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Macroeconomic Drivers of Industrial Performance in the Developing Eight (D-8) Countries

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Abstract: This study investigated the macroeconomic determinants of the manufacturing sector in the Developing 8 (D-8) countries—ie, Bangladesh, Egypt, Indonesia, Iran, Malaysia, Nigeria, Pakistan, and Türkiye—using annual data from 2011 to 2022. The effects of foreign direct investment (FDI), urbanization, inflation, unemployment, and defense expenditures were analyzed with two-stage least squares (2SLS) and generalized method of moments (GMM) estimators to address potential endogeneity. The findings revealed that urbanization has a positive and significant effect on manufacturing, highlighting the role of agglomeration economies and structural transformation. Inflation was also found to support industrial production, suggesting demand-driven dynamics. In contrast, unemployment exerts a negative effect on manufacturing output, highlighting the importance of labor market efficiency and effective resource utilization. Defense expenditure contributes positively to the sector, reflecting demand-side and potential technological spillover effects. However, FDI did not exhibit a significant effect, implying that its effectiveness might depend on country-specific institutional and structural conditions. Overall, the results provide important insights for policy makers aiming to promote sustainable industrial growth in D-8 countries.

Keywords: manufacturing sector, D-8 countries, foreign direct investment (FDI), urbanization, inflation, unemployment, military expenditures

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Introduction

Industrial production is at the center of economic development and is considered the driving force of sustainable growth, especially in low-income countries (Rodrik, 2013). The manufacturing sector, which is a sub-branch of the industrial sector, plays a crucial role in areas, such as job creation, technology transfer, and economic diversification, along with increasing economic output. However, understanding the key determinants of the performance of the manufacturing sector is crucial for improving the effectiveness of development policies. Macroeconomic variables, such as foreign direct investment (FDI), urbanization, inflation, unemployment, employment, and military spending are the main factors shaping the manufacturing sector (Haveman et al., 1993; Hansen & Rand, 2006; Onaran & Stockhammer, 2006; Kaskarelis, 2009; Zheng et al., 2019).

Known as the Developing 8 (D-8) countries, Bangladesh, Egypt, Indonesia, Iran, Malaysia, Nigeria, Pakistan, and Türkiye converged in 1997 to promote economic cooperation (Canbay, 2021). The conceptual foundations of the organization were laid during the Cooperation in Development seminar held in Istanbul in 1996, and it was officially established on December 15, 1997, via a declaration signed under the leadership of Necmettin Erbakan, the then Prime Minister of the Republic of Türkiye (Razzaqi et al., 2011). These countries, which attract attention because of their high population density, rapid urbanization, and economic potential, share the goals of modernizing their industrial infrastructure and supporting sustainable development (Doğan & Delice, 2021). However, the industrial production processes of D-8 countries show considerable differences in terms of economic structure, political conditions, and demographic characteristics. In this context, an analysis of the D-8 countries can make important contributions to both the development literature and the decision-making processes of policy makers.

In the literature, FDI has been shown to increase industrial production by transferring technology and modernizing production processes (Borensztein et al., 1998). Similarly, urbanization reportedly affects economic productivity via infrastructure development, labor intensity, and local market growth (Henderson, 2003; Zheng et al., 2019). However, it is also emphasized that rapid and uncontrolled urbanization processes can put pressure on infrastructure and negatively affect economic balances (Pradhan et al., 2021). Macroeconomic problems, such as inflation and unemployment, can affect manufacturing industry production due to production costs (Ball & Mankiw, 1994; Onaran & Stockhammer, 2006; Kaskarelis, 2009). Regarding military expenditures, Keynesian approaches argue that they

could support industrial production with demand growth (Keynes, 1936), while the crowding out effect suggests that these expenditures could limit private sector investments (Barro, 1979).

Figure 1 reveals substantial cross-country heterogeneity in the share of manufacturing in gross domestic product (GDP) across D-8 economies, reflecting differences in industrial structures, policy orientations, and exposure to external shocks.

In Bangladesh, the manufacturing share remained somewhat stable during the mid-1990s but began to increase steadily after the mid-2000s, surpassing 20% by 2015 and reaching approximately 22% in 2022. This upward trajectory can be largely attributed to export-oriented industrialization, particularly the rapid expansion of the textile and garment sector, supported by low labor costs and deeper integration into global value chains.

In contrast, Indonesia experienced a decline in the share of manufacturing following its peak of 26–28% in the early 1990s. Since the mid-2000s, this share has steadily decreased to around 18% by 2022. This pattern reflects a structural shift toward services and resource-based sectors, and the effects of deindustrialization observed in several emerging economies.

Malaysia presents a similar downward trend, despite maintaining a relatively high manufacturing share of around 30% in the 1990s. The gradual decline after the early 2000s, reaching approximately 23% in 2022, can be linked to economic diversification and the transition toward a more service-oriented and high-income economy, where manufacturing loses its relative weight.

Türkiye exhibits a U-shaped pattern. While the share of manufacturing was around 22% in the early 1990s, it declined considerably in the 2000s, falling to approximately 16–17%. This decline is closely associated with structural adjustments following the 2001 financial crisis and the increased integration into global markets. After 2015, however, a recovery was observed, with the share of manufacturing rising again to around 22% in 2022, reflecting renewed industrial growth and export expansion.

In Egypt, the manufacturing share increased until the early 2000s, reaching approximately 18.5% but subsequently declined and followed a volatile pattern. This instability can be associated with macroeconomic imbalances, structural inefficiencies, and political disruptions, particularly in the post-2011 period.

Iran demonstrates a fluctuating trajectory, with the manufacturing share at around 15–16% in the 1990s, followed by a decline in the early 2000s and a sharp increase after 2020. These dynamics are closely linked to external sanctions, oil dependency, and policy shifts aimed at strengthening domestic production under constrained international conditions.

Pakistan shows a somewhat stable but low manufacturing share, which was around 15% in the 1990s and followed by a notable decline in the early 2000s. Although a partial recovery was observed after 2010, the share remains limited between 11–13% indicative of structural constraints, such as energy shortages, political instability, and limited industrial diversification.

Nigeria experienced one of the most pronounced declines, with the manufacturing share falling from approximately 19% in the early 1990s to around 8% in the early 2000s. Although some recovery was observed after 2010, the share remains relatively low. This trend can be explained by the dominance of the oil sector, which has historically crowded out manufacturing activity, along with persistent infrastructure deficiencies.

Overall, manufacturing performance across D-8 countries has followed divergent paths (Figure 1). While countries such as Bangladesh and Türkiye have shown a resurgence in manufacturing, others such as Indonesia and Malaysia exhibit long-term declines associated with structural transformation. Meanwhile, countries, such as Nigeria, Egypt, and Iran, display more volatile patterns driven by macroeconomic instability and external constraints. These heterogeneous trajectories underscore the importance of country-specific structural factors and policy frameworks in shaping industrial development.

This study examined the effects of variables, such as foreign direct capital inflows, urbanization rate, inflation, unemployment, and military expenditures on the manufacturing sector in D-8 countries. Using generalized method of moments (GMM) and two-stage least squares (2SLS) data analysis methods with annual data from 2011 to 2022, this study aimed to consider the heterogeneities across countries and provide practical recommendations for policy makers. From the analyses, the study aims to fill the existing gap in the literature to better understand the industrialization processes of the D-8 countries.

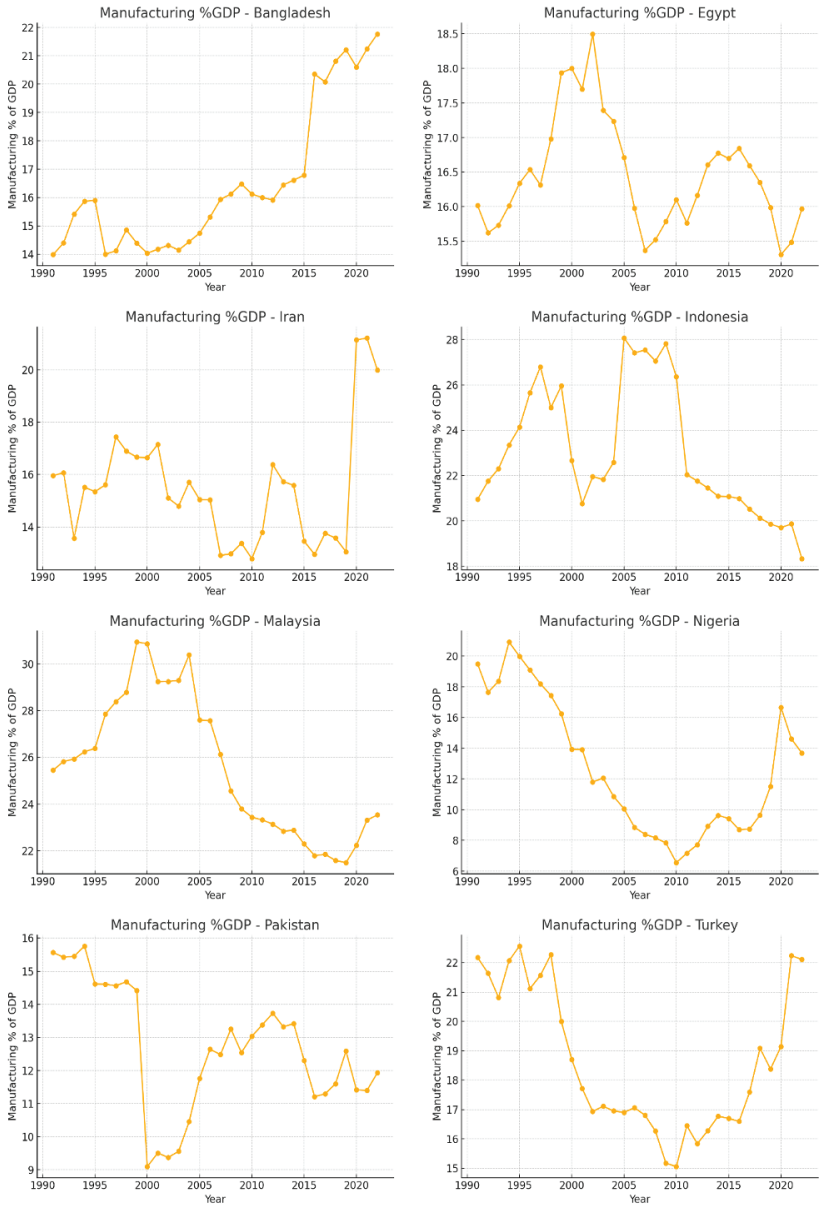

Figure 1: Manufacturing GDP (%) in D-8 countries

(source: World Bank)

Theory and Literature

The intensity of activity in the manufacturing sector is central to economic growth and development, and plays a crucial role in areas, such as job creation, technology transfer, and economic diversification. Understanding the key macroeconomic variables affecting this sector is crucial for the effectiveness of development policies, especially in low-income countries. In the literature, the effects of variables, such as FDI, urbanization, inflation, unemployment, and military expenditures on the manufacturing sector have been widely discussed.

FDI and the Manufacturing Sector

FDI has an important place in economic literature due to its strong effects on economic growth and industrial productivity. The endogenous growth theory (Romer, 1990) argues that FDI can increase the productivity of the industrial sector with technology transfer and knowledge accumulation and that such investments support sustainable economic growth in the host country, long term. Dunning's eclectic paradigm (OLI framework) explains why and how investments occur by analyzing FDI decisions via ownership, location, and internalization advantages (Dunning, 2015). These two theoretical frameworks provide a solid and comprehensive basis for assessing the effects of FDI on industrial production.

Studies on the effects of FDI in manufacturing industries show that these investments are effective in increasing industrial production. Borensztein et al. (1998) emphasize that FDI raises industrial productivity with technology transfer, while Hansen and Rand (2006) show that these investments play an important role in structural transformation and productivity growth. In other studies, Alfaro and Charlton (2007) argue that the effect of FDI is more pronounced in countries with a high-quality labor force and strong infrastructure, while Campos and Kinoshita (2008) argue that institutional structure and infrastructure adequacy are crucial factors in the success of this effect. In China, in particular, Zhang et al. (2008) showed that FDI stimulates technology diffusion and productivity in the equipment manufacturing sector in Shenyang city.

The effect of FDI in developing countries has been studied in more detail. For example, Gui-Diby and Renard (2015) argue that in the African context, the positive effects of FDI on industry become more pronounced with strong policies and integration into the local economy. Idoko and Taiga (2018) emphasize in their study in Nigeria that FDI has a limited but positive effect on industrial production via te-

chnology transfer and capital accumulation. Similarly, Ngepah et al. (2024) showed that in South Africa, FDI has positive effects on industry in both the short and long term. Nsofor et al. (2024), on the other hand, argue that FDI in sub-Saharan Africa supports industrial growth long term with technology transfer, knowledge sharing, and capital accumulation, but the short-term effects are not statistically significant. Conversely, the literature also reveals some negative effects of FDI. For instance, Schmidt and Broll (2009) argue that exchange rate uncertainty has a deterrent effect on FDI, limiting investment in the manufacturing sector. Moreover, Elia et al. (2009) reports that FDI to high-income countries reduces the demand for industrial labor in source countries.

In conclusion, while FDI generally supports productivity and growth in manufacturing industries, the magnitude and direction of this effect can vary depending on the infrastructure and institutional and economic characteristics of countries. Effective policy design, strong local integration, and infrastructure development are crucial to enhance the positive effects of FDI on industry. In this context, it is necessary to develop strategic approaches to turn FDI into an engine of industrial production.

Urbanization and Manufacturing Sector

Spatial economic theory argues that urbanization supports industrial production via economic agglomeration. While Krugman (1991) draws attention to the positive effects of urbanization on economic dynamics, Henderson (2003) argues that urbanization can increase industrial production with infrastructure development, labor intensity, and economies of scale. Duranton and Puga (2004) emphasize that urbanization directly expands production by providing productivity, innovation, and cost advantages in the manufacturing sector and encourages knowledge sharing and specialization. The contribution of clusters in large cities to industry is crucial for innovation and productivity.

Recent studies consider the effects of urbanization on industrial production from a broader perspective. Guo et al. (2016) find that urbanization in China increases industrial production while causing environmental pressures but improves productivity with scale and density effects. Ahmad and Zhao (2018) report that urbanization increases industrial production, especially in lower income regions, while Liang et al. (2019) argue that rapid urbanization supports economic growth and industrial development, but also brings environmental effects and cost pressures. Infrastructure investments and sustainable policies can offset these effects;

however, the negative effects of urbanization are also reported in the literature. Zheng et al. (2019) emphasized that urbanization can negatively affect the industrial production structure by increasing labor costs and highlighted that innovative processes cannot adequately compensate for the cost-increasing effects of environmental regulations. As such, the advantages of urbanization could be limited by context-specific economic, environmental, and structural factors.

Overall, spatial economic theory and related literature reinforce that urbanization contributes considerably to industrial production with economic agglomeration and productivity gains. However, environmental pressures, rising labor costs, and inefficiencies in innovation processes can limit these positive effects of urbanization. Effective environmental policies and innovation-based approaches are crucial for sustaining the contributions of urbanization to industry. Therefore, urbanization and industrial policies should be addressed in an integrated manner.

Inflation, Unemployment, and the Manufacturing Sector

Inflation and unemployment are important macroeconomic indicators that have both direct and indirect effects on the manufacturing sector. Both theoretical and empirical findings in the literature explain these indicators' effects on sectoral dynamics. Friedman (1977) emphasized that inflation increases production costs and limits investments in capital-intensive sectors, which subsequently has a negative effect on sectoral growth. The Phillips curve (Phillips, 1958) has shown that low unemployment rates can result in high inflation, which could lead to sectoral imbalances. This theoretical context provides a strong analytical framework for the manufacturing sector where costs are determinant.

Empirical studies have reached different conclusions on the effects of inflation on the manufacturing sector. Nell (2000) argues that single-digit inflation rates for South Africa might have positive effects on economic growth. In particular, the study suggests that inflation rates between 3% and 8% could be beneficial for growth, whereas double-digit inflation rates can have a dampening effect. Furthermore, at low levels, inflation can support production and growth by encouraging capital accumulation, but with high levels of inflation can cause uncertainty and discourage investment. In their study on South Asian countries, Mallik and Chowdhury (2001) found a positive relationship between inflation and economic growth, showing that short term, there is a positive relationship between inflation and output; however, high inflation could have a negative effect on output long term. Mallik and Chowdhury (2001) emphasized that moderate inflation

can support growth, but rapid economic growth can also increase inflation. Loto (2012) found that the effect of inflation on industrial production in Nigeria is positive but not statistically significant, while Chaudhry et al. (2013) showed that inflation has a negative effect on sectoral production in Pakistan. Siyakiya (2014) emphasized that hyperinflation in Zimbabwe severely reduced output and caused sectoral assets to depreciate. Fedderke and Liu (2018) report that inflation has a direct cost-increasing effect on production processes, which reduces overall production efficiency. Furthermore, Amaefule and Maku (2019) found that in Nigeria, rising inflation slows down the growth in industrial production, while Ngepah et al. (2024) argue that the long-term effects of inflation on the manufacturing sector in South Africa are negative and negatively affect sectoral growth by increasing production costs.

In addition to creating employment, the manufacturing sector subsequently has a major effect on unemployment rates. Kaldor (1966) defines the manufacturing sector as the engine of economic growth and states that its expansion has direct positive effects on employment. Chenery et al. (1986), who studied these relationships in the literature, found that the manufacturing sector enables more efficient use of economic resources by attracting labor from low-productivity sectors such as agriculture. Increases in income and changes in the demand structure contribute to economic growth by accelerating the shift of labor from agriculture to industry. In another study, Rowthorn and Well (1987) found that rising unemployment rates in industrialized countries have a negative effect on manufacturing employment. Ostry et al. (2001) examined the effects of deindustrialization on the labor market and found that 40% of workers in the lumber industry in Canada had long-term unemployment. The study showed that although deindustrialization creates short-term unemployment, it can improve productivity and working conditions long term with labor restructuring. Tseng et al. (2002) suggest that the shift from manufacturing to the service sector in Taiwan reduces the economic contribution of the labor force employed in low-skilled jobs, while Lavopa and Szirmai (2012) state that the manufacturing sector not only creates direct employment but also indirect job opportunities in other sectors. Atan and Effiong (2020) found a strong causal relationship between youth unemployment and industrialization and recommended increasing industrialization to reduce youth unemployment in Nigeria. Singh et al. (2023) found that the expansion of the manufacturing sector in India reduced unemployment rates and increased aggregate economic productivity by attracting labor from low-productivity sectors.

Contrary to these findings, most studies suggest that unemployment does not effect the manufacturing sector and could even have positive effects. For example, Weisskopf (1987) concluded that unemployment increases labor productivity in the USA, mainly because the threat of job loss increases the work intensity of employees. However, in other countries, such as Germany and Sweden, unemployment has a negative effect on productivity due to the high level of job security and the structure of labor relations. These findings show that the unemployment–productivity relationship is shaped by country-specific differences in economic and social structures. In another study, Rebitzer (1987) analyzed the relationship between unemployment, long-term employment relationships (LTERs) and productivity growth. In the study, it was argued that an increase in the unemployment rate can increase labor productivity, and this is due to the increased threat of job loss on workers. However, this effect is weakened in sectors where LTERs are common. The data show that an increase in unemployment has a positive effect on output growth, but LTERs significantly reduce this effect. Barış-Tüzemen and Tüzemen (2019) find no long-run relationship between unemployment and manufacturing industry growth in Türkiye; furthermore, in the short term, negative shocks in unemployment lead to negative shocks in output. These results indicate jobless growth in the manufacturing industry. Lastly, Yayar and Öztaş (2020) found that economic growth reduces unemployment only in Türkiye and Indonesia, but unemployment does not affect economic growth in the other D-8 countries. Yayar and Öztaş (2020) attributed this result to the characteristics of economic structures, employment markets, and growth dynamics in D-8 countries. In particular, the study emphasized that changes in the unemployment rate do not have a triggering effect on economic growth and that growth processes depend more on other economic factors, such as investments, technological developments, foreign trade. Moreover, the study highlights that the predominance of sectors with high hidden unemployment such as agriculture and informal employment in some of the D-8 countries limits the impact of the unemployment rate on economic growth.

These findings show that the manufacturing sector is both a tool for combating unemployment and subject to its effects. Policies for the manufacturing sector should aim for economic growth along with increasing employment capacity. Supported by effective policies, the manufacturing sector has a key role in ensuring sustainable growth and social welfare.

Defense Expenditures and the Manufacturing Sector

Defense expenditure is generally discussed in literature within the framework of Military Keynesianism and the crowding out effect. While Keynes (1936) argued that defense expenditure supports economic growth by increasing aggregate demand, Barro (1979) suggested that it could restrict industrial production by crowding out private sector investments. Deger and Sen (1983) argue that defense expenditures can contribute positively to industrial production via technology transfer and infrastructure development, while Dunne and Smith (2010) emphasize that these effects can vary depending on the economic conditions of countries.

The effects of defense expenditures on the manufacturing industry have been examined in different periods and from various perspectives. Cappelen et al. (1984) argue that while defense expenditures support manufacturing industry production in Organisation for Economic Co-operation and Development countries, they limit economic growth due to negative effects on investment. Henry and Oliver (1987) found that defense spending in the US slows economic shrinkage by increasing defense-related output and employment. Similarly, Huallacháin (1987) argues that defense expenditures, which stimulate growth in high-tech production sectors, change the spatial distribution of production and employment.

Assessments of the cost dimension of defense spending also differ. Yager (1992) argues that these expenditures weaken US competitiveness by raising costs in high-tech industries. Conversely, Saal (1999) emphasizes that defense production increases productivity in specific manufacturing sub-sectors but has a limited impact on overall economic growth. Heo (1998) argues that defense spending can support growth in technology-intensive industries, but this effect depends on the efficient use of the spending. Dunne et al. (2005) suggests that defense spending supports the manufacturing sector by increasing short-term economic demand might have negative long-term consequences due to distortions in resource allocation. Dunne and Uye (2010) add that, from a Keynesian perspective, defense spending can stimulate capacity utilization in the manufacturing sector by increasing aggregate demand but the magnitude and sustainability of this effect depends on the economic structure of countries.

Recent studies have shown that the effects of defense spending vary regionally and by sector. Saba and Ngepah (2020) report that in Africa, defense spending has spurred industrialization in some regions. Fursina (2021), on the other hand, stresses the diminishing distinction between military and civilian production lines, the proliferation of dual-purpose products, and the growing importance of civilian

research and development. In general, defense spending can have both positive and negative effects on economic growth, industrialization, and technology transfer. While defense spending has the potential to stimulate short-term economic recovery, it can limit long-term sustainable growth via opportunity costs and distortions in resource allocation. The size and direction of these effects depend on the countries' economic structure, policies, and the nature of expenditure. Therefore, the context needs to be carefully considered, and a strategic approach should be adopted when assessing defense spending.

Materials and Methods

In this study, two-stage least squares (2SLS) and generalized method of moments (GMM) were used to analyze the macroeconomic factors affecting industrial production. These two methods were preferred to eliminate possible endogeneity problems in the data and to make the model estimates more reliable.2SLS is a method used to obtain reliable estimates in econometric models when one or more of the explanatory variables are correlated with the error term—ie, when there is an endogeneity problem. 2SLS consists of two stages: (1) endogenous variables are estimated using exogenous variables and appropriate instrument variables, and (2) the model is estimated by substituting these estimated values (Wooldridge, 2020). This method requires the correct selection of instrument variables because they are expected to be highly correlated with the explanatory variable but uncorrelated with the error term (Gujarati & Porter, 2009). In this study, while examining the effect of urbanization rate on industrial production, it was considered that the urbanization rate could have a reverse causality relationship with the error term. For this reason, the urbanization rate was used as an instrument variable until its two-period lagged values.This choice assumes that the levels of urbanization in earlier periods could affect current industrial production but simultaneously be uncorrelated with the error term.

Mathematically, the 2SLS method can be expressed as:

First stage: $X_i = \gamma Z_i + v_i$

where X_i =endogenous variables, Z_i =exogenous and instrumental variables, γ=coefficients, and v_i =error term. At this stage, X_i is estimated by using Z_i.

Second stage: $Y_i = \beta \hat{X}_i + \epsilon_i$

*W*here Y_i =dependent variables, $\hat{X}_i$=endogenous variable estimated in the first stage, β=coefficients, and ϵ_i =error term.

GMM is a method developed to solve the endogeneity problem and to address issues, such as heteroskedasticity and autocorrelation, especially in panel data models. GMM obtains estimates based on moment conditions and therefore adapts to structural features in the data (Arellano & Bond, 1991). The differential GMM method developed by Arellano and Bond (1991) is widely used especially for dynamic panel data models. One of the main advantages of GMM is that it allows the use of multiple instruments in the model to increase the efficiency of estimation. In this study, the GMM method was preferred to address the possible problems of heteroscedasticity and serial correlation in the model. Additionally, the accuracy of the instrument variables in the GMM method can be tested with extreme restriction tests (eg, Hansen J test), which increases the reliability of the method (Wooldridge, 2020).

The GMM method is expressed mathematically as:

$$Y_{it}=\beta_1 X_{it}+u_{it}$$

where Y_{it}=dependent variable, X_i=independent variable, and u_{it} =error term. Considering the possibility of reverse causality in the effect of urbanization rate on industrial production, the urbanization rate variable was used as an instrument for up to two period lags. This approach was based on the assumption that past values of the relevant variable might affect the current industrial production but would not be directly related to the error term. In the literature, such applications are widely used for solving endogeneity problems (Wooldridge, 2020; Gujarati & Porter, 2009).

Furthermore, to make the model estimates more robust and meaningful, the analysis was conducted on two separate models with and without year dummies. The inclusion of year dummies helps to control fixed effects and possible shocks that can be observed over time. This approach makes the results more reliable and consistent by including the effects of time in the model. The model without year dummies, on the other hand, focuses on direct relationships between variables excluding time effects. As such, with these two separate analysis methods, the dynamic structure of the model was evaluated more comprehensively, and the robustness of the results was tested. 2SLS and GMM methods were preferred in this study to increase the reliability of the model and to overcome endogeneity problems. In particular, the use of past values of the urbanization rate as an instrument variable to address potential problems (eg, reverse causality) demonstrates the applicability of these methods. These methods have been extensively tested and validated to improve the efficiency and validity of model estimations.

In this study, annual data for D-8 countries for the period 2011–22 were used. The data were compiled from the World Bank's open access database and manufacturing sector performance (manufacturing) was used as the dependent variable. FDIs, inflation rate (Inflation), defense expenditures (Military), urbanization rate (Urbanization), and unemployment rate (Unemployment) were included in the model as independent variables. When the descriptive statistics are analyzed, different mean and standard deviation values are observed between the dependent and independent variables, indicating that the variables have heterogeneous characteristics in terms of variation and distribution (Table 1).

Table 1

Descriptive statistics

Variables	***N***	**Mean**	**SD**
Manufacturing	96	16.923	4.192
FDI	96	1.461	1.091
Inflation	96	10.949	10.916
Military	96	1.594	0.856
Urbanization	96	55.185	16.221
Unemployment	96	6.659	3.557

FDI=foreign direct investment. SD=standard deviation.

When evaluating the relationship between urbanization rate and industrial production, the possibility of reverse causality was considered. As stated in the literature, while urbanization can affect industrial production by economic clustering and economies of scale (Krugman, 1991; Henderson, 2003; Duranton & Puga, 2004), the rapid urbanization process also has negative effects, such as infrastructure and cost pressures (Zheng et al., 2019). In this context, the urbanization rate variable was used as an instrument variable in the model, with a two-period lag.

Although FDI has the potential to support technology transfer, capital accumulation, and productivity growth on industrial production, previous studies have shown that this effect is directly related to the infrastructural and institutional structures of countries (Borensztein et al., 1998; Hansen & Rand, 2006). Similarly, the effects of inflation and unemployment rates on production costs and employment in the manufacturing sector have been theoretically analyzed by Friedman (1977) and Phillips (1958), and empirical studies have shown the potential effects of these variables on the industry (Loto, 2012; Chaudhry & Ayyoub, 2013).

The impact of defense expenditures on industrial production has been evaluated within the framework of the Keynesian demand growth mechanism (Keynes, 1936) and the crowding out effect (Barro, 1979). The literature emphasizes that the effects of defense expenditures on economic growth and the industrial sector are country-specific (Dunne et al., 2005; Fursina, 2021).

In conclusion, the dataset based on World Bank data provides a solid basis for analyzing the dynamics of macroeconomic variables affecting industrial production over the years and offers a comprehensive analysis to fill the existing gaps in literature.

Empirical Analysis

This section analyzes determinant macroeconomic factors affecting D-8 countries' manufacturing sector. In the study, the effects of FDIs, inflation, defense expenditures, urbanization rate and unemployment variables on industrial production were evaluated using panel data analysis methods. 2SLS and GMM were preferred to eliminate endogeneity problems and ensure model consistency. To control time effects, the analysis was conducted with and without year dummies, and the robustness of the results was tested with these two different modeling approaches.

Table 2

Estimation results

	(1)	(2)	(3)	(4)
Variables	2SLS	GMM	2SLS	GMM
Urban	0.608***	0.583***	0.426***	0.437***
	(0.158)	(0.157)	(0.0991)	(0.0987)
FDI	0.0786	0.0215	-0.0601	-0.0998
	(0.197)	(0.194)	(0.168)	(0.165)
Inflation	0.113***	0.114***	0.108***	0.108***
	(0.0203)	(0.0203)	(0.0211)	(0.0211)
Military	1.430***	1.439***	1.666***	1.563***
	(0.514)	(0.514)	(0.553)	(0.548)
Unemployment	-0.182*	-0.208**	-0.144	-0.164*
	(0.106)	(0.104)	(0.0964)	(0.0951)
Firm FE	YES	YES	YES	YES
Time FE	YES	YES	NO	NO

Hansen J statistic	2.922	2.922	1.716	1.716
Observations	96	96	96	96
R-squared	0.418	0.417	0.519	0.518
Number of id	8	8	8	8

Robust standard errors in parentheses. Urban is instrumented by its own lagged values up to two lags because of possible endogeneity raised by reverse causality.

***p<0.01. **p<0.05. *p<0.1.

2SLS=two-stage least squares. FDI=foreign direct investment. FE=. GMM=generalized method of moments.

According to the estimation results, the effects of macroeconomic factors on the manufacturing sector were largely consistent across different model specifications and estimation techniques (Table 2).

The urbanization rate exhibited a positive and significant effect on manufacturing output in all models. This finding suggests that urbanization contributes to industrial production via channels, such as agglomeration economies, improved infrastructure, and a more efficient allocation of labor. Although the magnitude of the coefficient slightly declines in models without time dummies, the positive relationship remains robust, indicating that the contribution of urbanization to manufacturing is structurally stable rather than driven solely by time-specific factors.

In contrast, FDIs did not show a significant effect on the manufacturing sector across the estimated models. While the coefficients vary in sign, their lack of statistical significance indicates that FDI does not exert a direct and uniform effect on manufacturing performance in D-8 countries. This finding might reflect differences in institutional quality, sectoral allocation of investments, or the absorptive capacity of domestic economies.

The inflation variable was positive and highly significant in all specifications, which implies that inflation might support manufacturing output, possibly by reflecting demand-driven economic expansion or by increasing nominal revenues and encouraging production. The stability of this finding across all models suggests that the relationship between inflation and manufacturing is not sensitive to model specification.

Defense expenditures also had a positive and significant effect on the manufacturing sector. The relatively strong and consistent coefficients indicate that defense spending could stimulate industrial production with demand-side mechanisms,

public procurement, and potential technological spillovers. This effect remains robust regardless of whether time effects are included in the model.

In contrast, the unemployment rate had a negative and significant effect on manufacturing output. This finding is consistent with conventional economic expectations, suggesting that higher unemployment reflects weaker aggregate demand and underutilized labor resources, thereby constraining industrial production. Although the magnitude of the coefficient varied slightly across models, the direction and significance of the relationship remain stable.

Lastly, the R-squared values indicate a moderate level of explanatory power. While these values were not particularly high, this is a common outcome in panel data analyses involving macroeconomic variables. More importantly, the consistency of coefficient signs and significance levels across both 2SLS and GMM estimations supports the robustness of the results. Overall, the findings provide a coherent and theoretically consistent understanding of the macroeconomic determinants of manufacturing performance in D-8 countries.

Discussions and Conclusions

This study provides a comprehensive analysis of the macroeconomic determinants of the manufacturing sector in D-8 countries, offering both theoretical and empirical contributions. The findings present a more coherent and theoretically consistent picture of the relationship between key macroeconomic variables and industrial performance, while also highlighting the heterogeneity across countries.

One of the most important findings of the study is the positive and significant impact of urbanization on the manufacturing sector. This result is consistent with the core predictions of spatial economic theory, which emphasizes the role of agglomeration economies, infrastructure development, and labor market pooling in enhancing industrial productivity (Krugman, 1991; Henderson, 2003). In the context of D-8 countries, this finding suggests that urbanization—when accompanied by adequate infrastructure and planning—can facilitate industrial expansion by reducing transaction costs and increasing production efficiency. This result is also in line with the observed patterns in countries, such as Bangladesh and Türkiye, where industrial growth has been closely linked to urban expansion and integration into global production networks.

In contrast, the negative and significant effect of unemployment on manufacturing output aligns with conventional macroeconomic theory. Higher unemploy-

ment reflects underutilized labor resources and weaker aggregate demand, which subsequently constrains industrial production (Friedman, 1977; Phillips, 1958). In the context of D-8 countries, this relationship could also indicate structural inefficiencies in labor markets, including skill mismatches and the prevalence of informal employment, which limit the effective contribution of labor to industrial output. Therefore, the findings emphasize the importance of labor market policies that not only reduce unemployment but also improve workforce quality and productivity.

The results indicate that FDI does not have a significant effect on the manufacturing sector. This finding suggests that the impact of FDI in D-8 countries is not automatic and might depend on country-specific factors, such as institutional quality, absorptive capacity, and the sectoral allocation of investments. While the literature generally highlights the positive role of FDI in technology transfer and productivity growth (Borensztein et al., 1998; Hansen & Rand, 2006), the results of this study indicate that these benefits might not fully materialize in the absence of supportive domestic conditions, which highlights the need for policies that enhance the integration of foreign investments into local production systems.

The positive and highly significant effect of inflation on manufacturing output suggests that moderate levels of inflation could support industrial activity, possibly by reflecting demand-driven economic expansion or by increasing firms' nominal revenues. This finding is consistent with studies indicating that low and stable inflation can stimulate production (Mallik and Chowdhury, 2001). However, this relationship should be interpreted with caution, as high and volatile inflation can still have adverse long-term effects on investment and economic stability.

Similarly, defense expenditures have a positive and significant effect on manufacturing, which supports Keynesian demand-side arguments where public spending stimulates economic activity and increases capacity utilization (Keynes, 1936). In the case of D-8 countries, defense spending can also contribute to industrial development wy public procurement and technological spillovers. However, as emphasized in the literature, these positive effects might be limited longterm due to opportunity costs and resource misallocation (Dunne and Uye, 2010).

Overall, the findings highlight that the determinants of manufacturing performance in D-8 countries are shaped by both structural and macroeconomic factors. The positive role of urbanization and the negative effects of unemployment emphasize the importance of coordinated urban and labor market policies. Further-

more, the limited role of FDI suggests that external capital alone is insufficient to drive industrial development without strong institutional and structural support.

From a policy perspective, several implications emerge. First, urbanization policies should be aligned with industrial strategies, ensuring that infrastructure investments and spatial planning support manufacturing activities. Second, labor market reforms should focus not only on reducing unemployment but also on improving human capital and aligning skills with industrial needs. Third, policies aimed at attracting FDI should be complemented by institutional reforms that enhance absorptive capacity and facilitate technology transfer. lastly, while inflation and defense expenditures can have short-term supportive effects on industrial production, policy makers should carefully manage these factors to avoid long-term macroeconomic imbalances.

Despite its contributions, the study has some limitations. The analysis was limited to D-8 countries only, which restricts the generalizability of the findings. Additionally, the econometric framework focuses on linear relationships and might not fully capture more complex dynamics. Future research could extend the analysis by incorporating nonlinear models, sectoral disaggregation, or alternative estimation techniques to better understand the mechanisms underlying industrial development.

In conclusion, this study provides a comprehensive and empirically grounded assessment of the macroeconomic drivers of manufacturing performance in D-8 countries. By highlighting both common patterns and country-specific dynamics, the findings contribute to a better understanding of industrialization processes and offer valuable insights for policy makers aiming to promote sustainable industrial growth.

References

Ahmad, M., & Zhao, Z. (2018). Empirics on linkages among industrialization, urbanization, energy consumption, CO2 emissions and economic growth: A heterogeneous panel study of China. *Environmental Science and Pollution Research, 25*, 30617–30632. https://doi.org/10.1007/s11356-018-3054-3

Alfaro, L., & Charlton, A. (2007). Growth and the quality of foreign direct investment: Is all FDI equal? *HBS Finance Working Paper No. 07-072*. https://doi.org/10.2139/ssrn.981163

Amaefule, J. N., & Maku, O. E. (2019). National domestic savings, inflation, exchange rate, and manufacturing sector in Nigeria: ARDL approach. *EuroEconomica, 38*(2), 314–323.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies, 58*(2), 277-297. https://doi.org/10.2307/2297968

Atan, J. A., & Effiong, U. E. (2020). Industrialization and youth unemployment in Nigeria: An autoregressive distributive lag (ARDL) approach. *International Journal of Business and Economics Research, 9*(5), 324–334. https://doi.org/10.11648/j.ijber.20200905.15

Ball, L., & Mankiw, N. G. (1994). Asymmetric price adjustment and economic fluctuations. *The Economic Journal, 104*(423), 247–261. https://doi.org/10.2307/2234746

Bans-Akutey, M., Yaw-Deh, I., & Mohammed, F. (2016). What is the effect of inflation on manufacturing sector productivity in Ghana? *University Library of Munich: MPRA Paper No. 75145.*

Barış-tüzemen, Ö., & Tüzemen, S. (2019). The relationship between unemployment and growth: Evidence from Turkish manufacturing industry. *Sosyoekonomi, 27*(39), 133–149. https://doi.org/10.17233/sosyoekonomi.2019.01.08

Barro, R. J. (1979). On the determination of the public debt. *Journal of Political Economy, 87*(5), 940–971. https://doi.org/10.1086/260807

Borensztein, E., De Gregorio, J., & Lee, J. W. (1998). How does foreign direct investment affect economic growth? *Journal of International Economics, 45*(1), 115–135. https://doi.org/10.1016/S0022-1996(97)00033-0

Campos, N. F., & Kinoshita, Y. (2008). Foreign direct investment and structural reforms: Evidence from Eastern Europe and Latin America. *William Davidson Institute Working Paper No. 906.* https://doi.org/10.2139/ssrn.1141849

Canbay, Ş. (2021). Electricity consumption and economic growth in D8 countries: Bootstrap panel causality. *Journal of Economic Cooperation & Development, 42*(2), 37–68.

Cappelen, Å., Gleditsch, N. P., & Bjerkholt, O. (1984). Military spending and economic growth in the OECD countries. *Journal of Peace Research, 21*(4), 361–373. https://doi.org/10.1177/002234338402100404

Çarkovic, M., & Levine, R. (2005). Does foreign direct investment accelerate economic growth? In T. Moran, E. Graham, & M. Blomström (Eds.), *Does foreign direct investment promote development?* (pp. 195–220). Peterson Institute for International Economics.

Chaudhry, I. S., Ayyoub, M., & Imran, F. (2013). Does inflation matter for sectorial growth in Pakistan? An empirical analysis. *Pakistan Economic and Social Review, 51*(1), 71–92.

Chenery, H., Robinson, S., & Syrquin, M. (1986). *Industrialization and growth: A comparative study.* Oxford University Press.

Deger, S., & Sen, S. (1983). Military expenditure, spin-off, and economic development. *Journal of Development Economics, 13*(1–2), 67–83.

Doğan, A., & Delice, G. (2021). D-8 countries from economic development window. *Ekonomi İşletme Siyaset ve Uluslararası İlişkiler Dergisi, 7*(1), 20–37.

Dunning, J. H. (2015). The eclectic paradigm of international production: A restatement and some possible extensions. In J. Cantwell (Ed.), *The eclectic paradigm* (pp. 79–109). Palgrave Macmillan. https://doi.org/10.1007/978-1-137-54471-1_3

Dunne, J. P., & Tian, N. (2013). Military expenditure and growth: A survey. *The Economics of Peace and Security Journal,8(1)*. https://doi.org/10.15355/epsj.8.1.5

Dunne, J. P., & Uye, M. (2010). Military spending and development. In *The global arms trade: A handbook* (pp. 293–305). Routledge.

Dunne, J. P., Nikolaidou, E., & Smith, R. P. (2005). Military spending and economic growth in small industrialized economies: A panel analysis. *The Economic Journal, 115*(502), 587–603. https://doi.org/10.1111/j.1468-0297.2005.01006.x

Duranton, G., & Puga, D. (2004). Micro-foundations of urban agglomeration economies. In J. V. Henderson & J.-F. Thisse (Eds.), *Handbook of regional and urban economics* (Vol. 4, pp. 2063–2117). Elsevier. https://doi.org/10.1016/S1574-0080(04)80005-1

Elia, S., Mariotti, I., & Piscitello, L. (2009). The impact of outward FDI on the home country's labour demand and skill composition. *International Business Review, 18*(4), 357–372. https://doi.org/10.1016/j.ibusrev.2009.04.001

Fedderke, J., & Liu, Y. (2018). Inflation in South Africa: An assessment of alternative inflation models. *South African Journal of Economics, 86*(2), 197–230. https://doi.org/10.1111/saje.12192

Friedman, M. (1977). Nobel lecture: Inflation and unemployment. *Journal of Political Economy, 85*(3), 451–472. https://doi.org/10.1086/260579

Fursina, N. (2021). Trends in the dynamics of the military-technological complex industry in the global market. *International Journal of Innovative Technologies in Economy, 1*(33). doi:10.31435/rsglobal_ijite/30032021/7502

Fursina, N. (2021). Trends in the dynamics of the military-technological complex industry in the global market. *International Journal of Innovative Technologies in Economy, 1*(33). https://doi.org/10.31435/rsglobal_ijite/30032021/7502

Gui-Diby, S. L., & Renard, M. F. (2015). Foreign direct investment inflows and the industrialization of African countries. *World Development, 74*, 43-57. https://doi.org/10.1016/j.worlddev.2015.04.005

Gujarati, D. N., & Porter, D. C. (2009). *Basic econometrics* (5th ed.). McGraw-Hill Education.

Guo, J., Xu, Y., & Pu, Z. (2016). Urbanization and its effects on industrial pollutant emissions: An empirical study of a Chinese case with the spatial panel model. *Sustainability, 8*(8), 812. https://doi.org/10.3390/su8080812

Hansen, H., & Rand, J. (2006). On the causal links between FDI and growth in developing countries. *The World Economy, 29*(1), 21–41. https://doi.org/10.1111/j.1467-9701.2006.00756.x

Haveman, J., Deardorff, A. V., & Stern, R. (1993). Sectoral effects of reductions in NATO military expenditures in the major industrialized and developing countries. *Open Economies Review, 4*, 247–268. https://doi.org/10.1007/BF01000044

Henderson, J. V. (2003). The urbanization process and economic growth: The so-what question. *Journal of Economic Growth, 8*(1), 47–71. https://doi.org/10.1023/A:1022860800744

Henderson, J. V. (2003). Marshall's scale economies. *Journal of Urban Economics, 53*(1), 1-28. https://doi.org/10.1016/S0094-1190(02)00505-3

Henry, D. K., & Oliver, R. P. (1987). The defense buildup, 1977-85: Effects on production and employment. *Monthly Labor Review, 110*(8), 3-11.

Heo, U. (1998). Modeling the defense-growth relationship around the globe. *Journal of Conflict Resolution, 42*(6), 637-657.

Huallacháin, B. Ó. (1987). Regional and technological implications of the recent buildup in American defense spending. *Annals of the Association of American Geographers, 77*(2), 208-223. https://doi.org/10.1111/j.1467-8306.1987.tb00154.x

Idoko, C. U., & Taiga, U. U. (2018). Effect of foreign direct investment (FDI) on manufacturing output in Nigeria (1981-2016). *Advances in Social Sciences Research Journal, 5*(5). https://doi.org/10.14738/assrj.55.4319

Kaldor, N. (1966). *Causes of the slow rate of economic growth of the United Kingdom: An inaugural lecture.* Cambridge University Press.

Kaskarelis, I. A. (2009). Inflation and the mark-up in UK manufacturing industry. *Oxford Bulletin of Economics and Statistics, 55*(4), 391-407. https://doi.org/10.1111/j.1468-0084.1993.mp55004002.x

Keynes, J. M. (1936). *The general theory of employment, interest, and money*. Macmillan.

Krugman, P. R. (1991). Increasing returns and economic geography. *Journal of Political Economy, 99*(3), 483–499. https://doi.org/10.1086/261763

Lavopa, A., & Szirmai, A. (2012). Industrialization, employment and poverty. *UNU-MERIT Working Papers No. 081.* Maastricht Economic and Social Research and Training Centre on Innovation and Technology.

Liang, L., Wang, Z.-B., & Li, J. (2019). The effect of urbanization on environmental pollution in rapidly developing urban agglomerations. *Journal of Cleaner Production, 237*, 117649. https://doi.org/10.1016/j.jclepro.2019.117649

Loto, M. A. (2012). The determinants of output expansion in the Nigerian manufacturing industries. *Journal of Emerging Trends in Economics and Management Sciences, 3*(6), 911-917.

Loto, M. A. (2012). Global economic downturn and the manufacturing sector performance in the Nigerian economy (A quarterly empirical analysis). *Journal of Emerging Trends in Economics and Management Sciences (JETEMS, 3*(1), 38-45.

Mallik, G., & Chowdhury, A. (2001). Inflation and economic growth: Evidence from four South Asian countries. *Asia-Pacific Development Journal, 8*(1), 123-135.

Nell, K. S. (2000). Is low inflation a precondition for faster growth? The case of South Africa. *Department of Economics Discussion Paper No. 00/11*. University of Kent, Department of Economics.

Ngepah, N., Saba, C. S., & Kajewole, D. O. (2024). The impact of industry 4.0 on South Africa's manufacturing sector. *Journal of Open Innovation: Technology, Market, and Complexity, 10*(1), 100226. https://doi.org/10.1016/j.joitmc.2024.100226

Nsofor, E. S., Obani, C. D., & Agu, C. I. (2024). Impact of foreign direct investment on manufacturing sector growth in sub-Saharan Africa. *World Journal of Advanced Research and Reviews, 21*(1), 2521–2528. https://doi.org/10.30574/wjarr.2024.21.1.2581

Onaran, Ö., & Stockhammer, E. (2006). Do profits affect investment and employment? An empirical test based on the Bhaduri-Marglin model. In E. Hein, A. Heise, & A. Truger (Eds.), *Wages, employment, distribution and growth* (pp. 287–305). Palgrave Macmillan. https://doi.org/10.1057/9780230371781_10

Ostry, A. S., Hershler, R., & Kelly, S. (2001). Effects of de-industrialization on unemployment, re-employment, and work conditions in a manufacturing workforce. *BMC Public Health, 1*, 15. https://doi.org/10.1186/1471-2458-1-15

Phillips, A. W. (1958). The relation between unemployment and the rate of change of money wage rates in the United Kingdom, 1861–1957. *Economica, 25*(100), 283–299. https://doi.org/10.2307/2550759

Pradhan, R., Arvin, M. B., & Nair, M. (2021). Urbanization, transportation infrastructure, ICT, and economic growth: A temporal causal analysis. *Cities, 115*, 103213. https://doi.org/10.1016/j.cities.2021.103213

Rebitzer, J. B. (1987). Unemployment, long-term employment relations, and productivity growth. *The Review of Economics and Statistics, 69*(4), 627–635. https://doi.org/10.2307/1935957

Rodrik, D. (2013). Unconditional convergence in manufacturing. *The Quarterly Journal of Economics, 128*(1), 165–204. https://doi.org/10.1093/qje/qjs047

Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy, 98*(5), S71–S102. https://doi.org/10.1086/261725

Rowthorn, R., & Wells, J. R. (1987). *De-industrialization and foreign trade*. Cambridge University Press.

Saal, D. S. (1999). The impact of defense procurement on U.S. manufacturing productivity growth. *Mimeo*. New Brunswick, NJ: Rutgers University.

Saba, C. S., & Ngepah, N. (2020). Empirical analysis of military expenditure and industrialisation nexus: A regional approach for Africa. *International Economic Journal, 34*(1), 58–84. https://doi.org/10.1080/10168737.2019.1641541

Schmidt, C. W., & Broll, U. (2009). Real exchange-rate uncertainty and US foreign direct investment: An empirical analysis. *Review of World Economics, 145*, 513–530. https://doi.org/10.1007/s10290-009-0024-3

Singh, P. K., Lata, K., & Singh, A. K. (2023). Modeling the effect of unemployment augmented industrialization on the control of unemployment. *Environmental Development and Sustainability, 25*, 587–600. https://doi.org/10.1007/s10668-021-02069-6

Siyakiya, P. (2014). An analysis of the effects of hyperinflation on manufacturing sector output: A case of Zimbabwe's manufacturing firms (2000–2013). *International Institute of Social Studies, The Hague, The Netherlands*.

Sun, J., Wang, J., & Zhang, T. (2019). Urbanization, economic growth, and environmental pollution. *Management of Environmental Quality: An International Journal, 30*(2), 483–494. https://doi.org/10.1108/meq-05-2018-0101

Tseng, S., You, Y., & Ho, C. (2002). New economy, underemployment, and inadequate employment. *Journal of Contemporary Cultural and Information Studies, 3*(2), 215–237. https://doi.org/10.29843/jccis.200207.0008

Weisskopf, T. E. (1987). The effect of unemployment on labour productivity: An international comparative analysis. *International Review of Applied Economics, 1*(2), 127–151. https://doi.org/10.1080/758528894

Wooldridge, J. M. (2020). *Introductory econometrics: A modern approach* (7th ed.). Cengage Learning.

Yager, L. (1992). The effect of defense spending on the trade performance of high-technology industries. Santa Monica, CA: RAND Corporation. https://doi.org/10.7249/n3408

Yayar, R., & Öztaş, B. (2020). Panel causality analysis of unemployment and economic growth relationship in D-8 countries. *Research of Financial Economic and Social Studies, 5*(2), 188–200. https://doi.org/10.29106/fesa.696808

Zhang, L. X., Wang, J., & Yang, H. J. (2008). Empirical study on FDI's technology spillover effect on equipment manufacturing industry in Shenyang. *Journal of Northeastern University (Natural Science), 29*(6), 909–916.

Zheng, S., Kahn, M. E., & Liu, H. (2010). Towards a system of open cities in China: Home prices, FDI flows and air quality in 35 major cities. *Regional Science and Urban Economics, 40(1), 1-10.* https://doi.org/10.1016/j.regsciurbeco.2009.10.003

Zheng, T., Zhao, Y., & Li, J. (2019). Rising labour cost, environmental regulation and manufacturing restructuring of Chinese cities. *Journal of Cleaner Production, 214*, 583-592. https://doi.org/10.1016/j.jclepro.2018.12.328