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Foreign direct investment and industrialization in Tanzania admixture time series forecast analysis 1960 - 2020

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ABSTRACT

This paper examines and forecasts the impact of foreign direct investment (FDI) on industrialization and industrial performance in Tanzania by using World Bank data spanning 1960 to 2020. The admixture time series analysis of Vector Autoregressive (VAR) and Vector Error Correction Model (VECM) has been extensively explored in order to provide accurate estimation. The need to examine FDI inflows is enormously based on domestic macroeconomic parameters that are stuck in many developing countries, including Tanzania, implying that FDI is necessary for growth and development now and in the future. According to the findings, FDI granger causes industrialization, and the more the sector thrives, the more granger causes FDI inflow. In the long run, FDI has a significant impact on Tanzanian industrialization growth, whereas the exchange rate (EXR) has a significant impact on industrialization growth in the short run. The study recommends the Bank of Tanzania to take appropriate measures to control poor-performing economic parameters such as the exchange rate, inflation, and the improvement of the money market in order to enhance capital availability and accessibility.

KEYWORDS

Industrialization; foreign direct investment; vector error correction model; Tanzania; vector autoregressive

JEL CLASSIFICATION

E630; F43; F47; O43; O550

I. Background

Industrialization involves economic and social processes that efficiently produce value-added goods; thus, it represents thorough modernization with new technology and production techniques, implying that industrialization requires centralization and motorization of operations. However, in developing countries it is difficult to achieve without FDI (Matonya 2017; Utouh, Rao, and Mutalemwa 2016). Some emerging nations are investing in competitive industries, while others are transitioning to more advanced manufacturing due to increased inter-country and regional economic competition (Kreickemeier and Wrona 2020; Morris and Fessehaie 2014).

Since independence, Tanzania has striven promoting industry to rebuild its economy and escape colonial structures (Baya and Jangu 2017). However, most post-independence industries failed, reducing industrial sector's economic share. Manufacturing's GDP contribution declined from 22% in 1975 to 10% in the 1990s and 9.5% between 2000 and 2010 (Matonya, Baya and Jangu 2017), while manufacturing value increased to US$ 1,992 million from US$ 894 million (World Bank 2021).

This study theoretically used Solow's exogenous growth model (1956 and 1957) modified by Piętak's (2014). The theory assumes that exogenous production factors – capital and labour – drive economic growth. The aggregate production function, by Cobb-Douglas in 1928, is modelled against capital input (domestic and foreign), exchange rate, technological progress, which varies with FDI, and trade (import and export status) that changes over time. Figure 4 illustrates this theory.

Some studies (Matonya 2017; Utouh, Rao, and Mutalemwa 2016; Fauzel, Seetanah, and Sannasee 2015; Eze 2019) show that FDI enhances economic growth, while others (Morris and Fessehaie 2014) show that it hurts both economic growth and industrialization, prompting theoretical and empirical research into its short- and long-term effects on industrialization. Agu and Okoli (2015) used time series data and OLS and VECM estimation techniques to examine FDI flow in Nigerian manufacturing firms and found

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that FDI inflows had a positive long-term impact on manufacturing, while Gui-Diby and Renard (2015) used panel data to examine the impact of FDI on industrialization in Africa and found a negative impact.

Tanzania's industrial ownership landscape has shifted dramatically (URT & UNIDO 2012). From the late 1980s to the 2000s, structural adjustment programmes resulted in the privatization of most industries leading the government to have less participation in industrial sector. Figure 1 shows that 91% of industries are privately owned, 8% are publicly owned, with construction accounting for (50%), manufacturing (31%), mining (15%), electricity (3%), water and sewerage (1%). Figure 2 depicts this.

Capital inflows and government support drive Tanzania's industrial growth (Fauzel, Seetanah, and Sannasee 2015). In 2015, FDI totalled US$ 1,561 billion, boosting Tanzania's industrialization (Figure 3). From 2015 to 2021, FDI volatility and macroeconomic parameters affected industrial performance. This study shows that industrialization and FDI have a back-and-forth relationship due to feedback effects. Thus, to understand the short-run and long-run relationships between FDI and industrialization, we

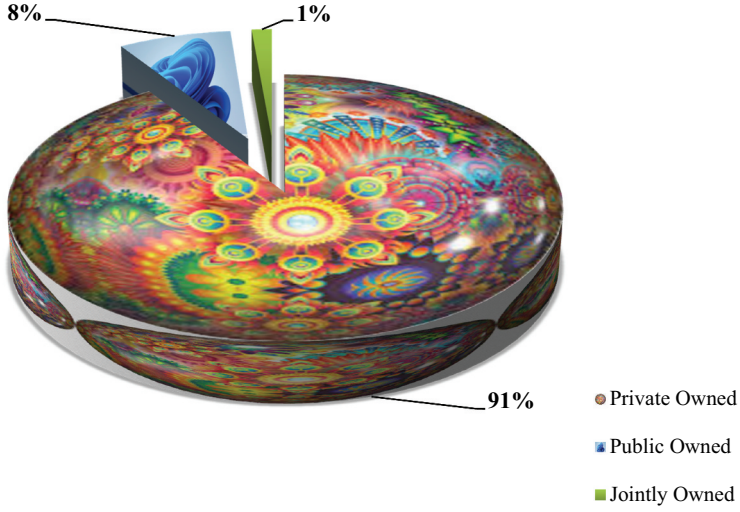

Figure 1. Industrial ownership in Tanzania. Source: (Minsitry of Industry and Trade, 2016)

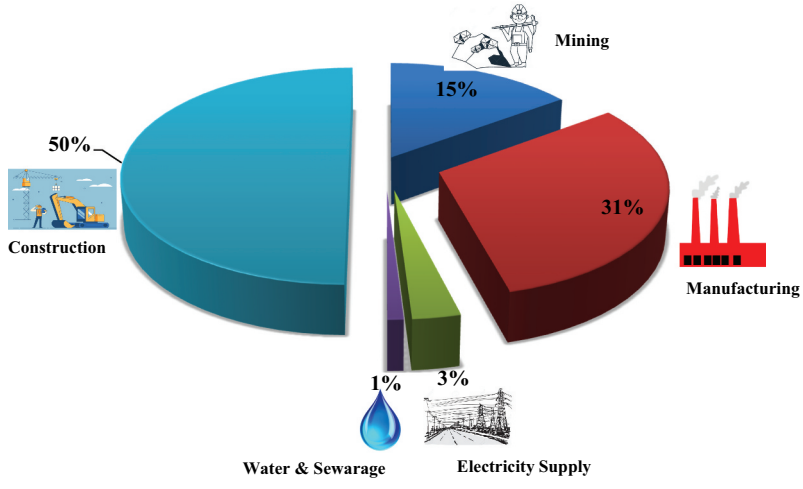

Figure 2. Tanzania industrial sector breakdown. Source: World Bank (2021).

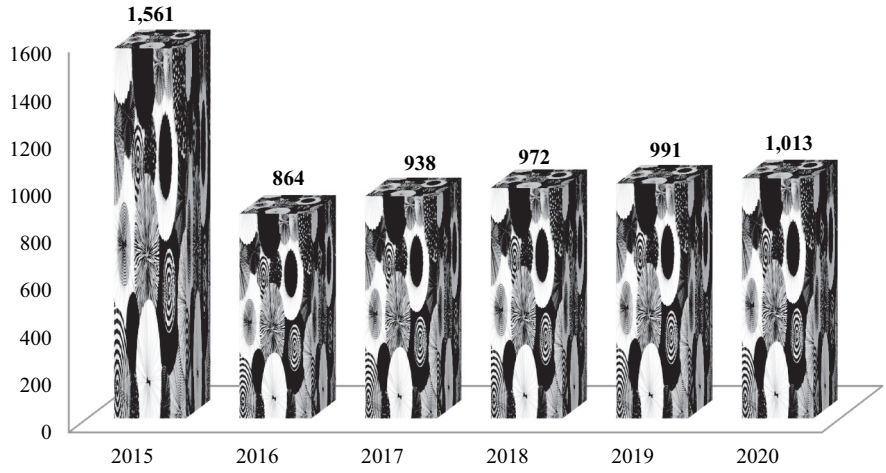

Figure 3. Tanzania FDI, 2015–2020. Source: World Bank (2021).

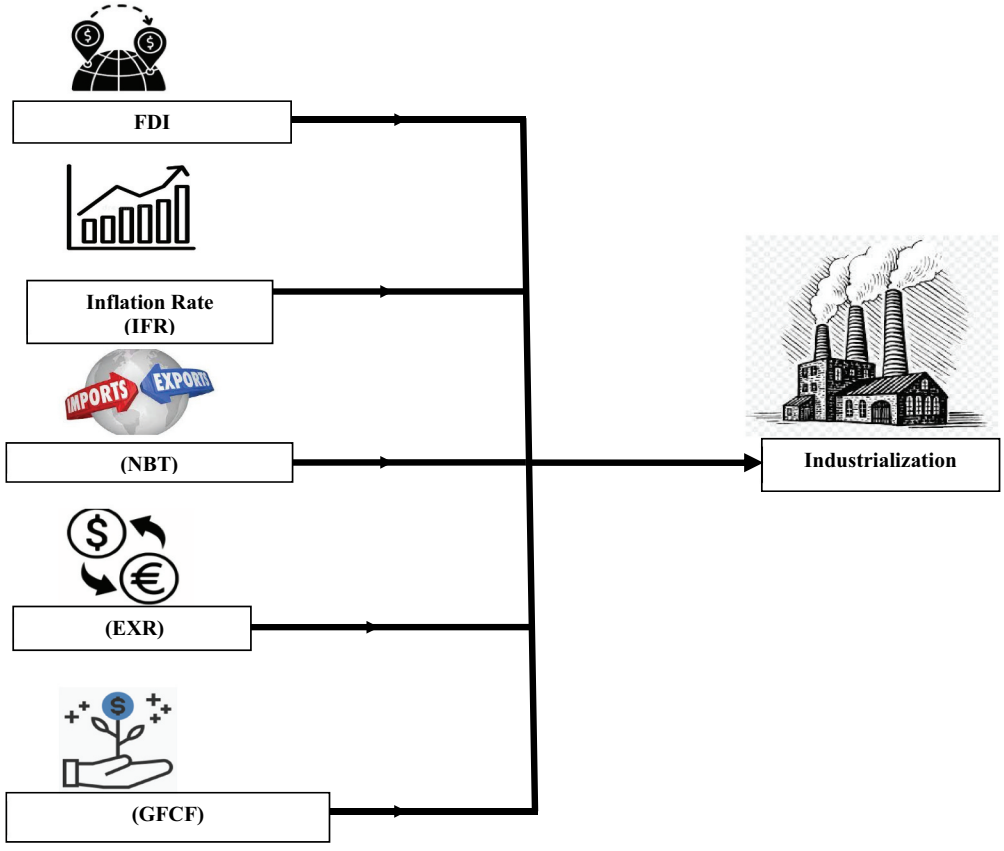

Figure 4. Conceptualization of the study. Tanzania's industrialization is estimated using Figure 4's macroeconomic parameters.

must also examine its effects on macroeconomic factors like Inflation, EXR, Gross fixed capital formation (GFCF), Terms of trade (NBT) as indicated in Figure 4.

Method, data and modelling

This study employed 1960–2020 World Bank macroeconomic data, using quantitative research design to provide good analytical insight of the key macroeconomic components in Tanzania. Sixty years of data reduces forecast and scale-dependent errors, which many time series studies ignore.

II. Stationarity tests (unit root test)

The Augmented Dickey Fuller (ADF) test is performed in testing for unit root under null hypothesis that series are not stationary $(H_0 : \delta = 0)$
Consider the ADF test that;

$$\Delta Y_t = \beta_1 + \delta Y_{t-1} + \sum_{i=1}^{n} \alpha_i \Delta Y_{t-i} + \varepsilon_i \qquad (1)$$

III. Cointegration test

This study performs Johansen cointegration test, which employs maximum likelihood to test multivariate VAR model long-run relationships.

Consider a vector$k$VARmodel; given vector being $I(1)$ or integrated at order one, then the explained variable can be written as:

$$Y_t = A_t Y_{t-1} + A_t Y_{t-2} + \ldots\ldots\ldots\ldots + A_k Y_{t-k} + \varepsilon_t \qquad (2)$$

Whereas Y_t and ε_t are the $n \times 1 vectors$ of which the equation 2 can be rewritten as

$$\Delta Y_t = \sum_{i=1}^{k-1} \omega_i Y_{t-i} + \prod Y_{t-1} + \mu_0 + \varepsilon_t \qquad (3)$$

of which

$$\prod = \sum_{i=1}^{k} A_i - \ 1 \ and \ \omega_i = -\sum_{j=i+1}^{k} A_j \qquad (4)$$

Meaning there are $n \times rmatrices and \alpha$and$\beta$ each with $'r'$ ranking with matrix of $\prod^{=} \alpha\beta'$ and $\beta' Y_t$is said to be stationary. However, this depends on whether the reduced rank $r < n$, α and individual columns of β are the adjustment parameters in VECM and cointegrating vector respectively, whereby$r$ is the number of cointegrating relationships.

We adopted VECM to capture the long-run and short-run dynamics after testing for cointegration.

FDI's impact on Tanzania's industrial performance was estimated using the following equations;

$$\begin{aligned} lnINDUL_t = \alpha_0 &+ \sum_{i=1}^{n} \theta \, lnINDUL_{t-1} \\ &+ \sum_{i=1}^{n} \psi \, lnEXR_{t-1} + \sum_{i=1}^{n} \eta \, lnFDI_{t-1} \\ &+ \sum_{i=1}^{n} \lambda \, lnINF_{t-1} + \sum_{i=1}^{n} \partial \, lnGFC_{t-1} \\ &+ \sum_{i=1}^{n} \Omega \, lnNBT_{t-1} + \ \varepsilon_t \end{aligned} \qquad (5)$$

$$\begin{aligned} \Delta lnINDUL_t = \alpha_0 &+ \sum_{i=1}^{n} \theta \Delta \, lnINDUL_{t-1} \\ &+ \sum_{i=1}^{n} \psi \Delta \, lnEXR_{t-1} \\ &+ \sum_{i=1}^{n} \eta \Delta \, lnFDI_{t-1} \\ &+ \sum_{i=1}^{n} \lambda \Delta \, lnINF_{t-1} \\ &+ \sum_{i=1}^{n} \partial \Delta \, lnGFC_{t-1} \\ &+ \sum_{i=1}^{n} \Omega \Delta \, lnNBT_{t-1} + \quad ECT_{t-1} \\ &+ \varepsilon_t \end{aligned} \qquad (6)$$

The coefficient of ECT_{t-1} is . To capture the short-run impact of FDI on Tanzanian industrial performance, equation 5 was transformed to the following estimating equation:

$$lnINDUL_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \, lnINDUL_{t-1} + \sum_{i=1}^{n} \beta_2 \, lnEXR_{t-1} + \sum_{i=1}^{n} \beta_3 \, lnFDI_{t-1} + \sum_{i=1}^{n} \beta_4 \, lnINF_{t-1} + \sum_{i=1}^{n} \beta_5 \, lnGFC_{t-1} + \sum_{i=1}^{n} \beta_6 \, lnNBT_{t-1} + \varepsilon_t \quad (7)$$

$$\Delta lnINDUL_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \Delta lnINDUL_{t-1} + \sum_{i=1}^{n} \beta_2 \Delta lnEXR_{t-1} + \sum_{i=1}^{n} \beta_3 \Delta lnFDI_{t-1} + \sum_{i=1}^{n} \beta_4 \Delta lnINF_{t-1} + \sum_{i=1}^{n} \beta_5 \Delta lnGFC_{t-1} + \sum_{i=1}^{n} \beta_6 \Delta lnNBT_{t-1} + ECT_{t-1} + \varepsilon_t \quad (8)$$

Therefore, $INDUL_t$ represents Tanzania's industrial sector performance from (1960–2020), while is the coefficient of the (ECT_{t-1}).

IV. Results and discussion

Stationarity test results in Table 1 show that all variables are stationary except EXR and GFCF. After variable transformation (i.e. first differencing) all variables became stationary.

Table 2 shows that the optimal lag for this study was order 2 because variables were integrated at order one (I(1)), indicating a long-term relationship between variables.

Table 3 shows that an increase in FDI increases industrial growth by 2.5% at lagged 2. Though the findings are not significant at first lag, a 1% increase in FDI increases industrial performance in Tanzania by 1.60%.

This suggests that FDI has a positive long-run relationship with industrial performance, which is consistent with Fauzel, Seetanah, and Sannasee (2015), Faruq (2012) and Chandran and Krishnan (2008). An increase in EXR reduces industrial performance by (65.567%) contrary to Afamefuna, Nnaji, and Nkalu (2019) who found that a 1% EXR hike increases manufacturing in Nigeria by 85.1% in

Table 1. Dickey fuller tests for stationarity (unit root test).

Variables (drift lags (0))	P-value for Z(t)	Test Statistic	Interpolated Dickey-Fuller		
			1% Critical Value	5% Critical Value	10% Critical Value
FDI	0.0054	-2.719***	-2.457	-1.697	-1.310
IFL	0.0268	-1.974**	-2.400	-1.675	-1.298
NBT	0.0884	-1.377*	-2.429	-1.686	-1.304
INDUL	0.0053	-2.639***	-2.392	-1.672	-1.296
EXR	0.9998	3.845	-2.392	-1.672	-1.296
GFC	0.9916	-0.194	-4.316	-3.572	-3.223
TRANSFORMATION OF SERIES TO BE STATIONARY					
D.EXR	0.0002	-4.546***	-3.567	-2.923	-2.596
D.GFC	0.0026	-3.831***	-3.709	-2.983	-2.623

***p < 0.01, **p < 0.5, *p < 0.1.

Table 2. Lag order selection criteria.

Lag	LL	LR	df	P-Value	FPE	AIC	HQIC	SBIC
0	-1251.01				6.70027	81.0972	81.1876	81.3747
1	-1089.38	323.25	36	0.000	2.10024	72.9924	73.6257	74.9352*
2	-1034.51	109.74*	36	0.000	8.30023*	71.7749*	72.9511*	75.383

Indicates lag order selected by the criterion.
LR: *Sequential Modified LR Test Statistic (each test at 5% level)*.
FPE: *Final Prediction Error*.
AIC: *Akaike information Criterion*.
SBIC: *Schwarz Bayesian Information Criterion*.
HICQ: Hannan Quinn Information Criterion.

Table 3. Long-run effects of FDI on industrialization.

VARIABLES	(1) lnINDUL	(2) lnFDI	(3) lnEXR	(4) lnGFC	(5) lnIFL	(6) lnNBT
L.lnINDUL	0.375	1.577	-0.124	-0.642	-1.086	0.0668
	(0.293)	(1.471)	(0.143)	(0.497)	(0.858)	(0.124)
L2.lnINDUL	0.123	3.149**	0.129	0.170	0.456	-0.321**
	(0.308)	(1.546)	(0.150)	(0.522)	(0.901)	(0.130)
L.lnFDI	0.0160	0.301***	0.00827	-0.0402	0.0413	-0.00196
	(0.0166)	(0.0832)	(0.00808)	(0.0281)	(0.0485)	(0.00701)
L2.lnFDI	0.0251*	-0.442***	-0.0135*	0.0395	-0.00326	-0.000113
	(0.0149)	(0.0749)	(0.00727)	(0.0253)	(0.0437)	(0.00631)
L.lnEXR	-0.656	2.056	1.095***	-0.385	0.220	0.231
	(0.418)	(2.100)	(0.204)	(0.710)	(1.225)	(0.177)
L2.lnEXR	0.383	3.126*	-0.248	0.490	-0.746	-0.223
	(0.356)	(1.790)	(0.174)	(0.605)	(1.044)	(0.151)
L.lnGFC	0.119	0.338	0.137	0.926***	0.564	-0.0384
	(0.196)	(0.987)	(0.0958)	(0.334)	(0.575)	(0.0831)
L2.lnGFC	-0.155	-1.841*	-0.0607	-0.0711	-0.328	0.248***
	(0.194)	(0.977)	(0.0949)	(0.330)	(0.570)	(0.0823)
L.lnIFL	-0.113*	0.810***	-0.0466*	-0.0989	0.798***	0.0110
	(0.0575)	(0.289)	(0.0281)	(0.0977)	(0.168)	(0.0243)
L2.lnIFL	0.000390	0.866***	0.0459	0.0112	-0.119	0.0424
	(0.0665)	(0.334)	(0.0324)	(0.113)	(0.195)	(0.0281)
L.lnNBT	0.774*	4.882**	0.111	0.494	0.203	0.327*
	(0.411)	(2.065)	(0.201)	(0.698)	(1.204)	(0.174)
L2.lnNBT	-0.287	-7.399***	-0.208	-0.339	-0.559	-0.258*
	(0.334)	(1.676)	(0.163)	(0.567)	(0.977)	(0.141)
Constant	1.681**	-3.397	-0.144	3.112***	1.930	0.157
	(0.690)	(3.465)	(0.337)	(1.171)	(2.020)	(0.292)
Model Strength						
AIC			-7.561097			
HQIC			-6.384948			
SBIC			-3.953001			
Log likelihood			195.1970			
FPE			2.921100			

***$p < 0.01$, **$p < 0.5$, *$p < 0.1$.
Standard errors in parentheses.

Table 4. VECM results with short-run dynamics.

Variables	Coefficients	P- Value	[95% Confidence Interval]	
ECT L1.	-0.1632089*** (0.053939)	0.002	-0.2689274	-0.0574904
lnINDUL	-0.3906029 (0.3860079)	0.312	-1.147165	0.3659588
lnFDI	-0.0369082** (0.018255)	0.043	-0.0726874	0.0011289
lnEXR	0.2470798** (0.6238949)	0.046	-0.3877425	0.881902
lnGFC	0.2075971 (0.2488694)	0.404	-0.2801778	0.6953721
lnIFL	-0.0365797 (0.0805392)	0.650	-0.1944336	0.1212741
lnNBT	0.0102927 (0.411161)	0.980	-0.7955682	0.8161535
Model Strength				
AIC		-5.871851		
HQIC		-5.072672		
SBIC		-3.420195		
Log likelihood		144.0137		

***p < 0.01, **p < 0.5, *p < 0.1.
Standard errors in parentheses.

the long-run. Increased GFCF enhanced industrialization in the first lag but had negative effects in the second lag. In contrast, inflation behaved differently in both lags, while NBT boosted industrialization.

Table 4 provides estimates on the speed of adjustment for both short-run and long-run equilibrium measured by ECT. The negative value of the *ECT* (-0.1632089) shows that when $lnINDUL_{t-1}$ is out or below the equilibrium level; the ECT_t must be negative so that it pulls $lnINDUL_{t-1}$ towards its long-run equilibrium with other variables affecting industrialization performance. Since these time series data are yearly specified, 16.32089% of the model's disequilibrium will be corrected in a year period. The model is well specified because the ECT ranges from 0 to 1 and has negative coefficient. Table 4 shows that NBT, EXR, and GFCF significantly impact industrial performance. The findings are similar to studies conducted in Ghana and Mauritius by Iddrisu, Adam, and Halidu (2015) and Fauzel, Seetanah, and Sannasee (2015).

V. Conclusion

The results inform policies and strategies for short- and long-term economic recovery in Tanzania and the economic impact of FDI on industrialization. This study establishes that FDI has a negative short-term impact on Tanzania's industrial performance but a positive and significant long-term impact. Implying that FDI has multiplier effects on the economy and can stimulate industrial growth and other sectors through capital generation and technological transfer from highly industrialized countries, helping developing nations diversify their exports and economic base.

Disclosure statement

No potential conflict of interest was reported by the authors.

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