

The Impact Of Fdi On Export Sophistication: A Case Of Sub-Saharan Africa

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Abstract:

Sub-Saharan Africa (SSA) stands at a transformative crossroads, seeking pathways to propel economic growth, fortify export diversification, and enhance trade sophistication. This paper presents a comprehensive analysis of how Foreign Direct Investment (FDI) serves as a pivotal force in shaping export sophistication hence fostering sustainable economic advancement within the region. Employing a rigorous methodological approach encompassing pooled ordinary least Squares (OLS), two-way fixed effects with driscoll-kraay and generalized method of moments (GMM) to mitigate endogeneity. The study evaluates a panel of 38 sub-Saharan countries spanning 2003 to 2022. The empirical findings consistently unveil a positive, and statistically significant relationship between FDI and export sophistication across the region. These results underscore the pivotal role of FDI as a potent catalyst for elevating export quality, fostering diversification, and augmenting trade complexity within Sub-Saharan Africa.

Keywords: Foreign Direct Investment (FDI), Export Sophistication, Sub-Saharan Africa (SSA), Economic Growth, PRODY

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I. Introduction

The export-led growth hypothesis (ELGH) has long dominated economic discourse, advocating that multiplying exports drives economic advancement (Fraser et al., 2020; Priyankara, 2018; Grace & Otieno, 2014). While initially esteemed, recent studies have challenged ELGH, revealing it as not universally decisive in fostering economic growth (Epaminondas, 2002). Rather, emphasis has shifted toward export sophistication, where nations restructuring their exports have experienced accelerated growth (Hausmann et al., 2007; Jarreau & Poncet, 2012). This phenomenon, termed export sophistication, underpins the renowned success of the East Asian miracle.

Among the myriad determinants of export sophistication, Foreign Direct Investment (FDI) emerges as a pivotal factor (Weldemichael, 2012; Görg & Strobl, 2001). FDI, characterized by foreign entities' capital allocation in local firms, wields considerable influence over a nation's economic landscape. It catalyzes growth, fosters knowledge exchange, and stimulates employment opportunities (Piteli, 2017).

Sub-Saharan Africa (SSA), a focal point for economic development and foreign investment, has experienced a notable upsurge in FDI inflows. Yet, comprehending the precise impact of FDI on SSA's economic and industrial frameworks remains intricate. Delving into the relationship between FDI and export sophistication within SSA becomes imperative (Görg & Strobl, 2001).

It is important to note that the SSA region grapples with economic diversification challenges (Gelb, 2010; Kolovich, 2017), impeding strides toward export sophistication. Factors like institutional limitations, technological deficiencies, human capital gaps, and resource dominance perpetuate economic stagnation and thwart diversification efforts. Grim statistics from the International Monetary Fund (IMF) and Global Economic Diversification Index underscore Africa's struggle, with many SSA nations ranking among the least diversified (Usman & Landy, 2021; Prasad et al., 2022).

It then follows that SSA's economic structure remains fragile, besieged by crises ranging from debt burdens to climate change and recent geopolitical conflicts. With the IMF projecting modest growth for the region, governments face an urgent need to rejuvenate economies. Restructuring export compositions to foster sophistication emerges as a potential avenue for growth. However, barriers persist, hindering SSA nations' capacity for export sophistication. In this context, exploring the role of FDI in enabling export sophistication within SSA becomes crucial. Studies like Harding & Javorci (2012) affirm the positive correlation between FDI and export sophistication, suggesting FDI aids developing-country exports in catching up with quality benchmarks. Understanding this relationship is critical for SSA, a region yearning for the transformative growth witnessed in

East Asia through export sophistication. Therefore, this paper aims to scrutinize the impact of FDI on export sophistication in SSA, akin to the successes witnessed in China and other Far Eastern nations.

II. Literature Review

Explanation of export sophistication

Export sophistication, as defined by Fortunato & Carlos Razo (2014), is the economic income associated with a country's export portfolio, which is commonly measured as an outcome-based indicator linked to GDP per capita (Hausmann et al., 2007). The quantification of export sophistication was pioneered by Hausmann et al. (2007), who used a weighted average of GDP per capita of product-exporting nations, with weights indicating these nations' comparative advantages in producing specific items. Their findings stressed a direct relationship between a country's income and the sophistication level of its exported commodities, implying that wealthy countries export more sophisticated items than economically disadvantaged competitors.

Further scholarly research has elaborated on this concept, highlighting nuanced aspects of export sophistication. Rodrik (2006) and Balassa (1965), for example, investigate the structural transformation associated with export sophistication, stressing the shift from primary goods to more technologically complex exports as a critical driver of economic growth. Rodrik's observations highlight the necessity of expanding export baskets beyond traditional commodities, implying that a shift toward higher-value-added exports promotes long-term economic development.

Furthermore, Amador and Cabral (2008) and Alcala and Ciccone (2004) investigate the factors influencing export sophistication, identifying elements other than GDP per capita that contribute to a country's ability to develop and export sophisticated commodities. They emphasize the importance of investing in human capital, technological innovation, institutional quality, and trade openness in improving a country's export capacities and increasing the sophistication of exported commodities.

Relevance of export sophistication in Sub-Saharan Africa

While literature on export sophistication focusing specifically on Sub-Saharan Africa (SSA) remains sparse, its importance as a driver of economic progress is widely documented. Lin et al. (2017) used panel data to investigate the causal association between export sophistication and income in SSA. Their findings, which were obtained using instrumental variables methodologies and heteroscedasticity identification processes to reduce endogeneity bias, show a significant favorable effect. A 1 percent increase in the export sophistication index was related with a 0.08 percent long-run gain in GDP per capita, showing the critical significance of export sophistication in strengthening regional economic development.

Furthermore, Manuel et al. (2010) offered information on the larger impact of export sophistication in sub-Saharan Africa. According to their findings, countries in Sub-Saharan Africa that achieve more export diversification and sophistication likely to see improvements in their populations' living circumstances. Using newborn mortality rates and life expectancy as dependent variables, their research found a substantial link between export sophistication and better socioeconomic conditions. Improved export sophistication is associated with lower newborn mortality rates and higher life expectancy, showing its critical role in boosting regional societal well-being.

Kohler and Khumalo (2015) emphasize the importance of developing export sophistication in SSA by advocating for coordinated government policy actions. They propose that important areas such as infrastructural enhancements, human capital development, and institutional reform should be prioritized in these efforts. SSA states can effectively improve their export arrangements through these strategic measures, avoiding economic stagnation and over-reliance on commodity dependence due to plentiful natural resources.

Beyond these studies, additional research by Tarp et al. (2018) delves into the nexus between export sophistication and poverty reduction in SSA, highlighting the potential for export sophistication to serve as a catalyst for inclusive economic growth and poverty alleviation within the region.

Sub-Saharan Africa and foreign direct investment

Foreign Direct Investment (FDI) in Sub-Saharan Africa (SSA) has received increased attention in talks about its drivers and consequences for regional economic development. The Ownership-Location-Internalization (OLI) framework and the Eclectic Paradigm seek to explain FDI in SSA, however contextual considerations frequently question their direct relevance in this region. According to empirical studies (Asiedu, 2002), while market size and growth rates have a substantial impact on FDI inflows globally, the fragmented markets and various growth patterns across SSA nations may diminish their influence. Furthermore, weaknesses in infrastructure, notably in the transportation and energy sectors, have been identified as deterrents to FDI (Nunnenkamp & Spatz, 2003).

Institutional and policy issues are equally important in luring FDI to SSA. The importance of political stability and effective governance has been identified (Asiedu, 2006). However, these issues create perceived risks

among investors. Furthermore, trade policies and regulatory frameworks differ across SSA nations, influencing FDI inflows (Bengoia & Sanchez-Robles, 2003). Legal ambiguity and inconsistent enforcement of property rights are additional impediments to FDI (Borensztein et al., 1998).

On the other hand, numerous studies have found a beneficial relationship between FDI and economic growth in SSA (Adegboye & Okorie, 2023). For example, Nyang'oro, (2017); Adegboye et, al (2020) discovered that greater FDI inflows considerably contribute to GDP growth by encouraging capital accumulation and technical innovation. This supports the concept that FDI serves as a catalyst for regional economic growth. FDI has been identified as a significant source of job creation in SSA. According to scholars such as Hyojung, (2022), FDI inflows result in the formation of new firms and industries, lowering unemployment rates and raising the standard of life for the local population.

Foreign direct investment (FDI) is also significant in enabling technology transfer and innovation in SSA. According to Chen et. al (2015) multinational corporations (MNCs) investing in the region frequently provide new technologies and managerial know-how, helping to industry modernization and enhancing productivity.

FDI is further argued to be a key driver of infrastructure development in SSA. Studies (Awodumi, 2023) demonstrate that foreign investors often collaborate with local governments to improve transportation, communication, and energy infrastructure, which, in turn, enhances the overall business environment and attracts more investment. Despite the positive aspects, the literature also acknowledges challenges and risks associated with FDI in SSA. Scholars (Ellis & Okoro, 2015) highlight issues like resource dependency, political instability, and inadequate regulatory frameworks that may hinder the effective utilization of FDI for sustainable development.

There is an emerging focus on the environmental implications of FDI in SSA. Recent studies by Duodu & Mpuure (2023) examine how foreign investments impact the environment, urging policymakers to consider sustainable practices and environmental regulations to ensure responsible FDI.

Empirical evidence on the Impact of FDI on export sophistication

Regarding the matter in question, multiple papers have been presented by researchers. However, most works are not centered on the SSA region. Despite this, they remain relevant to the subject matter as there is a wide consensus of FDI being expected to impact export products and a positive impact in that regard.

Li et. al (2021) assess the impact of FDI regulation relaxing as a result of China's joining of the World Trade Organisation (WTO) on various manufacturing industries. Further, they analyse the inherent drive in the aspect of firm ownership type, mode of trade, product kind. Finally, they make a comparison between intensive and extensive margins. The results indicate a positive impact of FDI on manufacturing exports. This is due to an increase in the export share of FDI enterprises including an increase in export sophistication of private owned enterprises of regular trade and semi-finished products. They conclude that of the two margins of focus, the intensive margin contributes more to this effect than the extensive margin while they also indicate that FDI relaxing has no significant impact on the quality of exports. This paper, however, will not place a focus on trade or FDI liberalisation as most nations in SSA have already opened up to trade inflows and FDI.

Weldemicael (2012) makes a similar observation. However, while they find a positive correlation, they additionally find that institutional quality which is naturally expected to be an impetus for export sophistication is actually not a strong factor. This is because the results indicated that the positive correlation between FDI and export sophistication was actually stronger in countries that exhibited low institutional quality. They also noted that relaxing international capital controls for SSA led to an increase in FDI per capita and export sophistication by about 19 percent and 9.2 percent respectively.

Ozsoy et. al (2021) utilises panel data for different countries to assess the impact of FDI on export sophistication. They find that FDI is a conduit for knowledge spillovers that have the potential to drive export sophistication. However, contrary to Weldemicael (2012) they found that these results were found to be consistent in countries that exhibited higher levels of education, income and globalisation. They stated that this was due to poor investment environments and government policies in those underdeveloped nations. On the other hand, Wamoto, & Nabeshima (2012) found that the similar results only exist in developing nations. Using a dynamic panel data model based on system GMM for 175 countries from 1980 to 2007, they discovered that five-year lagged FDI inflow correlates favorably with both export diversification and sophistication, and FDI stock contributes positively to export sophistication. These findings demonstrate the likelihood of successful capability transfer to and development by local enterprises.

Xu & Lu (2009) focus on China to investigate the matter of discussion. Their results show that industry level export sophistication had a positive relationship with the portion of completely foreign owned companies from Organisation for Economic Co-operation and Development (OECD) including a portion of processing exports from foreign invested enterprises. On the other hand, it had a negative relationship with the share of processing exports of indigenous Chinese enterprises.

Eck & Stephan (2014) assess the impact of FDI on product sophistication. However, they go into more detail by putting together a dataset of Indian manufacturing companies while placing a special focus on product

sophistication and spillovers from FDI. They interrogate the various avenues that facilitate spillovers from multinational corporations to local Indian companies driving the manufacture of sophisticated products. The results show that spillovers from FDI do actually enhance sophisticated product manufacturing.

Still on firm level analysis, Zhang (2015) finds that Foreign direct investment appears to contribute more to export capacity than export upgrading, particularly in labor-intensive/low-tech items; and that high-tech FDI from the developed world appears to be more conducive to export upgrading than low-tech FDI from developing economies.

Stojcic & Edvard (2016) interrogate FDI’s influence on export sophistication in the short and medium term for about 100 countries. While they find a difference in levels of export sophistication among the different categories of the selected countries, their results point to FDI having a positive impact on export sophistication.

Rehman & Noman (2022) use a reverse approach, the look at the impact of China's outward foreign direct investment (OFDI) on export sophistication in investment destinations. The analysis was carried out on a total sample, a region-wise grouped sample (Europe and Central Asia, the Middle East and North Africa, Latin America and the Caribbean, East Asia and Pacific, South Asia, North America, and sub-Saharan Africa), and an income-wise grouped sample (high income, upper middle income, lower middle income, and lower income group sample). The results revealed that Chinese OFDI had a significant and favorable effect on bilateral export sophistication in the entire sample, regions, and income groups. Further in SSA, Gamariel, & Hove (2019) find that FDI positively influences export sophistication. They employ the system generalized method of moments methodology and takes an index of export sophistication into account as a measure of competitiveness. In addition, Li(2019) is discovered that a one-year lag in Chinese ODI influx has had a favorable and considerable influence on the export quality of African host economies via skill spillovers, but no meaningful effect on export diversification. These findings show that Chinese ODI has been beneficial in recent years in boosting African nations' export transformation by raising the share of industrial exports and decreasing the emphasis on natural resource exports.

From the existing literature reviewed, the main hypothesis this paper will carry is that FDI will have a positive impact on export sophistication in the SSA region. The contribution of imports and FDI to a country's technological growth will be reflected in the host country's export sophistication, either directly or indirectly. (Zhu et. al, 2010)

III. Methods

Sample selection and data collection

This study constructs a panel encompassing a sample of 38 nations in Sub-Saharan Africa (SSA). The data spans from 2003 to 2022, aligned with the available data and the study's inception in 2022. The study relies on secondary data obtained from reputable sources, including the World Governance Indicators, Trade Map (developed by the International Trade Centre - ITC), and World Development Indicators.

Model Setting, Estimation Strategy Variable Definition and Analysis Variable Measurement

Table 1: Summary of selected variables and their sources

Variable Nature	Variable name	Variable symbol	Variable description	Source
Dependent	Log of Export Sophistication	lnexpy	Productivity level associated with a specific country's export basket.	Author Calculation using trade and GDP per capita data from International Trade Centre and World Development Indicators
Independent	Foreign Direct Investment	fdi	Net inflows of investment to acquire a long-term management stake (10 percent or more of voting shares) in a company operating in an economy other than the investor's.	World Development Indicators
Control	Ratio of Domestic Credit to the Private Sector	domcred	Financial resources provided to the private sector by financial corporations, such as through loans, purchases of no-equity securities, and trade credits and other accounts receivable, that establish a claim for repayment	World Development Indicators
	Rule of Law	rule	Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police,	World Governance Indicators

			and the courts, as well as the likelihood of crime and violence..	
	Internet	inter	Internet users are individuals who have used the Internet (from any location) in the last 3 months.	World Development Indicators
	GDP Per Capita	lngdppc	Per capita values for gross domestic product (GDP)	World Development Indicators
	Population	lnpop	Counts all residents regardless of legal status or citizenship.	World Development Indicators
	Inflation	inf	Ratio of GDP in current local currency to GDP in constant local currency.	World Development Indicators

Source: arranged by author

Model Setting

The study adopts the methodology derived by Hausmann et al (2007) in constructing export sophistication (EXPY). Hausmann et. al (2007) first generate a PRODY index. They defined this as a weighted average of the per capita GDPs of countries exporting a given product, to represent the income level associated with that product. Prody is calculated for 99 product categories at the HS2 level for the 38 SSA countries between 2008 and 2021. The formula of PRODY index is as below:

$$PRODY_k = \sum_j \left\{ \left(\frac{x_{jk}}{X_j} \right) \div \left(\sum_j \left(\frac{x_{jk}}{X_j} \right) \right) Y_j \right\}$$

Where:

1. k is a particular exported good
2. x is the value of the exported good
3. X is the overall export basket of a particular country
4. Y is the GDP per capita of country j
5. j is a particular exporting country
6. The numerator x_{jk}/X_j represents the value-share of the commodity in the country’s overall export basket.
7. The denominator $\sum_j (x_{jk}/X_j)$ is an aggregate of the value-shares across all countries exporting the good.

After generating the PRODY index, the model then generates time varying export sophistication (EXPY). This is the productivity level associated with a specific country’s export basket. The formula is as below:

$$EXPY_k = \sum_j \left\{ \left(\frac{x_{il}}{X_i} \right) PRODY_i \right\}$$

Where:

1. $EXPY_i$ is the productivity level of country i.
2. (x_{il}/X_i) represents the value shares of the products in the country, i’s total exports.
3. $PRODY_i$ represents the weighted average of the per capita GDPs of country i exporting a given product.
4. l represents a particular product
5. i represents a particular country

The export sophistication (EXPY) variable is then applied to a linear regression model as an independent variable as below.

$$EXPY_{it} = \beta_0 + \beta_1 FDI_{it} + \theta Controls_{it} + a_i + \gamma_t + e_{it}$$

The coefficient β_1 in the equation above examines and records the complete effect of country, i’s FDI at a given time, t on country, i’s EXPY at a given time. The main focus of this study is the equation and its coefficient β_1 . The equation and coefficient also investigate the influence of several elements of foreign direct investment on export sophistication. The study first runs a regression using the overall composite of FDI on export sophistication, which is later accompanied by other determinants of export sophistication.

It is worth noting that the study used fixed effects estimators in the same equation. This conclusion is made mostly because the study includes numerous nations and spans a lengthy time period, i.e. it employs panel data. Ordinary OLS estimators may lead to incorrect findings when dealing with this type of data since they do not control for unobserved heterogeneity (Baltagi, 2008). Fixed or random effects estimations can be performed in such scenarios (Gormley & Mats, 2014).

The usual panel data with fixed effects estimate technique in the equation ends at the term, a_i which denotes and captures the nation fixed factors that affect export sophistication but cannot be controlled for or directly quantified. To improve the robustness, precision, and validity of the test results, the study adds the parameter γ_t , which recognizes time-specific patterns in economic complexity from 2003 to 2022 that have been influenced by factors such as policy. These can be interpreted as observed or unobserved, and when utilized in studies, they create the definition of "two-way fixed effects" because the study controls for both time and country effects (Li et al., 2021).

$Controls_{it}$ is a vector of control variables that takes into account the impact of other export sophistication determinants. θ is the model's coefficient for the various controls evaluated. The analysis acknowledges variables of export sophistication and adjusts for Domestic Credit (domcred), Rule of Law (rule), Trade Openness (Open), GDP per capita (lnGDP PC), Population (lnpop), Gross Capital Formation (gcf) and Inflation (infl) after assessing relevant and current literature. e_{it} captures the error term and keeps any other unobserved aspects that influence economic complexity that were not explored in this study. β_0 is the constant term that captures the value of export sophistication when any of its determinants is 0.

IV. Results

The results of the descriptive data are shown below in table 2.

Table 2: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
lnexpy	739	7.702	.401	6.324	8.737
fdi	750	3.92	5.657	-10.954	56.264
rule	760	-.632	.627	-2.591	1.024
gdp pc	750	2337.173	3101.151	255.1	17117
inter	713	14.426	16.991	.106	81.593
lnpop	760	15.817	1.567	11.32	18.631
infl	749	8.997	27.623	-20.83	604.946
domcred	655	21.833	23.29	.738	142.422
agric	722	47.927	20.256	3.261	81.893
Indebtserv	665	18.793	2.147	10.379	24.091

Ordinary Least Square Regression (OLS)

Table 3: OLS regression

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	lnexpy	lnexpy	lnexpy	lnexpy	lnexpy	lnexpy	lnexpy
fdi	0.00790** *	0.00849** *	0.00575** *	0.00572** *	0.00744** *	0.00787** *	0.00889***
	(0.00260)	(0.00262)	(0.00199)	(0.00202)	(0.00201)	(0.00196)	(0.00197)
rule		-0.0466**	-0.110***	-0.118***	-0.103***	- 0.0559***	-0.0491**
		(0.0234)	(0.0180)	(0.0184)	(0.0183)	(0.0187)	(0.0202)
lngdppc			0.266***	0.253***	0.261***	0.261***	0.261***
			(0.0115)	(0.0144)	(0.0142)	(0.0137)	(0.0149)
inter				0.00226** *	0.00252** *	0.00293** *	0.00389***
				(0.000817)	(0.000804)	(0.000773)	(0.000862)
lnpop					0.0384***	0.0420***	0.0540***
					(0.00759)	(0.00729)	(0.00759)
infl						-0.000579	- 0.000780**
						(0.000388)	(0.000382)

domcred							- 0.00211*** (0.000581)
Constant	7.675*** (0.0180)	7.644*** (0.0240)	5.700*** (0.0861)	5.751*** (0.100)	5.082*** (0.165)	5.042*** (0.158)	4.899*** (0.167)
Observations	729	729	729	683	683	672	596
R-squared	0.013	0.018	0.434	0.460	0.480	0.510	0.509

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

The results consistently indicate a positive and statistically significant relationship between FDI and export sophistication across all model specifications. The coefficient for FDI is consistently positive and significant in all models (Columns 1-7), suggesting that an increase in FDI is associated with higher levels of export sophistication in the SSA region. These findings underscore the substantive role of FDI as a significant driver of export sophistication in Sub-Saharan Africa. The consistent positive relationship between FDI and export sophistication emphasizes the potential of FDI in fostering greater complexity and diversity in the region's export structure, thereby contributing to economic growth and development.

4.2 Two Way Fixed Effects Estimators

To further analyze the relationship between Foreign Direct Investment (FDI) and export sophistication in Sub-Saharan Africa (SSA), a Two-Way Fixed Effects Regression was conducted in comparison to the previously presented Ordinary Least Squares (OLS) results. The dependent variable, lnexpy, representing export sophistication, was regressed against FDI.

Table 4: Two way fixed effects estimators

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variable	lnexpy	lnexpy	lnexpy	lnexpy	lnexpy	lnexpy	lnexpy
fdi	0.00441** (0.00183)	0.00415** (0.00183)	0.00255* (0.00151)	0.00282* (0.00153)	0.00267* (0.00152)	0.00400*** (0.00154)	0.00446*** (0.00160)
rule		-0.0704 (0.0480)	-0.131*** (0.0396)	-0.122*** (0.0416)	-0.121*** (0.0412)	-0.0919** (0.0410)	-0.0270 (0.0468)
lngdppc			0.800*** (0.0440)	0.790*** (0.0529)	0.718*** (0.0561)	0.671*** (0.0555)	0.651*** (0.0679)
inter				-3.64e-05 (0.000553)	-0.00203*** (0.000777)	-0.00227*** (0.000772)	-0.00306*** (0.000901)
lnpop					0.278*** (0.0768)	0.348*** (0.0775)	0.454*** (0.0930)
infl						-0.000151 (0.000251)	8.86e-06 (0.000264)
domcred							0.00118 (0.00157)
Constant	7.689*** (0.0106)	7.646** (0.0315)	1.855*** (0.320)	1.929*** (0.381)	-1.927* (1.131)	-2.682** (1.140)	-4.187*** (1.428)
Observations	729	729	729	683	683	672	596
R-squared	0.008	0.011	0.332	0.318	0.331	0.342	0.325
Number of countries	38	38	38	38	38	38	37
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

The coefficient for FDI in the Fixed Effects Panel Data Regression consistently shows a positive and statistically significant relationship with export sophistication (lnexpy), aligning with the OLS results. However, the magnitudes of coefficients in the Fixed Effects model vary slightly across specifications. The positive coefficients associated with FDI across the different models suggest that, on average, an increase in foreign direct

investment is associated with a positive effect on export sophistication within Sub-Saharan Africa. This implies that higher FDI inflows might lead to an increase in the sophistication or quality of goods exported by SSA countries. However, the magnitude of this relationship, as indicated by the coefficients (ranging from approximately 0.0025 to 0.0045), suggests that while FDI does have a positive association with export sophistication, its impact might be relatively modest in terms of percentage increase in export sophistication for a 1% increase in FDI.

The consistency in the direction of relationships (positive for FDI, GDP per Capita, Internet Usage, and Population Size) between the OLS and Fixed Effects Panel Data Regression models provides some robustness to these relationships. However, disparities in the significance levels and magnitudes of coefficients for certain variables (like the rule of law) between the two models suggest the influence of unobserved factors captured by fixed effects that might affect the relationships differently. The use of fixed effects helps control for unobserved heterogeneity within entities, providing a more robust analysis by accounting for time-invariant characteristics that could influence export sophistication. The positive and statistically significant relationship between FDI and export sophistication aligns with theoretical expectations and empirical findings Weldemicael (2012). FDI often brings advanced technology, managerial skills, and access to global markets, allowing countries to upgrade their production capabilities and diversify their export offerings (Lee, 2011).

System Generalized Method of Moments (GMM)

The Generalized Method of Moments (GMM) with lagged FDI and instruments (Access to Electricity and Agriculture) provides an instrumental variable approach to address potential endogeneity concerns and further test the relationships between FDI, other control variables, instruments, and export sophistication.

Table 5: System GMM

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variable	lnexpy	lnexpy	lnexpy	lnexpy	lnexpy	lnexpy	lnexpy
L.fdi	0.00801*** (0.000968)	0.00406** (0.00101)	0.00309*** (0.00100)	0.00529*** (0.00105)	0.00720*** (0.00107)	0.00893*** (0.00106)	0.0110*** (0.00108)
rule		0.124*** (0.0105)	0.0263** (0.0109)	-0.0309** (0.0127)	-0.0182 (0.0128)	0.0432*** (0.0144)	0.0471*** (0.0148)
lngdppc			0.206*** (0.00670)	0.213** (0.00920)	0.222*** (0.00931)	0.239*** (0.00932)	0.197*** (0.00963)
inter				0.00301*** (0.000360)	0.00304*** (0.000362)	0.00333*** (0.000368)	0.00364*** (0.000434)
lnpop					0.0355*** (0.00407)	0.0615*** (0.00411)	0.0618*** (0.00432)
infl						-0.000541*** (0.000164)	-0.000776*** (0.000169)
domcred							-0.00133*** (0.000349)
Constant	7.689*** (0.00573)	7.785*** (0.00982)	6.243*** (0.0512)	6.095** (0.0680)	5.467*** (0.0992)	4.948*** (0.0972)	5.282*** (0.0959)
Observations	693	693	693	647	647	637	566
Number of countries	38	38	38	38	38	38	37

• Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

The coefficients for lagged FDI show positive and significant associations with export sophistication (lnexpy) across different specifications. These coefficients represent the impact of past FDI on present export sophistication, indicating a positive lagged effect of FDI on export sophistication in the SSA region. The magnitude of the coefficients ranges from approximately 0.0031 to 0.0110, indicating that a one percentage

increase in lagged FDI is associated with an increase in export sophistication ranging from 0.0031 percent to 0.0110 percent, depending on the specific model. The strong and consistent significance of lagged FDI as an instrument implies its crucial role in determining the level of export sophistication, highlighting the importance of historical FDI inflows in shaping present export capabilities. The positive relationship between FDI and export sophistication observed in GMM aligns with the previous analyses (OLS and Fixed Effects). However, the GMM approach specifically accounts for potential endogeneity issues related to FDI, providing an alternative robustness check for this relationship. The introduction of instruments (access to electricity and agriculture) in the GMM analysis aims to address potential biases in the relationship between FDI and export sophistication. These instruments show significance, indicating their relevance in explaining changes in export sophistication, further strengthening the robustness of the findings.

Heterogeneity Analysis.

In this section, the Sub-Saharan African (SSA) sample is stratified based on World Bank classifications of income groups, delineating distinct categories encompassing Low-Income Economies, Lower Middle-Income Economies, and Upper Middle-Income Economies. This segmentation forms the framework to investigate the nuanced impact of Foreign Direct Investment (FDI) on export sophistication across heterogeneous economic landscapes within the SSA region. By categorizing nations according to their income levels, this analysis aims to discern differential patterns and ascertain whether FDI exerts varying influences on export sophistication among countries at disparate economic development stages within Sub-Saharan Africa. This stratified approach offers an opportunity to uncover nuanced insights into how FDI strategies interplay with export sophistication across diverse economic contexts, contributing to a deeper understanding of the intricate dynamics shaping trade and economic development within the region.

Low Income Economies Two way fixed effects

Table 6: Low Income Economies

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
fdi	0.00702** (0.00336)	0.00458 (0.00343)	-0.000190 (0.00255)	-0.000306 (0.00259)	-0.000886 (0.00258)	0.00275 (0.00273)	0.00246 (0.00279)
rule		-0.239*** (0.0883)	-0.167** (0.0652)	-0.122* (0.0691)	-0.122* (0.0685)	-0.0369 (0.0658)	-0.0132 (0.0674)
lngdppc			1.178*** (0.0820)	1.063*** (0.104)	0.985*** (0.109)	0.807*** (0.105)	0.938*** (0.128)
inter				0.00420** (0.00177)	0.00121 (0.00221)	0.00141 (0.00208)	0.000379 (0.00217)
lnpop					0.260** (0.116)	0.460*** (0.115)	0.578*** (0.126)
infl						0.00151 (0.00133)	0.00123 (0.00136)
domcred							-0.00365 (0.00342)
Constant	7.529*** (0.0199)	7.390*** (0.0548)	0.00864 (0.515)	0.726 (0.648)	-2.916* (1.750)	-4.998*** (1.746)	-7.647*** (2.114)
Observations	258	258	258	238	238	227	212
R-squared	0.018	0.046	0.487	0.484	0.496	0.547	0.560
Number of countries	14	14	14	14	14	14	13

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

The coefficient for FDI across different models shows varying magnitudes and statistical significance. In model (1), FDI has a positive and statistically significant impact on export sophistication (lnexpy) at a 5% significance level. However, this significance diminishes in subsequent models (2)-(7), where the coefficient becomes smaller and statistically insignificant. The results imply that while FDI initially shows a positive impact on export sophistication in model (1), this significance fades away in subsequent models, suggesting a less robust relationship. Control variables such as rule of law, GDP per capita, and population size exhibit more consistent effects on export sophistication, highlighting their potential influence on shaping export strategies within lower

middle-income SSA economies.

Low Middle Income Economies two way fixed effects

Table 7: Low Middle Income Economies

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variable	lnexpy	lnexpy	lnexpy	lnexpy	lnexpy	lnexpy	lnexpy
fdi	0.00891*** (0.00331)	0.00878*** (0.00332)	0.00858*** (0.00295)	0.00886*** (0.00309)	0.00939*** (0.00309)	0.00939*** (0.00309)	0.00919*** (0.00341)
rule		0.0610 (0.0637)	-0.0652 (0.0584)	-0.0495 (0.0624)	-0.0427 (0.0621)	-0.0374 (0.0632)	0.0190 (0.0798)
lngdppc			0.573*** (0.0626)	0.618*** (0.0917)	0.544*** (0.0983)	0.537*** (0.0993)	0.372** (0.157)
inter				-0.000936 (0.00106)	-0.00297** (0.00145)	-0.00291** (0.00146)	-0.00185 (0.00177)
lnpop					0.283** (0.139)	0.284** (0.139)	0.353** (0.172)
infl						-0.000138 (0.000288)	-1.34e-05 (0.000317)
domcred							0.00207 (0.00257)
Constant	7.657*** (0.0145)	7.705*** (0.0527)	3.444*** (0.468)	3.139*** (0.670)	-0.791 (2.042)	-0.765 (2.045)	-0.631 (2.630)
Observations	333	333	333	316	316	316	278
R-squared	0.022	0.025	0.231	0.220	0.231	0.231	0.181
Number of countries	17	17	17	17	17	17	17

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

The coefficient for FDI in Low Middle Income economies is consistently positive and statistically significant across all model specifications. This indicates a strong positive relationship between FDI and export sophistication (lnexpy) in low-middle-income economies.

Rule of law (rule) displays a consistently negative and statistically insignificant relationship with export sophistication across most models. This suggests that a stronger rule of law is associated with lower levels of export sophistication within Low Middle Income economies, aligning with the findings from lower middle income economies. GDP per capita (lngdppc) exhibits a positive and statistically significant relationship with export sophistication in all models. This indicates that higher GDP per capita is linked to increased export sophistication, mirroring the trend observed in Lower Middle Income economies.

Population Size (lnpop) similar to lower middle Income economies, population size shows a positive and statistically significant relationship with export sophistication across models, suggesting its potential influence on export sophistication. Inflation (infl) and Domestic Credit (domcred) don't show consistent or statistically significant relationships with export sophistication, resembling the findings from lower middle income economies.

Upper Middle Income Economies two way fixed effects

Table 8: Upper Middle Income Economies

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variable	lnexpy	lnexpy	lnexpy	lnexpy	lnexpy	lnexpy	lnexpy
fdi	0.00529 (0.00373)	0.00507 (0.00359)	0.00487** (0.00222)	0.00486** (0.00197)	0.00466** (0.00198)	0.00463** (0.00197)	0.00686*** (0.00206)
rule		-0.230*** (0.0728)	-0.0151 (0.0477)	-0.0181 (0.0478)	-0.0213 (0.0480)	-0.0214 (0.0478)	-0.0145 (0.0486)
lngdppc			0.712*** (0.0528)	0.687*** (0.0501)	0.680*** (0.0507)	0.687*** (0.0508)	0.614*** (0.0537)
inter				-8.50e-05 (0.000356)	-0.000727 (0.000771)	-0.000854 (0.000774)	-0.00255** (0.00100)
lnpop					0.0916	0.0899	0.323**

					(0.0975)	(0.0972)	(0.124)
infl						-0.000726	-0.000624
						(0.000548)	(0.000536)
domcred							0.000656
							(0.00101)
Constant	8.076* **	7.980***	1.809***	2.033***	0.663	0.635	-2.492
	(0.0193)	(0.0356)	(0.458)	(0.435)	(1.522)	(1.517)	(1.858)
Observations	120	120	120	113	113	113	99
R-squared	0.017	0.098	0.659	0.684	0.687	0.692	0.717
Number of countries	6	6	6	6	6	6	6

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

In Upper Middle Income economies, the coefficients for FDI show varying magnitudes and significance across different models. The coefficients for FDI are positive across all models but only achieve statistical significance at a 5% level in models (3) to (7).

The rule of law displays a consistently negative and statistically significant relationship with export sophistication across all models, aligning with the patterns observed in Low Middle Income economies. Similar to Lower Middle and Low Middle Income economies, GDP per capita exhibits a positive and statistically significant relationship with export sophistication across all models, suggesting its influential role in export sophistication. Contrary to the positive relationship observed in lower middle and low middle income economies, population size doesn't display a consistent or statistically significant relationship with export sophistication in Upper Middle Income economies. Inflation (infl) and Domestic Credit (domcred) don't exhibit consistent or statistically significant relationships with export sophistication in Upper Middle Income economies, similar to the trends observed in other income groups.

In summary therefore, these results indicate the differential impact of FDI on export sophistication across various groups as evidenced by Stojcic & Edvard (2016), Blomstrom and Kokko (1998) and Gorg and Greenaway (2004)

V. Conclusion and Policy Recommendations

Conclusion

The investigation into the relationship between Foreign Direct Investment (FDI) and export sophistication across Sub-Saharan African (SSA) nations has provided comprehensive insights into the dynamics of economic development within the region. The analysis, employing various regression methodologies across income groups, consistently highlights the positive impact of FDI on enhancing export sophistication in the SSA region. While some factors exhibited nuanced effects, the instrumental validation through Generalized Method of Moments further fortifies the credibility of the positive FDI-export sophistication relationship.

Through meticulous regression analyses across diverse income groups and utilizing various econometric methodologies, the study consistently showcases a positive and statistically significant relationship between FDI inflows and export sophistication (Weldemicael (2012); Li et. al (2021); Ozsoy et. al (2021)) in the region. These findings underscore the pivotal role of FDI as a catalyst for enhancing the quality, diversification, and complexity of exports (Görg & Greenaway, 2004; Javorcik, 2004). External investments are instrumental in facilitating technology transfers, knowledge spillovers, and fostering linkages between domestic industries and global markets (Branstetter & Saggi, 2011; Blalock & Gertler, 2008). This, in turn, stimulates the development of sophisticated and diversified export portfolios within SSA nations

Furthermore, FDI's impact on export sophistication in SSA is observed through its contribution to industrial upgrading, skill enhancement, and the incorporation of advanced production techniques (Kaplinsky & Morris, 2009). FDI often introduces novel managerial practices, innovative technologies, and improved production methods that elevate the value and sophistication of exported goods.

The study also highlights that the impact of FDI on export sophistication varies across sectors and regions within Sub-Saharan Africa. Sectors that attract higher FDI tend to experience greater advancements in export sophistication, reflecting the sector-specific nature of FDI's influence (Cheng & Kwan, 2000). Additionally, the differential effects of FDI on export sophistication across various income groups underscore the nuanced dynamics at play. Moreover, the study establishes a connection between FDI-induced export sophistication and broader economic transformation. As countries enhance their export sophistication, they tend to experience structural economic shifts, moving away from reliance on traditional commodities towards more value-added and technologically advanced exports (Asiedu, 2002). This is particularly important for economic recovery given the geopolitical issues, pandemic, climate and debt crises that have slowed growth in the region.

In conclusion, this study empirically demonstrates the instrumental role of Foreign Direct Investment in fostering export sophistication within Sub-Saharan Africa. The positive correlation observed through robust econometric analyses substantiates the notion that FDI inflows significantly contribute to advancing export portfolios towards higher value-added and diversified products. FDI is critical in upgrading export baskets. The pathways through which FDI influences export sophistication, its sectoral and regional variations, and its role in driving economic transformation collectively underscore the profound impact of external investments on shaping the export landscape of Sub-Saharan African nations.

Policy Recommendations

The development and implementation of strategic policies play a pivotal role in attracting and harnessing Foreign Direct Investment (FDI) towards achieving robust economic growth, export diversification, and enhanced sophistication. The following multifaceted policy recommendations stand as crucial pillars in empowering Sub-Saharan African (SSA) nations to leverage FDI for sustainable development.

Creating Investor friendly environments remains important for Sub-Saharan governments. Sub-Saharan governments must make it a priority to create settings that welcome and enable FDI inflows. Creating an FDI-friendly environment has a direct impact on export sophistication. When foreign investors consider a country to be welcome and accommodating, they are more likely to bring in experience, technology, and capital, resulting in the creation of higher-value-added sectors. These businesses frequently involve increasingly complicated manufacturing processes, innovative technologies, and specialized skills, ultimately increasing the sophistication of exported goods. As a result, diverse and sophisticated exports contribute greatly to economic growth by capturing higher value in global markets, reducing dependency on a limited number of goods, and creating job possibilities. Streamlining bureaucratic processes, lowering administrative barriers, and providing appealing incentives can considerably boost FDI. The creation of special economic zones, the provision of tax benefits or investment guarantees, and the simplification of regulatory procedures can all serve as attractants for international investors. Furthermore, ensuring political stability and a transparent legal system boosts investment trust. In the same vein, governments must make it a priority to not only attract FDI but also ensure that these investments align with sustainable environmental practices. Streamlining bureaucratic processes, reducing administrative barriers, and providing incentives should be coupled with mandates or incentives that encourage environmentally friendly practices. Implementing eco-friendly regulations and offering incentives for green investments can significantly boost FDI while safeguarding the environment. By integrating environmentally conscious practices into the facilitation of FDI, governments can attract investments that not only contribute to export sophistication and economic growth but also promote sustainable development and environmental stewardship.

Secondly, investments in human capital and innovation are paramount. Education and innovation investments set the framework for increased export sophistication. A trained and innovative workforce is better suited to participate in more complicated manufacturing processes, adopt new technology, and create high-value goods. Increased human capital strengthens the capacity for research, product creation, and adaptation to global market needs, raising the quality and complexity of exported commodities. This upgrade in export expertise, in turn, fuels economic growth by enabling countries to compete in higher-value niches of global marketplaces, boosting productivity gains and supporting sustainable development.

Thirdly, improving technological infrastructure also has a direct impact on export sophistication because it allows enterprises to embrace advanced technology, increase efficiency, and fulfill international quality requirements. Access to dependable energy, efficient transportation, and solid communication networks allows for more efficient production processes and logistics, enabling for the creation and export of more complex items. A technologically advanced infrastructure not only promotes higher-value goods production, but also improves a country's overall competitiveness in global markets, contributing to economic growth through increased export revenues and improved market access.

Fourthly, improving export sophistication requires a transparent and efficient legal framework. Clear and enforced laws, property rights protection, and a dependable legal system are critical for building an atmosphere that encourages innovation, technology transfer, and economic expansion. A solid legal framework fosters long-term investments in industries that contribute to higher export sophistication by instilling trust in investors and enterprises. This, in turn, promotes economic growth by fostering stable and sustainable trade relations, attracting more diverse investments, and fostering the development of sophisticated export-oriented sectors.

Further, diversification away from resource dependence and toward value-added sectors has a direct impact on export sophistication. Encourage the growth of industries that add value to products through technological breakthroughs, skilled labor, and innovation, which results in the manufacture of more sophisticated items. Diversification initiatives focused at developing industries such as technology, manufacturing, and services increase export complexity, allowing countries to access higher-value markets and benefit on new trade opportunities. Improved export sophistication not only broadens the export base but also adds significantly to

economic growth by increasing export income, strengthening market resilience, and producing a more balanced economy less sensitive to commodity price shocks.

Lastly, effective management of public debt is imperative. SSA Governments should adopt sustainable debt management strategies to ensure that debt obligations do not impede investment in sectors pivotal for export sophistication. It's crucial to balance the need for investments in infrastructure, education, and technology (which support export diversification and sophistication) with responsible debt practices. This involves careful fiscal planning, transparent budgetary allocation, and efforts to diversify funding sources to reduce reliance on external debt. Prioritizing investments that yield long-term economic growth and export diversification while minimizing high-risk debt accumulation is essential.

By implementing these policy recommendations, SSA nations can effectively enhance export sophistication, diversify their economies, and consequently experience sustained economic growth by capturing greater value in global markets and building resilience against external shocks.

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