An Investigation of the Impact of Intra- and Extra-African Trade on Manufacturing Output: A panel data analysis

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Outline of the Presentation

1. Introduction/Motivation
2. A brief review of the related literature
3. Estimation model, methodology, and data
4. Estimation results
5. Conclusions & policy implications

1. Introduction (cont.)

- African countries saw their trade openness (i.e., the sum of exports and imports of goods and services as a share of GDP) increase from an annual average of 42.5% in the 1970s to 54.7% in the 2010s.
- The observed rise occurred through bilateral/multilateral trade arrangements and through regional market integration initiatives.

1. Introduction (cont.)

- Meanwhile, a trend of deindustrialization (or stalled industrialization in some cases) has been observed.
  - The average value-added share (in GDP) of the industrial sector (including construction) decreased from 42.5% in the 1970s to 31.2% in the 2010s.
  - The corresponding figures for the share of manufacturing were 15.9% and 11%, representing a share shrinkage of 30.1% over five decades.

1. Introduction (cont.)

- There is a paucity of empirical evidence on whether market integration in the form expanded intra-African trade has affected the manufacturing sector of African economies, motivating the present study.
- This study seeks to test the following null hypotheses:
  - Market integration exerts no effect on manufacturing activity
  - The manufacturing effect of market integration is no different from that of overall trade openness (distinguishing between intra-African versus extra-African trade effects)

2. A Brief Review of Related Literature

- Market integration is argued to be a major determinant of growth for poor countries, as:

  - it would create larger markets and economies of scale, leading to lower costs of business.

  - the induced rise in competitiveness, efficiency, productivity, the ability to trade and gain experience, and in the diversification of the sources of growth could lead to effective global integration and bigger market share

  (e.g., Sachs & Warner, 1995; UNECA, 2021; Dollar & Kraay, 2004; Fofack, 2018; World Bank, 2020).

2. A Brief Review of Related Literature (cont.)

- Advocates of South-South market integration maintain that such trade flows would, among others, help:
  - facilitate de-dollarization of trade payments,
  - improve coordination of policy, and
  - generate stable growth owing to the limited scope for expansion of exports to developed countries (Greenaway & Milner, 1990), with potentially favorable effects on manufacturing activity.
- However, for international trade to stimulate long-run growth, institutional pre-requisites need to be met (Rodrik et al., 2004) and local firms ought to be able to develop imitative and absorptive capabilities (Cameron et al., 2005).

2. A Brief Review of Related Literature (cont.)

- The relevant literature suggests that the manufacturing effect of South-South market integration could be different from that of North-South bilateral and multilateral trade flows.
- To our knowledge, there exists little cross-country econometric empirical evidence on the effect of regional market integration or intra-African trade on manufacturing output for Africa.
- The available evidence is largely based on simulation results (e.g., Mold & Mukwaya, 2016; UNECA, 2018; World Bank, 2020), predicting that the manufacturing sector in Africa would benefit from market integration.

2. A Brief Review of Related Literature (cont.)

- In contrast, the response of manufacturing to overall trade openness has been the subject of more empirical inquiry. Studies reporting:
  - favorable effects include Alagidede et al., 2020, for SSA; Anyanwu (2017) for North Africa; Umoh & Effiong, 2013 and Onakoya et al., 2012, for Nigeria.
  - negative effects include Wan, et al., 2022 for a panel of 130 developing countries; Khobai & Moyo, 2021, for SADC member countries; Jenkins & Sen, 2006, for Kenya and South Africa.
  - ambiguous (neutral or negative) effects include Fongang et al. (2017) for the Economic and Monetary Community of Central Africa countries.

2. A Brief Review of Related Literature (cont.)

- The evidence on the response of manufacturing activity to overall trade openness is inconclusive, and cross-country econometric evidence on the effect of Africa's market integration is lacking.
- Therefore, further studies using representative samples of African countries are necessary to contribute to our understanding of the role of market integration in the growth of the manufacturing sector in Africa.
- The present study attempts to contribute to the literature by investigating the experiences of African countries in relation to the impact of intra-African trade openness on manufacturing growth.

3. Estimation Model, Methodology, and Data

- We employ the endogenous growth theory framework to derive the econometric equation that we, in turn, use to evaluate the impact of both intra- and extra-African trade openness on manufacturing activity on the continent.
- Consider a production function for the manufacturing sector in which the number of workers is constant.

$$Y_{it} = A_{it} K_{it}^{\alpha} \qquad (1)$$

where Y is the aggregate output of the manufacturing sector and K is the aggregate capital stock. *A* is an index of technology or total factor productivity that varies across countries and time.

3. Estimation Model, Methodology, and Data (cont.)

- Thus, from Eq. (1), our growth equation is

$$\Delta InY_{it} = \Delta lnA_{it} + \alpha \Delta lnK_{it} \qquad (2)$$

- The temporal changes in the level of *A* could arise from innovations in the manufacturing sector, or
  - a technological transfer resulting from cross-border trade (e.g. Ben-David and Loewy, 1998; Frankel and Romer, 1999);
  - human capital development (e.g., Benhabib and Spiegel, 1994; Krueger and Lindahl, 2001), or
  - R&D activities (e.g., Griliches and Lichtenberg, 1984; Cohen and Levinthal, 1989; Griffith et al., 2000).

3. Estimation Model, Methodology, and Data (cont.)

- We specify the change in the level of *A* as a function of human capital and international trade.
- Included is also the rainfall variable, given the importance of rain-fed agriculture in many of the study countries. Thus, the modified empirical endogenous growth equation that we employ is

$$\Delta \ln Y_{it} = \sigma_{it} + \alpha \Delta lnK_{it-j} + \delta_1 lnHC_{it-j} + \delta_2 lnTO_{it-j} + \beta RF_{it} + \mu_{it}, \quad (3)$$

where HC is human capital, TO is trade openness, RF is rainfall fluctuations around average rainfall, and σ, α, δ1, δ2, and β are the coefficients to be estimated. The variable μ is the error term.

- The sign δ_2 is not known a priori (because of the possible opposite efficiency-enhancing and crowding-out effects). In contrast α, δ_1, and β are expected to have positive signs.

3. Estimation Model, Methodology, and Data (cont.)

- We use the Pooled Mean Group–Autoregressive Distributed Lag–Vector Error Correction (PMG-ARDL-VEC) estimation approach.
- The original PMG estimator developed by Pesaran, et al. (1999) produces consistent estimates even in the case of heterogeneity across the panels, and cross-section dependence.
- This approach, which constrains the long-run coefficients to be homogeneous while allowing the intercept, short-run coefficients and the error variances to differ across study countries,
  - enables estimation of the long run relationship in a consistent and efficient fashion in the situation where the series are a mixture of I (0) and I (1).
  - allows distinguishing between long run and short run effects and is also robust to the outliers and lag orders (Lau, et al. 2019).

3. Estimation Model, Methodology, and Data (cont.)

- With all the variables in Eq. (3) treated as dynamic, except RF (treated as a fixed regressor), we estimate the following ARDL-EC model.

$$\Delta lnY_t = \rho(lnY_{t-1} - \boldsymbol{\tau}'_* \boldsymbol{X}_{t-1}) + \gamma_* + \sum_{j=1}^{p-1} \varphi_{j*} \Delta lnY_{t-j} + \sum_{j=0}^{q-1} \boldsymbol{\pi}'_{j*} \Delta \boldsymbol{X}_{t-j} + \beta RF_t + \mu_t \quad (4)$$

where ***X*** is a vector of dynamic regressors (i.e., proxies of fixed capital accumulation, human capital, and trade openness).

- The first term in Eq. (4) is the error correction term and is expected to be negatively signed for the model to be stable.
- The long-run relationship between ln (Y_t) and the dynamic regressors is embedded in Eq. (4).

3. Estimation Model, Methodology, and Data (cont.)

- To address the endogeneity issue associated with the proxies of the trade openness variable, we take the lead from Brueckner and Lederman (2015; 2018) in constructing instruments for trade openness and remove the influence of the dependent variable on trade openness.
- We use as instruments the residuals of a regression of the trade openness variables on the growth of manufacturing output and the trade-weighted growth rate of trade partners.
- To avoid biased estimators caused by endogeneity of the growth of output, we replace the latter with RF and apply the panel EGLS cross-section SUR estimation procedure to generate the residuals.
- The instruments thus constructed can be viewed as capturing mainly the trade associated with geographical, cultural, and demographic factors, which can be regarded as exogenous.

3. Estimation Model, Methodology, and Data (cont.)

- We use annual data for 42 African countries for the period 1995-2020 to estimate the equation for manufacturing, measured as manufacturing value added in US dollars at constant prices.
- Following early empirical studies (e.g., Yanikkaya, 2003; Cohen and Soto, 2007; and Musila and Mpekansambo, 2024), we proxy fixed capital accumulation (i.e., change in fixed capital stock) in the manufacturing sector by fixed telephone lines subscriptions and human capital by life expectancy.
- We construct the trade openness variables as ratios of merchandize trade over GDP for both intra-African and extra-African merchandise trade openness.

3. Estimation Model, Methodology, and Data (cont.)

- Intra-African merchandise trade openness:

$$IATOPEN = \frac{(X_{iA}+M_{iA})}{GDP_i}$$

- Extra-African merchandise trade openness:

$$EATOPEN = \frac{(X_{iNA}+M_{iNA})}{(GDP_i)},$$

where GDP_i is the gross domestic product of African Country i, X_{iA} is exports of African Country i to other African countries, M_{iA} is imports of African Country i from other African countries, X_{iNA} is total exports of African Country i to non-African country, M_{iNA} is total imports of African Country i from non-African country

3. Estimation Model, Methodology, and Data (cont.)

- To determine the time series properties of the model variables, we conducted a panel-unit root test based on Levin, Lin & Chu common root procedure.
- All variables in the model but one are integrated of order zero (I (0)) and one variable is integrated of order one (I (1)) at the 5% level of significance or better. Thus, the variables in the model are a mixture of I (0) and I (1.
- The sources of data used for the estimation of the model include the databases of World Bank's WDI (for manufacturing output, fixed telephone subscription, life expectancy), UNCTAD (for IATOPEN and EATOPEN), and NASA–GPCP (for rainfall data).
- The choice of study countries is dictated by data availability.

Pannel Unit Root test (Common Root – Levin, Lin & Chu)

Variable	level	first difference	Decision (at 5% level or better)
Log (MFG)	-2.819***	---	I (0)
	(0.002)		
Log (FTS100)	-1.395	-8.692***	I (1)
	R (0.082)	(0.000)	
Log (LIFEXP)	-9.005***	---	I (0)
	(0.000)		
IATOPEN	-3.272***	---	I (0)
	(0.001)		
EATOPEN	-2.013***	---	I (0)
	(0.022)		
RF	-10.264***	---	I (0)
	(0.000)		

4. Estimation Results

- The estimation results of various versions of the model are presented in the following two tables.
- The first table presents estimates of the coefficients of the trade openness variables with and without control variables.
- The second table records results with each of the openness indicators separately included in the regressions.

PMG-ARDL-VEC Estimates (1)

Explanatory Variables	1	2
I. Long run equation: dependent variable=LOG(MFG)		
IATOPENRES	0.0161 (3.30)***	0.0083 (5.73)***
EATOPENRES	-0.0026 (2.57)***	-0.0034 (4.55)***
OPENRES	--	--
LOG(FTS100)	--	0.0738 (3.16)***
LOG(LIFEXP)	--	2.51 (28.1)***
II. Short run equation: dependent variable= ΔLOG(MFG)		
Error correction term	-0.0740 (5.57)***	-0.1868 (3.68)***
a. Dynamic Variables (included in estimation but not reported here in the interest of space)		
a. Fixed Regressors		
RF	--	0.0001 (0.969)
C	0.5181 (6.32)***	-0.8258 (3.09)***
Included Obs.	1050	924
Selected Model ARDL(…)	(1,1,1)	(4,2,2,2)
Root MSE	0.158	0.090

PMG-ARDL-VEC Estimates (2)

Explanatory Variables	3	4	5
I. Long run equation: Dependent variable=LOG(MFG)			
IATOPENRES	0.0130 (14.4)***	--	--
EATOPENRES	--	-0.0035 (8.09)***	--
OPENRES	---	--	-0.0038 (12.84)***
LOG(FTS100)	0.0277 (4.75)***	0.1299 (6.42)***	0.0703 (3.08)***
LOG(LIFEXP)	1.98 (39.7)***	3.23 (52.4)***	3.37 (43.4)***
I. Short run equation: dependent variable= ΔLOG(MFG)			
Error correction term	-0.2686 (4.24)***	-0.2353 (3.56)***	-.02491 (3.31)***
a. Dynamic Variables (included in estimation but not reported here in the interest of space)			
a. Fixed Regressors			
RF	0.0003 (1.57)	0.0002 (1.08)	0.0002 (0.957)
C	-0.4754 (2.61)	-1.69 (3.42)***	-1.92 (3.25)***
Included Obs.	924	924	924
Selected Model ARDL(…)	(4,4,4,4)	(4,3,3,3)	(4,3,3,3)
Root MSE	0.088	0.047	0.047

4. Estimation Results (cont.)

- The findings of the study suggest that in the long run increases in:
  - both physical and human capital formation would boost manufacturing output
  - intra-African merchandise trade would stimulate manufacturing activity
  - extra-African merchandise trade would lead to a decline in manufacturing output
  - total trade openness would exert unfavorable effect on manufacturing output, suggesting that the negative effect of extra-African trade dominates the favorable effect of intra-African trade
- The short-run effects of the variables of interest were statistically insignificant for the most part.

5. Summary and Conclusions

- The estimated results appear to bear out the view that manufacturing activity would benefit more from the expansion of intra-African merchandise trade than extra-African trade.
- Our findings justify the merit of distinguishing between intra- and extra-African trade to characterize the effect of cross-border trade on manufacturing activity
- The study highlights the importance of expanded intra-African trade or market integration to promote industrialization on the continent.
- The policy implications of the paper's findings include expanding intra-continental trade (market integration) as a manufacturing growth enabler.

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List of Study Countries

Algeria	**Gabon**	**Niger**
Angola	**Gambia**	**Nigeria**
Benin	**Ghana**	**Rwanda**
Botswana	**Guinea**	**Senegal**
Burkina Faso	**Guinea-Bissau**	**Seychelles**
Burundi	**Kenya**	**Sierra Leone**
Cabo Verde	**Lesotho**	**South Africa**
Cameroon	**Liberia**	**Tanzania**
Chad	**Madagascar**	**Togo**
Congo, Dem. Republic	**Malawi**	**Tunisia**
Congo, Republic	**Mauritania**	**Uganda**
Cote d'Ivoire	**Mauritius**	**Zambia**
Egypt	**Morocco**	
Eswatini	**Mozambique**	
Ethiopia	**Namibia**	

Thank you!