Assessing the Role of FDI Inflows and Money Supply in Driving Manufacturing Success: A Case of Singapore

Dr. Hira Aftab[1], Arifa Saeed[2], Muhammad Mudassar Naushahi[3], Hafiz Muhammad Irfan[4]

Abstract
The manufacturing value added is an important macroeconomic indicator that drives economic activities through supply chain, exports, employment opportunities, public revenue and living standards. This research paper aims to identify the major macroeconomic factors that determine manufacturing value added in Singapore. The study applies ARDL method over annual ranging from 1981 to 2022. The results indicates long run cointegrating relation between manufacturing value added and its determinants, while money supply acts as a tool of monetary policy and foreign direct investment to boost manufacturing value added. The results obtained further indicates that although in the short run imports might increase manufacturing value added, but over time they reduce it instead. The study therefore recommends expansionary monetary policy may be promoted to boost manufacturing value added while actively encouraging FDI inflows so that domestic manufacturing can be stimulated.
Keywords: FDI Inflows; Monetary Policy, Manufacturing Value Added, ARDL, Singapore

1. Introduction

Manufacturing shows to all the industries which belong to International Standard Industrial Classification (ISIC) divisions fifteen to thirty seven. However, the value added refers to the net production that we receive after excluding the intermediate inputs from the gross production of the sector. Manufacturing value added (MVA) is a key driver that reflects industrial growth and this ultimately represents economic activity of any country. The higher manufacturing value added refers to higher level of employment. This increases incomes of the economic agents - households and businesses. The higher rewards provide opportunities to economic agents to access basic needs. This helps them to uplift their livelihood and ultimately standard of living. There are several indicators which may escalate manufacturing value added. FDI inflows, monetary policy, imports and energy use are among one the important drivers of manufacturing value added. According to various researches, there are many macroeconomic factors which influence level of production [Hanif et al. (2014); Nazli et al. (2018); Hanif et al. (2020); Hanif and Gago-de Santos (2017); Huang et al. (2020); Wang et al. (2022) and Alharthi and Hanif (2020)]. The FDI inflows allow the multinational corporations to bring their investments in a country. This increases availability of funds; R&D, technological advancement, skills, overall production and employment opportunities. The increase in production actually expands domestic manufacturing therefore; we have taken FDI inflows as a determining factor of MVA in our research. There are scholars like Danmola et al. (2017); Abbasi (2022), Dhungel and Lamichhane (2023) and Yee and Bakar (2023) who have considered FDI inflows as an important factor of manufacturing value added in their research. Their findings uncover significantly encouraging effects of FDI inflows on MVA.

Another important factor which drives manufacturing value added is the conduct of monetary policy. In this research, we have taken money supply as proxy for monetary policy. The increase in money supply refers to expansionary monetary policy while vice versa in case of contractionary monetary policy. The increase in quantity of money in the economy tends to increase cash in hands of the general public. The more cash in hands gives opportunity to to investors to increase investments and hence the overall production in the economy. While on the other side, the more cash in hands provides chance to buyers to purchase more goods and services. This allows suppliers to increase supply of goods in the market. These both channels put pressure upon the supply chain and hence it increases manufacturing of goods and services to meet the required demand for goods and services. This shows that money supply has a positive impact on manufacturing value added. There are researchers such as Okonkwo et al. (2015); Hammed (2020), Adekunle (2021) and Bello (2023) who have inquired the impact of monetary policy in the form of money supply on manufacturing value added and provide evidence of positive and significant impact of money supply on MVA. These researchers have supported our intuition. Afterwards, we also see the role of imports and energy use in determining the performance of manufacturing value added. Both imports and energy use can have dual impact on MVA. Based on this discussion, this research is designed to capture the effects of FDI inflows, money supply, imports and energy use on manufacturing value added for Singaporean economy.

The rest of the study is organized as the next section will throw light upon literature review section. The third section will provide discussion of model and methods. Section four will highlight results and discussion. Last and final section will present conclusion and policy recommendations.

2. Literature Review

In this part, the research contribution of various scholars is presented who have conducted their studies to capture the effects of foreign direct investment flows and money supply on manufacturing value added. This section begins from the research of Okonkwo et al. (2015) who reported that industrial production significantly improved due to increase in money supply in Nigerian context. During the similar year and for similar sample economy, we found Ali et al. (2015)'s contribution in which they suggested an insignificant role of money supply in determining manufacturing sector performance. For Algerian economy, Omolade and Ngalawa (2016) uncovered an insignificant contribution of shocks in money supply to shocks in manufacturing sector. After this research Omolade and Ngalawa (2017) extended their sample to Libya and Nigeria and tested the similar hypothesis. They exposed that Libya following fixed exchange rate system was showing insignificant impact of shocks in money supply on shocks in manufacturing sector while the impact of shocks in money supply turned significant to influence shocks in manufacturing sector in case of Nigerian economy. The FDI in manufacturing sector exerted significant and positive influence on production of manufacturing sector in case of Nigeria [Danmola et al. (2017)].

---

[1] Assistant Professor; Institute of Business and Information Technology, University of the Punjab, Lahore, Pakistan, hira.aftab@ibitpu.edu.pk
[2] Assistant Professor; Department of Economics and Finance, Greenwich University, Karachi, Pakistan, arfasaeed@gmail.com
[3] PhD Scholar; Department of Economics and Quantitative Methods, Dr. Hasan Murad School of Management (HSM), University of Management and Technology, Lahore, Pakistan, economistnaushahi18@gmail.com
[4] Corresponding Author, Administrative Manager, Zonergy Corporation Limited, Pakistan, irfan.hamid78658@gmail.com

Eze et al. (2019) in their research highlighted the insignificant impact of foreign direct investments on growth of manufacturing output for Nigerian economy. According to Hammed (2020), shocks to monetary policy left significantly increasing impact on productivity of manufacturing sector in case of Nigerian economy. The study considered money supply as a tool of monetary policy. During the same period, we witnessed Azolibe (2020) who inquired the role of both inward and outward FDI flows on manufacturing sector of MENA region. The empirical results exerted positive and significant impact of both types of FDI on manufacturing sector of the selected region. After this research, Adekunle (2021) for the similar country disclosed that manufacturing sector production was increasing due to expansion in supply of money. In another research considering Bangladesh economy, Al Abbasi (2022) disclosed that manufacturing value added significantly stimulated due to increase in FDI. The contribution of Dhungel and Lamichhane (2023) suggested that FDI inflows and money supply significantly escalate economic growth in Nepal. In another research conducted by Bello (2023), the study highlighted that manufacturing value added was significantly increasing in response to increase in money supply in Nigeria's case. The manufacturing sector growth responded significantly and positively to the changes in money supply for the similar African economy as considered by Bello (2023). After this, we further witnessed Sunde's (2023) work who disclosed significantly increasing impact of foreign direct investment on Namibia's economic growth. The net inflow of FDI was significantly appreciating growth of manufacturing sector of Malaysian economy as highlighted by Yee and Bakar (2023) in their research. After this section, the model and methodological discussion is going to be discussed in the next section.

3. Sample, Model and Method

The annual sample ranging from 1981 to 2022 is selected from World Bank (2024) data bank. All the selected variables in a model are presented as below:

$$\ln MVA_t = f\ (\ln FDI_t, \ln MS_t, \ln IMP_t, \ln EU_t)$$

Whereas;

Table 1: Names of the Variables & their Demonstration

Indicators	Representation
Manufacturing as share of GDP	$\ln MVA_t$
Foreign Direct Investment, Net Inflows as share of GDP	$\ln FDI_t$
Money Supply as share of GDP	$\ln MS_t$
Imports of Goods and Services as share of GDP	$\ln IMP_t$
Energy Use Per Capita	$\ln EU_t$

In order to estimate empirical findings, this research is going to apply different steps. Initially the summary of all the selected variables will be presented to see the mean values and normality status. After this, the detection of multicollinear regressors will be identified by using VIF test. The results will expose whether the explanatory variables are significantly correlated with each other or not. Later on, the status of stationarity will be tested by using KPSS (1992) unit root test. This test will guide the readers about the order of integration of the selected series. Besides this, the long run relation between manufacturing value added; FDI inflows, money supply, imports and energy use will be estimated using the method of Pesaran et al. (2001). This method is frequently applied in case of mixed order of integrated data series. After confirming long run relation for our proposed model, the impact of all the explanatory variables on manufacturing value added will be reported for two periods – long run period and short run period. In order to see whether the impact of our proposed regressors on MVA is stable during both periods, we will present post estimation diagnostics. If these diagnostics will be stable then based on these results, we will present certain policy implications to improve manufacturing value added for our proposed country. The empirical results are going to be presented in the next part which is presented as below:

4. Results and Discussion

The discussion of results is going to be demonstrated in this section. Table -2 shows the summary of mean values, standard deviation and normality of the selected indicators. The energy use demonstrates the highest mean value which 8.3771 percent while money supply reveals lowest mean value which is negative 0.0317 percent. Imports and energy use do not represent the normal distribution as the JB test appears significant for both indicators. The results are presented as below:

Table 2: Variables Summary Statistics

Variables	Mean	Standard Deviation	Jarque-Bera Test	Probability Value	Sample Size
$\ln MVA_t$	2.9898	0.0578	0.4386	0.8031	42
$\ln FDI_t$	-0.1975	0.0511	2.1001	0.3499	42
$\ln MS_t$	-0.0317	0.2156	4.4191	0.1097	42
$\ln IMP_t$	4.7841	0.2871	4.9141	0.0857	42
$\ln EU_t$	8.3771	0.3217	8.7041	0.0129	42

Now the detection of multicollinear regressors are going to be identified by considering the results of VIF. In case if VIF values for any pair of regressors appear to be 10 or above then the two regressors reveal significant correlation between them.

Hence indicating presence of multicollinearity. But if VIF values remain below 10 between pair of regressors then correlation between both regressors appears to be insignificant hence leading to conclude absence of multicollinearity problem. Results of VIF are shared in the following Table -3 represent that all the regressors have insignificant correlation between each other as VIF value for all the pair of regressors remain less than 10. On the basis of the results, we may conclude that there is no issue of multicollinearity in this research. Below presented Table -3 shows the VIF stats:

Table 3: VIF Matrix

Variables	$\ln FDI_t$	$\ln MS_t$	$\ln IMP_t$	$\ln EU_t$
$\ln FDI_t$	-			
$\ln MS_t$	1.6037	-		
$\ln IMP_t$	1.9357	6.6814	-	
$\ln EU_t$	1.3011	2.4179	2.8192	-

After discussing multicollinear regressors, the status of stationary indicators is going to be explained in Table -4. For this purpose, KPSS (1992) unit root test is used. The null hypothesis reveals stationary series while alternate shows nonstationary series. If the calculated LM stats appear to be larger than the 1% critical value which is 0.739 then the LM stats falls in the critical region where we reject null hypothesis and conclude that series is nonstationary. At zero difference, the below presented results show that manufacturing value added; foreign direct investment, imports and energy use have LM –stats larger than the 1% critical value of 0.739 therefore, for all these series we reject null hypothesis of stationary series and accept alternate hypothesis of nonstationary series. The unit root results are shared as below:

Table 4: KPSS Unit Root Test

At Level		At First Difference	
Variables	LM-Test	Variables	LM-Test
$\ln MVA_t$	0.8214	$\Delta \ln MVA_t$	0.1161
$\ln FDI_t$	1.4494	$\Delta \ln FDI_t$	0.0340
$\ln MS_t$	0.6493	$\Delta \ln MS_t$	0.1438
$\ln IMP_t$	1.0357	$\Delta \ln IMP_t$	0.2291
$\ln EU_t$	1.1724	$\Delta \ln EU_t$	0.2983

The money supply has LM stats = 0.6493 which is less than the 1% critical value of 0.739 hence for this series, we accept the null hypothesis and conclude that at zero difference only money supply is stationary series while the rest are nonstationary series. At first difference all the variables have LM –stats below than 1% critical value of 0.739 hence, all are stationary series at first difference. Based on these results, we conclude that we have mixed order of integrated series for our proposed model. Therefore, we are going to apply ARDL bounds test developed by Pesaran et al. (2001) in order to examine long run cointegrating relation between manufacturing value added and its determining factors.

Table 5: Pesaran et al. (2001) Estimates

Proposed -Function	$\ln MVA_t = f\ (\ln FDI_t, \ln MS_t, \ln IMP_t, \ln EU_t)$	
Lag-Order	(1 , 0 , 0 , 1, 0)	
F –Test	5.9379	
	Critical Bounds	
Significance-Level	Lower	Upper
5 -percent	3.1825	4.4427
10 -percent	2.6494	3.7911
	DIAGNOSTIC -TESTS	
Serial -Correlation	0.0008 [0.978]	
Functional -Form	0.4037 [0.525]	
Normality	0.6154 [0.735]	
Heteroscedasticity	0.1205 [0.729]	

"[]" carries probability values

We are going to present the results of the cointegrating relation between manufacturing value added; FDI inflows, money supply, imports and energy use in the Table -5. This relation is said to be significant if the F –test is witnessed as larger than

the 5% or 10% upper critical value. From the results, the F –test value is 5.9379 which is larger than the 5% upper critical value of 4.4427, this confirms that the cointegrating relation between manufacturing value added and its regressors is significant. Therefore, both have long run relationship between each other. The results further highlight that error term has no serial correlation as the serial correlation test suggest that null hypothesis of no serial correlation is true. The study also shows that the proposed model is correctly specified; error term is normally distributed and error term has homoskedastic variance. For all these tests, null hypothesis is accepted based on the insignificant probability values of each test. The estimates are shared in table 5.

After presenting discussion of long run cointegrating relation between manufacturing value added, FDI inflows, money supply, imports and energy use, now we are going to explain the impact of all the regressors on MVA in long run. The estimates are presented in Table -6 which reveal that FDI inflows have significantly positive impact on manufacturing value added. This reveals that when more investments are received from multinational companies then more industries are installed leading to escalate level of production in the country. Therefore, FDI inflows have encouraging effect on manufacturing value added. Like if we increase FDI inflows by one percent then manufacturing value added significantly increase by 0.7768 percent. The results also expose that money supply has significant and positive impact on manufacturing value added. Like if expansionary monetary policy is implemented by the monetary authority then more quantity of money is flouted in the market. This shows that economic agents like buyers and investors carry more cash in hands. The investors tend to increase investments with more funds leading to expand industrial growth. This indicates expansion of domestic manufacturing. The coefficient of money supply shows that if we increase money supply by 1 percent then manufacturing value added significantly stimulates by 0.6534 percent. The results further uncover that imports significantly hinder manufacturing value added in the long run. The increase in imports expands availability of goods and services in the economy leading to increase competition for the domestic manufacturer. When imported item is available on a relatively cheaper rate than the domestic product then this would reduce sales of domestic goods leading to incur losses to the domestic manufacturer. This will ultimately reduce domestic production hence leading to reduce overall manufacturing of goods and services. From the coefficient we may see that by increasing imports 1 percent, manufacturing significantly deteriorates by 0.3298 percent. The energy utilization is not relevant in our proposed scenario. The results are shared as below:

Table 6: Parameters for Long Run

Dependent Variable = $\ln MVA_t$

Regressors	Coefficients	Standard Error	t-test	P.Value
$\ln FDI_t$	0.7768	0.3875	2.0044	0.0530
$\ln MS_t$	0.6534	0.2480	2.6345	0.0126
$\ln IMP_t$	-0.3298	0.1733	-1.9024	0.0656
$\ln EU_t$	-0.1094	0.0782	-1.3989	0.1709
C	5.6275	1.0299	5.4641	0.0000

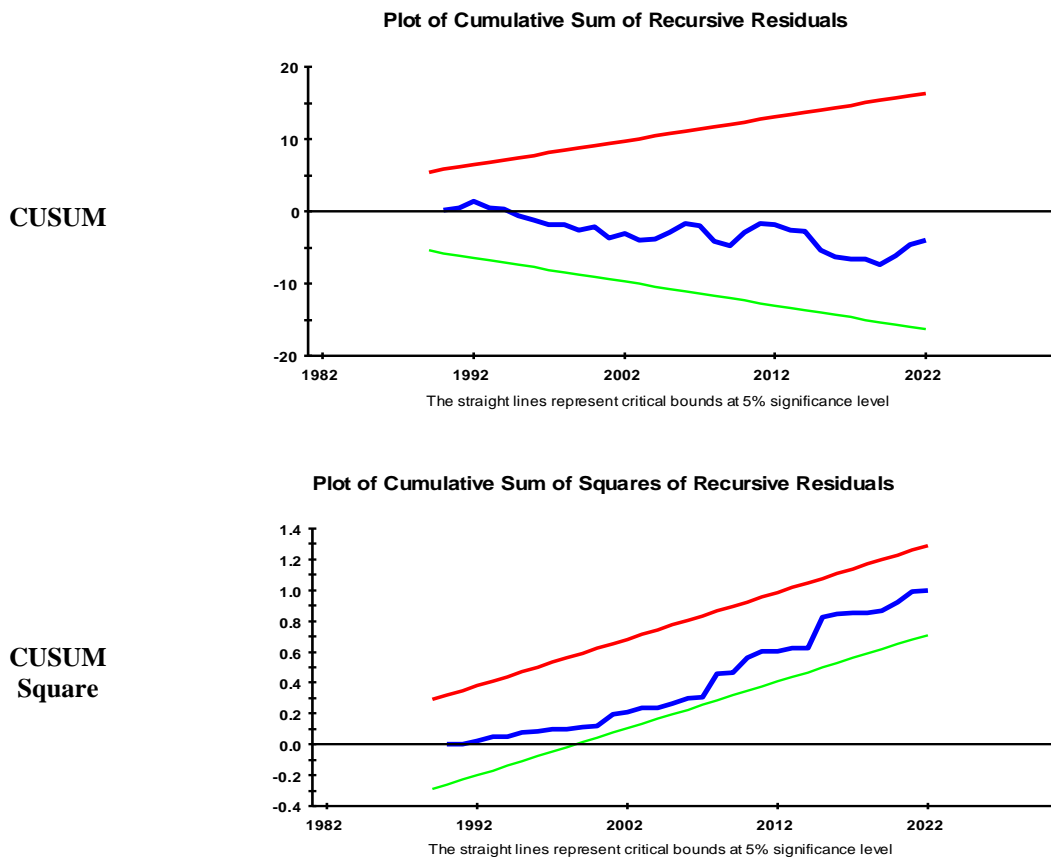### Table 7: Short-Run Estimates

Dependent Variable = $\Delta \ln MVA_t$

Regressors	Coefficients	Standard Error	t-test	P.Value
$\Delta \ln FDI_t$	0.3250	0.1503	2.1616	0.0378
$\Delta \ln MS_t$	0.2734	0.0724	3.7749	0.0006
$\Delta \ln IMP_t$	0.4643	0.1327	3.4978	0.0013
$\Delta \ln EU_t$	-0.0458	0.0312	-1.4663	0.1518
CointEq(-1)	-0.4184	0.0996	-4.2008	0.0002
Diagnostic Tests				
$\bar{R}^2$				0.5885
F-Test (Probability Value)				12.6426 (0.000)
DW-Test				1.9906

The impact of FDI inflows; money supply, imports and energy use on manufacturing value added is further captured for short run period which is presented in Table 7. The results highlight that FDI inflows significantly encourage domestic manufacturing while expansionary monetary policy also stimulates manufacturing value added. Both indicators are production friendly indicators. The results further demonstrate that expanding imports help in increasing manufacturing in the short run. This is may be due to the reason that raw material or technological inputs are imported in the short run which may help in expanding production activities leading to give boost to manufacturing value added. Hence imports may lead to leave significantly positive impact on manufacturing value added. Besides this, unlike long run, energy use has also insignificant impact on manufacturing value added even in short run. The results further indicate that lagged error term for first period has

negative and significant coefficient. This confirms convergence hypothesis and the disequilibrium is going to be corrected with the speed of adjustment 41.84 percent each year. This means that the study will attain long run stable equilibrium in about 2.39 years.

After presenting discussion of short run estimates, now we are going to talk about the stability of mean and variance of error term. This can be witnessed with the help of CUSUM - Cumulative sum and CUSUM square - cumulative sum of square graphs. If the blue thick line appears within its critical boundary then the said test appears to be stable. From the below presented graphs we may see that both CUSUM and CUSUM square graphs are stable which reveal that both mean and variance of error term of our proposed model for manufacturing value added are stable. Therefore, both long and short run estimates for manufacturing value added during the selected period 1981-2022 are stable. This also indicates that there is absence of structural break issue in the study. The graphs are presented as below:

Plot of Cumulative Sum of Recursive Residuals

CUSUM

The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals

CUSUM Square

The straight lines represent critical bounds at 5% significance level

5. Conclusion

This research inquires the impact of FDI inflows; money supply, imports and energy use on manufacturing value added for Singaporean economy. After considering ARDL bounds test over a span of 1981-2022, this research confirms that FDI inflows have significant and positive influence on manufacturing value added. The results further expose that expansionary monetary policy is helpful in stimulating manufacturing value added. Imports demonstrate mixed results based on time period like in the long run it reveals inverse impact while in short run it encourages manufacturing value added. The study also shows that energy use remains irrelevant in Singapore. On the basis of these estimates this research recommends that expansionary monetary policy may be encouraged in such as way that it may expand manufacturing value added at a faster rate while it may not effect inflation in the country while FDI inflows are also promoted for stimulating manufacturing value added. Lastly, the imports of raw material, technology, R&D may be encouraged which may give boost to domestic manufacturing in Singapore.

References

Adekunle, O. E. (2021). The Manufacturing Sector Impact of Monetary Policy Frameworks: Evidence from Nigeria. *Financial Markets, Institutions and Risks,* 5 (3), 14-22.

Al Abbasi, A. A. (2022) Impact of Foreign Direct Investment on Manufacturing Sector of Bangladesh. *International Journal of Innovation, Creativity and Change,* 16 (3), 224-247.

Alharthi, M., & Hanif, I. (2020). Impact of blue economy factors on economic growth in the SAARC countries. *Maritime Business Review*. 5(3), 253-269.

Ali, M., Aliero, H., & Abubakar, M. (2015). An empirical analysis of the effect of monetary policy on the manufacturing sector in Nigeria. *Economic and Financial Review*, *53*(2), 19-46.

Asemota, J. O., & Agunobi, C. C. (2023). Effect of Monetary Policy on Manufacturing Sector Growth in Nigeria. *AFIT Journal of Marketing Research*, *3*(1), 125-136.

Azolibe, C. B. (2020). Does foreign direct investment influence manufacturing sector growth in Middle East and North African region?. *International Trade, Politics and Development*, *5*(1), 71-85.

Bello, S. M. (2023). Impact of Money Supply and Exchange Rate on Manufacturing Sector in Nigeria (1980–2019). *2nd International Conference, Department of Economics, Gombe State University,* 389-401.

Danmola, R. A., Olateju, A. O., & Aminu, A. W. (2017). The impact of foreign direct investment on the Nigeria manufacturing sector: A time series analysis. *European Scientific Journal*, *13*(31), 521-556.

Dhungel, B. D., & Lamichhane, P. (2023). Impact of Foreign Direct Investment on Economic Growth. *Humanities and Social Sciences Journal*, *15*(1-2), 1-13.

Eze, A. A., Nnaji, M., & Nkalu, N. C. (2019). Impact of foreign direct investment on manufacturing sector output growth in Nigeria. *International Journal of Applied Economics, Finance and Accounting*, 5 (2), 55-64.

Hammed, Y. S. (2020). Monetary policy shocks and manufacturing output in Nigeria (1981-2018). *Advanced Journal of social science*, *7*(1), 27-37.

Hanif, I., Chaudhry, I. S., & Wallace, S. (2014). Fiscal autonomy and economic growth nexus: Empirical evidence from Pakistan. *Pakistan Journal of Social Sciences*, *34*(2), 767-780.

Hanif, I., & Gago-de Santos, P. (2017). Impact of fiscal decentralization on private savings in a developing country: Some empirical evidence for the case of Pakistan. *Journal of South Asian Development*, *12*(3), 259-285.

Hanif, I., Wallace, S., & Gago-de-Santos, P. (2020). Economic growth by means of fiscal decentralization: an empirical study for federal developing countries. *SAGE Open*, *10*(4), 2158244020968088.

Huang, Y., Raza, S. M. F., Hanif, I., Alharthi, M., Abbas, Q., & Zain-ul-Abidin, S. (2020). The role of forest resources, mineral resources, and oil extraction in economic progress of developing Asian economies. *Resources Policy*, *69*, 101878.

Kwiatkowski, D., Phillips, P. C., Schmidt, P., & Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root: How sure are we that economic time series have a unit root?. *Journal of econometrics*, *54*(1-3), 159-178.

Nazli, A., Siddiqui, R., & Hanif, I. (2018). Trade reforms and productivity growth in manufacturing industries of Pakistan. *Review of Economics and Development Studies*, *4*(2), 199-207.

Okonkwo, O. N., Godslove, K. E., & Mmaduabuchi, E. F. (2015). Monetary policy and the manufacturing sector in Nigeria. *SSRG International Journal of Economics and Management Studies (SSRG-IJEMS)*, *2*(1), 17-25.

Omolade, A., & Ngalawa, H. (2016). Monetary policy transmission and growth of the manufacturing sector in Algeria. *Investment Management and Financial Innovations*, *13*(4), 212-224.

Omolade, A., & Ngalawa, H. (2017). Monetary policy transmission mechanism and growth of the manufacturing sectors in Libya and Nigeria. Does exchange rate regime matter? *Journal of Entrepreneurship, Business and Economics*, *5*(1), 67-107.

Pesaran MH, Richard J, Shin Y (2001) Bounds Testing Approaches to the Analysis of Level Relationships. *J Appl Econom* 16(3), 289-326.

Sunde, T. (2023). The impact of foreign direct investment on Namibia's economic growth: A time series investigation. *Cogent Economics & Finance*, 11 (1), 1-15.

Yee, W. S., & Bakar, N. A. A. (2023). Determinants of Manufacturing Sector Growth in Malaysia. *Global Academic Journal of Economics and Business,* 5 (6), 151-156.

Wang, J., Hassan, M. S., Alharthi, M., Arshed, N., Hanif, I., & Saeed, M. I. (2022). Inspecting non-linear behavior of aggregated and disaggregated renewable and non-renewable energy consumption on GDP per capita in Pakistan. *Energy Strategy Reviews*, *39*, 100772.

World Bank (2024) World Development Indicators. World Bank, Washington, D.C.