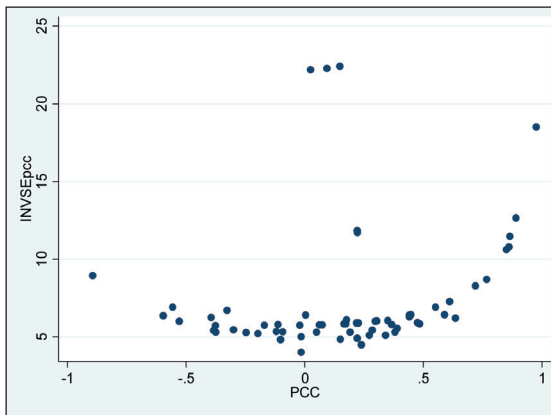


Figure 1a. Funnel Plot of PCC.

Source: The authors.

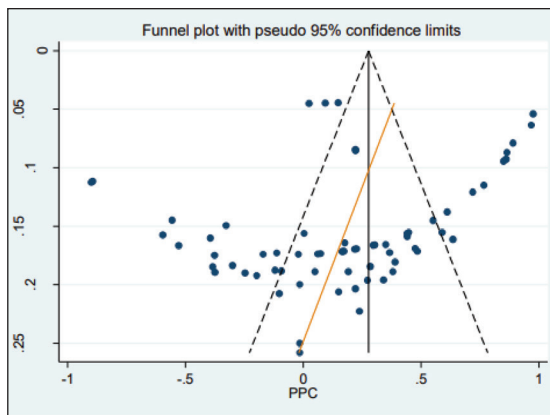


Figure 1b. Funnel Plot of PCC.

Source: The authors.

dashed lines joining the funnel's vertical line indicate 5% statistical significance. Outside these boundaries, estimates differ from the fixed-effects. These estimates constitute over 5% of the data. This may indicate publication bias or heterogeneity in data and methods. The remaining dashed line is our simple meta-regression model's effect size vs. standard error regression line. The negative slope and slightly positive intercept suggest publication bias for the reported negative relationship between agricultural export and economic growth. Next, we engaged in a formal test for publication bias.

Table 3 presents the regression analysis testing the null hypothesis of no publication bias (FAT) and the null hypothesis that there is no overall effect of agricultural export on economic growth in Africa (PET). The results of three regression estimation techniques are reported under two main approaches, namely, weighted and unweighted. Under the weighted models, we use the inverse of standard error of the PCC as the primary weight similar to prior meta-analysis studies such as Havranek et al. (2016). The results suggest significant presence of a negative publications bias, which is consistent with the deleterious effect of export instability hypothesis (Glezakos, 1973). Additionally, we find that elasticity estimate of agricultural export on economic growth is significantly positive, suggesting agricultural export-led growth in Africa (Ijirshar, 2015; Ojo et al., 2014; Oluwatoyese et al., 2016; Zayone et al., 2020).

Meta-regression Analysis Explaining Why Agricultural Export Estimates Vary

Next, we test whether the elasticity estimate of agricultural export on economic growth varies systematically depending on the characteristics of the data and publication. In doing this, we follow Havranek et al. (2012) and adopt the mixed-effect multilevel modelling.¹ The use of this methodology is motivated by

Table 3. Results of FAT and PET.

	Weighted			Unweighted		
	WLS	FE	ME	OLS	FE	ME
Publication bias	-1.898 (2.093)	-8.020*** (1.447)	-8.283*** (1.583)	-2.812** (1.164)	-4.305*** (1.167)	-2.916*** (1.033)
Constant (true effect)	0.471 (0.313)	1.283*** (0.192)	1.476*** (0.265)	0.598** (0.214)	0.831*** (0.182)	0.613*** (0.170)
Number of estimates	68	68	68	68	68	68
R-squared	0.055	0.549		0.100	0.172	
Number of studies	16	16	16	16	16	16

Source: The authors.

Notes: WLS denotes Weighted least squares regression. FE denotes Fixed effects regression. ME denotes Mixed-effect multilevel regression. OLS denotes Ordinary least squares regression. FAT represents funnel asymmetry test. PET denotes precision effect test. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

the following reasons, namely, (a) the higher likelihood of dependence of estimates collected from one primary study, and (b) the substantial level of between-study heterogeneity due to the use of data from different countries in the primary studies.

Table 4 presents the results of the meta-regression analysis of the effect of agricultural-led growth nexus in Africa while controlling for other explanatory variables (i.e., estimation methods, income levels, impact factor, trade openness, capital investment and labour force participation rate). In column (1), we report results of the meta-regression where we control for data and publication characteristics. In column (2)–(4), we account for trade openness, capital investment, and labour force participation rate, respectively. Finally, in column (5), we report the full model controlling for all explanatory variables.

The results suggest a significant presence of negative publication bias after controlling for additional explanatory variables, which is consistent with the deleterious effect of the export instability hypothesis (Glezakos, 1973). On the true effect of agricultural export on economic growth, we find a consistently robust positive and significant growth effect ranging from 0.48 to 1.00. From column (5), a one-percentage point increase in agricultural export leads to a 0.76 percentage point increase in economic growth. The magnitude of the agricultural export elasticity of GDP is 10 times greater than those reported in Sanjuán-López and Dawson (2010). In line with Doucouliagos (2011) economic guidelines for

Table 4. Meta-regression Analysis of Agricultural Export Led Growth.

	(1)	(2)	(3)	(4)	(5)
Variables	ME	ME	ME	ME	ME
I/PCC_SE	0.523***	0.484***	0.733***	1.004***	0.763***
(True effect)	(0.172)	(0.172)	(0.220)	(0.280)	(0.184)
UMI_Dummy	-0.627***	-0.595***	-0.554**	-0.626***	-0.720**
	(0.191)	(0.199)	(0.229)	(0.169)	(0.320)
IMPACT factor	0.084***	0.086***	0.064***	0.038*	0.048***
	(0.016)	(0.018)	(0.016)	(0.020)	(0.010)
VECM_Dummy	0.688***	0.712***	0.655***	0.596***	0.632***
	(0.171)	(0.189)	(0.166)	(0.149)	(0.108)
TRADE_Dummy		0.187			0.351***
		(0.186)			(0.105)
CAPITAL_Dummy			-0.201		0.302
			(0.152)		(0.370)
LABOUR FORCE_Dummy				-0.485**	-0.646*
				(0.222)	(0.374)
Constant	-5.214***	-5.280***	-5.588***	-6.436***	-6.066***
(publication bias)	(1.143)	(1.174)	(1.368)	(1.429)	(1.244)
Wald χ^2	408.76	354.00	626.08	162.19	151.33
p-Value	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Observations	68	68	68	68	68
Number of studies	16	16	16	16	16

Source: The authors.

Notes: Robust standard errors in parentheses*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

assessing the strength of a correlation coefficient, agricultural export has a moderate effect on growth for the poor in Africa.

The estimated meta-regression coefficients for income level (i.e., UMI_Dummy) indicate the mean difference in the elasticity estimate of agricultural export in upper middle-income countries compared to other countries (i.e., low-income and lower-middle income countries). Interestingly, the UMI_Dummy variable shows that the mean agricultural export contribution to economic growth is lower by 0.72 in Model 5. The net effect is that agricultural export elasticity of GDP is 0.043 [$0.763 + (-0.720)$] in a rich country in Africa. This result complements and extends empirical evidence in Simasiku and Sheefeni (2017) by showing that the positive growth effect of agricultural export is statistically significant for the rich in Africa. In line with Doucouliagos (2011) economic guidelines for assessing the strength of a correlation coefficient, agricultural export has a small effect on growth for the rich in Africa. This result reinforces the fact that higher income countries may achieve high economic growth from non-agricultural export (Mlambo et al., 2019; Sanjuán-López & Dawson, 2010). This is consistent with empirical evidence on the process of structural changes whereby the share of agriculture in GDP decreases as countries develop (Eberhardt & Teal, 2013).

Furthermore, the results indicate that there is a positive relationship between *IMPACT* factor and mean effect of agricultural export, suggesting that a high impact factor journal reports a higher agricultural export led growth than low impact factor journals. Accordingly, journal quality matters for the size of the reported agricultural export led growth in Africa. The estimated meta-regression coefficients for the estimation method (i.e., VECM_Dummy) indicate the mean difference in the elasticity estimate of agricultural export compared to other methods (i.e., ordinary least squares, fixed effects, random effects, vector autoregression). We find that studies using the VECM method report approximately a 0.63 higher mean effect of agricultural export on growth under Model 5. Accordingly, the use of other methods in the primary studies' regression significantly reduces the size of the growth effect of agricultural export in Africa.

For the control variables, we find that trade openness is positively associated with the estimated size of agricultural export-led growth. Thus, in countries with greater trade openness, the growth effect of agricultural export is stronger. Additionally, we find that labour force participation rate is negatively associated with the estimated size of growth effect of agricultural export. Although human capital is crucial for economic growth in Africa (Gilbert et al., 2013; Siaw et al., 2018), the negative effect of labour force on the growth potential of agricultural export is suggestive of the need for better human capital development through education, skills and training, and better health facilities for the poor in Africa.

Conclusion and Policy Implications

We review a decade of empirical research on agricultural export-led growth in Africa. Previous studies have found a great deal of variation in the effect of agricultural export on economic growth. The mixed results in the literature prompt two questions, namely, (a) whether publication bias is present in the agricultural export-growth literature in Africa, and (b) if there is an overall effect of

agricultural export on economic growth. Using meta-analysis, we collected 68 estimates from 16 studies and find that agricultural export leads to growth in low-income and lower middle-income African countries. We find significant evidence of negative publication bias in the literature. Our meta-analysis shows that several factors affect the agricultural export impact on economic growth in Africa. We find that controlling for income level, trade openness and capital investment affects the results. When primary studies consider income level, agricultural export-led growth is less likely. This result highlights the importance of a country's level of economic development in the agricultural export-led growth strategy. When primary studies control for trade openness, agricultural export-led growth is more likely. The literature suggests that trade openness has a mixed effect on economic growth in Africa (Quaicoe et al., 2017). Our meta-analysis reveals that trade openness enhances the effect of agricultural export on economic growth. The attendant meta-analysis also shows that when the VECM econometric approach is employed, the agricultural export-led growth is more apparent.

The findings reported in this study have the following implications. First, we show that export promotion should be targeted at agricultural output in low-income and lower middle-income countries whereas upper middle-income countries in Africa may focus on non-agricultural export. By this, we provide strong empirical basis for policy makers to draw on the right lessons to form policy direction. Thus, policy decision on resource allocation could be improved. Additionally, the existence of an income differential effect on the mean elasticity estimate of agricultural export implies that agricultural export-growth strategy has a pronounced effect for the poor in Africa. The result suggests that the poor in Africa could follow an agricultural growth strategy because it is a promising means to increasing income for the poor (Dorosh & Mellor, 2013; Johnston & Mellor, 1961).

The findings obviously leave room for further research especially with respect to assessing how the findings in this study withstand empirical scrutiny in other continents. Moreover, additional meta studies focusing on inclusive economic growth instead of economic growth would provide more insights into the sustainable development agenda.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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Appendix A1. List of References Included in the Meta-analysis.

#	Authors	Year of Publication	Title of Study
1	Sanjuán-López and Dawson	2010	Agricultural exports and economic growth in developing countries: A panel cointegration approach
2	Gilbert et al.	2013	Impact of agricultural export on economic growth in Cameroon: Case of banana, coffee and cocoa
3	Ojo et al.	2014	Agricultural export and economic growth in Nigeria: A multivariate Johansen cointegration analysis
4	Ijirshar	2015	The empirical analysis of agricultural exports and economic growth in Nigeria.
5	Yifru	2015	Impact of agricultural exports on economic growth in Ethiopia: The case of coffee, oilseed and pulses
6	Oluwatoyese et al.	2016	Agricultural export, oil export and economic growth in Nigeria: Multivariate co-integration approach
7	Alam and Myovella	2016	Causality between agricultural exports and GDP and its implications for Tanzanian economy
8	Edeme et al.	2016	A comparative analysis of the impact of agricultural export on economic growth of ECOWAS countries
9	Verter and Bečvářová	2016	The impact of agricultural exports on economic growth in Nigeria
10	Twumasi-Ankrah and Wiah	2016	Testing for long-run relation between economic growth and export earnings of Cocoa in Ghana using co-integration techniques
11	Bakari	2017	The impact of vegetables exports on economic growth in Tunisia
12	Simasiku and Sheefeni	2017	Agricultural exports and economic growth in Namibia
13	Siaw et al.	2018	Agricultural exports and economic growth: A disaggregated analysis for Ghana
14	Bakari and Mabrouki	2018	The impact of agricultural trade on economic growth in North Africa: Econometric analysis by static gravity model
15	Mlambo et al.	2019	An investigation of the contribution of processed and unprocessed agricultural exports to economic growth in South Africa
16	Ijuo and Andohol	2020	Agricultural exports and economic growth in selected west African countries

Source: The authors.

Note

1. For detailed discussion on the ME technique in meta-analysis, interested readers may consult Havranek and Irsova (2011) and Havranek et al. (2012).

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