Linear and non-linear regression analysis of Trade Openness and FDI on Economic Growth of Myanmar (1990-2022)

Htwe Ko[1]

Abstract

The study objects to investigate trade openness, foreign direct investment (FDI) and their impact on economic growth of Myanmar for the periods between 1990 and 2022. Authors employ Ordinary Least Squares (OLS) multiple linear regression model and Exponential Smooth Threshold Regression (ESTR) Model. Before model estimation, we first performed a Unit Root Testing with Phillips-Perron (1988) to check the stationarity issues. We second performed Pearson correlation test to check if the correlation exists between dependent and independent variables before model estimation. The findings of the results reveal that trade openness has positive influence on economic growth of Myanmar. The results also show that foreign direct investment does not have positive effect on economic growth of Myanmar. Future study is encouraged to adopt models that can capture short-/long-run relationships between dependent and independent variables.

[1] [ORCID: 0009-0005-6596-9263], Faculty of Economics, Chiang Mai University

Inya Economic Journal (2024), Vol.3 (No.1), 58-85.

Keywords: Ordinary Least Squares Linear Regression, Exponential Smooth Threshold Regression, Trade Openness, Foreign Direct Investment, Economic Growth,

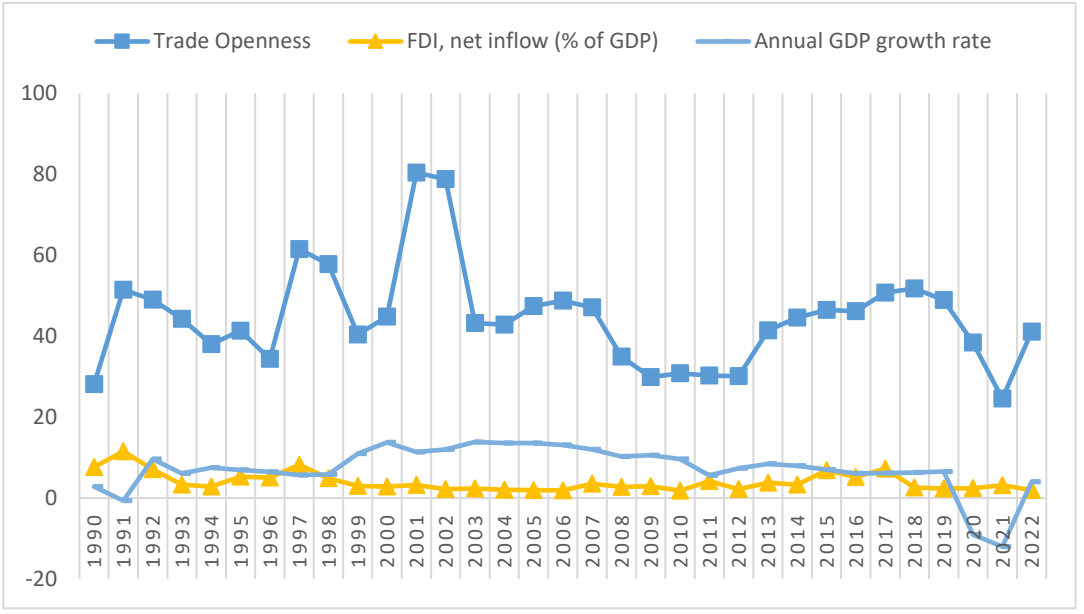
1. Introduction

Foreign Direct Investment (FDI) and Trade Openness have emerged as significant drivers of economic evolution in developing nations during the period of liberalization and globalization (E. Nketiah et al, 2020). As the globalization continues, understanding the associations between among trade openness, FDI and economic development becomes increasingly central, especially for countries undergoing significant transitions, such as Myanmar.

Myanmar, as a developing country, has been actively engaging in foreign trade and attracting more foreign direct investment. Myanmar, a country transitioning from decades of military rule to a more democratic system, the associations between trade openness, FDI, and political transition is particularly relevant. The recent political reforms in Myanmar have created new opportunities for international trade and investment, but also pose challenges related to institutional capacity-building and regulatory reform (Chowdhury & Kabir, 2017: Kyaw, 2013). However, the dynamics have shifted again with the onset of a military coup in February 2021, significantly impacting the country's economic landscape and raising

questions about international trade, foreign investment, and economic development in the face of political instability. And, the influence of international trade and foreign investment on economic development in Myanmar remains unclear.

Figure 1. Trends of Trade Openness, FDI (% of GDP) and GDP annual growth rate



Source: author adjusted the data from World Bank and Myanmar Statistical Yearbook

The figure I.1 illustrates the trends of trade openness, FDI % of GDP and annual-GDP-growth rate from 1990 to 2022. Open openness has a significant peak around 2000, after which it declines sharply and then stabilizes at a lower level before year 2020. FDI as percentage of GDP also fluctuates but in a less

dramatic manner compared to trade openness. For GDP growth rate, it shows a generally increasing trend from 2.82% in 1990 to a peak of 13.84% around 2013. After this peak, there decreased a trend, hitting a low of -12.02% in 2021.

The primary objectives of this study are to investigate the influence of trade openness and foreign divestment investment on economic growth of Myanmar during 1990 and 2022 by using both linear and non-linear regression models. The remainder of this paper is organized as follows. In section II, we review the relevant literature section followed by thersitical framework with section III. Then, we will report the data sources and describe research methodology in section IV. We will discuss the results in section V. Finally, we will conclude this paper with section VI.

2. Literature Review

Ordinary Least Squares (OLS) regression, as a statistical method, is widely used by econometrics learners to examine the real-time effects of multiple independent variables on a dependent variable, such as GDP, while controlling for other factors (Greene, 2012). It allows the analysis of long-term correlations and provides valuable insights into policy implications (Wooldridge, 2015). By estimating coefficients and assessing significance levels, OLS regressions offers a severe framework for investigating complex economic phenomena,

making it a suitable choice for analyzing the factors like trade openness and foreign direct investment and their impact on economic progress (Kmenta, 1986: Stock & Watson, 2014).

A study investigated the influence of macroeconomic variables and trade openness on Pakistan's GDP growth using yearly time-series dataset over the periods of 1973 to 2012. Researchers used Ordinary Least Square (OLS) regression model to analyze the long-run and short-run relationship between trade openness, GDP growth and other macroeconomic features, including government expenditure, inflation and exchange rate. The findings disclosed a positive and significant effect of trade openness on GDP growth for the long run, indicating the importance of international trade for Pakistan's economic development. Additionally, the study highlights the role of other macroeconomic variables in shaping Pakistan's economic growth trajectory (Ramzan et al, 2013).

Another study also examined the connection FDI, trade openness, and Ghana's economic improvement. In that study, panel dataset covering FDI net inflows, trade openness, the growth rate of GDP and inflation rate was used for a specific time period. They employed OLS regression model to analyze the connection among economic growth, FDI and trade openness. They found a significant positive bond between FDI inflows, trade openness and economic development in Ghana

((Nketiah et al, 2020). In 2012, HYE & LAU studied the relationship between trade liberalization and economic growth in India using annual time series data from 1971 to 2009 (HYE & LAU, 2012). They used an autoregressive distributed lag (ARDL) approach and found that a positive and statistically significant correlation has been identified between India's economic growth and trade openness. Sijabhat, R (2023) also carried out a study investigating the nexus between foreign portfolio investment (FPI), foreign direct investment (FDI) and GDP in ASEAN countries (Sijabat, 2023). The study applied Fully Modified Least Squares and Dynamic Least Squares panel testing methods for data obtained from 2009 to 2020. The findings indicated a significant influence of both FDI and FPI on the GDP of the ten ASEAN member countries.

In the context of Myanmar, a few studies in this field have been published. Among them, Jinhwan OH and Kyi Chi Thant conducted a study to analyze Myanmar's trade liberalization and its effects on foreign trade landscape, employing a Gravity approach (Oh & Thant, 2016). Their investigation used a panel dataset encompassing 8 ASEAN countries, including Myanmar. Their findings illuminated that Myanmar's trade has encountered distortions attributable to political influences, particularly the economic sanctions levied by Western powers. Their analysis concluded that Myanmar's

trade patterns have been skewed, with a notable reliance on neighboring nations such as China and Thailand.

Another paper also delivered the correlation between foreign trade and GDP growth of Myanmar with the use of annual exports data and imports data and GDP at current prices and constant prices for three different time periods (Nem, 2020). He, author employed Toda and Yamamoto (1995) Modified Wald (MWALD) Test and causality test for three periods (1948 – 1962), (1962-1988) and (1988 – 2017). During the initial period, Toda and Yamamoto's causality analysis revealed evidence of causal relationship between imports and GDP growing. Similarly, the findings indicated unidirectional causality from imports to exports and from exports to GDP growth. Moreover, bidirectional causality was observed between the quarterly real values of imports and exports, as well as between quarterly real values of exports and economic development. In subsequent periods, a feedback relationship between GDP growth and imports emerged. Additionally, unidirectional causality from GDP growth to exports was identified. However, in the third period, no discernible relationship was found between the quarterly real values of imports, exports, and GDP growth in Myanmar.

A large body of existing literature have not used both linear and non-linear regression approaches in examining the

impact of trade openness and FDI on GDP growth rate including the specific case of Myanmar. It leaves a knowledge gap to fill for this study to carry out.

3. Theoretical Framework

The link between economic growth and trade liberalization or openness could be a central tenet to classical and neoclassical economic theories. According to these theories, increased openness to trade allows nations to specialize in the production of goods and services in which they have a comparative advantage, leading to greater efficiency and higher overall output. This can result in enhanced productivity, technological advancement, and ultimately, economic growth (Balassa, 1965: Romer, 1990).

Foreign investment is another important factor for economic advance, particularly in the situation of developing countries. Theories such as Solow-Swan model and Endogenous growth theory hypothesize that Foreign direct investment can stimulate economic development by promoting wealth accumulation, technology transfer, and knowledge spillovers (Lucas, 1988: Solow, 1956). FDI inflows enable recipient countries to access new technologies, managerial expertise, and international markets, thereby enhancing their productive capacity and competitiveness. Moreover, political transition acts a decisive role in mediating the associations between trade, FDI,

and economic progress. Countries with stable political environments is more likely to interest foreign investment and benefit from trade liberalization policies (Acemoglu, Johnson & Robinson, 2001). Conversely, political instability, corruption, and weak governance can undermine investor confidence and delay economic development efforts.

4. Data Collection and Methodology

Authors uses secondary annual timeseries dataset obtained from reliable sources including world bank open database, Myanmar yearly statistics and UNCTAD database. The sources of variables are summarized in Table IV.1 below.

Table IV.1 Summary of Sources of data and variables

Symbols	Variables	Sources
GDP	Gross Domestic Product (GDP) annual growth rate (%)	"World Development Indicators (1990 – 2022, http://databank.worldbank.org"
TOP	Trade Openness [(exports + imports)/GDP*100]	"World Development Indicators (1990 – 2009) and Myanmar Statistical Yearbook (2010-2022),

		http://databank.worldbank.org and http://csostat.gov.mm/publicationandrelease/statisticalyearbook"
FDI	Foreign-Direct-Investment net inflows (% of GDP)	"World Development Indicators (1990 – 2022), http://databank.worldbank.org"
EMR	Employment to Total Population ratio, (%), (aged 15 +)	"World Development Indicators (1990 – 2022), http://databank.worldbank.org"
EXR	Exchange Rate (1MMK=USD$)	"United Nations Conference, Trade and Development (UNCTAD), https://unctadstat.unctad.org"
INR	Consumer Price Index, Inflation Rate (%)	"World Development Indicators (1990 – 2019) and Myanmar Statistical Yearbook (2020-2022), http://databank.worldbank.org and http://csostat.gov.mm/publicationandrelease/statisticalyearbook"

PTD	Political Transition Dummy (0 and 1)	Dummy for military rule is 0 and democratic transition is 1

Ordinary Least Squares (OLS) Linear Regression Model

Ordinary Least Squares (OLS) method is commonly applied to estimate the unknown parameters in the linear regression model (Hayashi, 2000). The general form of a linear regression model is presented in equation [1]. If that develops to a multiple linear regression model at which several independent variables (X_1, X_2, …, X_q) and one dependent variable (Y), it can be written as expressed in equation [2]. It is essential to ensure that there exists a correlation between dependent and independent variables before linear regression modeling. Pearson and Spearman Correlation Tests are very common for that (Hauke & Kossowski, 2011).

$$Y = X\beta + \epsilon \quad [1]$$

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_q X_{nq} + \epsilon_i \quad [2]$$

Where, Y is the vector values of dependent variable (n×1), X is the matrix of independent variables (q (n+1)), β = the vector of unknown parameters of the regression model ((q+1) × 1) and ϵ = the vector of error term (n× 1).

$$Y = \begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_n \end{bmatrix}$$

$$X = \begin{bmatrix} 1 & 1 & \dots & 1 \\ X_{11} & X_{21} & \dots & X_{n1} \\ \vdots & \vdots & \ddots & \vdots \\ X_{1q} & X_{2q} & \dots & X_{nq} \end{bmatrix}$$

$$\beta = \begin{bmatrix} \beta_0 \\ \beta_1 \\ \vdots \\ \beta_q \end{bmatrix}$$

$$\varepsilon = \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_n \end{bmatrix}$$

The coefficient of unknown parameters in the linear regression model can be estimated using the OLS formula presented in equation [3].

$$\hat{\beta} = (X^T X)^{-1} X^T Y \qquad [3]$$

In this paper, authors use multiple linear regression modeling with OLS method. In which, one dependent variable, two independent variables and four control variables are used to investigate the impact of trade openness and foreign direct investment on the economic growth of Myanmar for the periods between 1990 and 2022. They are as follows;

Y = Gross Domestic Product (GDP) annual growth rate

X_1 = Trade Openness

X_2 = Foreign Direct Investment, percentage of GDP

C_1 = Employment to total population ratio aged 15 +

C_2 = Exchange Rate, Myanmar Kyat (MMK) against US dollar

C_3 = Consumer Price Index, Inflation Rate

C_4 = Political Transition Dummy

The data is analyzed with Frequentist method by using linear and non-linear regression modeling to estimate the coefficient of the parameters. In this study, we use EViews software for the regression analysis. The first empirical model of this research for OLS linear regression is developed in equation [4]. And the second empirical model for ESTR model is shown in equation [6].

$$\mathrm{GDP}_t = \beta_0 + \beta_1 \mathrm{TOP}_t + \beta_2 FDI_t + \beta_3 EMR_t + \beta_3 EXR_t + \beta_4 INR_t + \beta_5 PTD_t + \epsilon_t \qquad [4]$$

Exponential Smooth Threshold Regression (ESTR) Model

Threshold regression models including Exponential Smooth Threshold Regression (ESTR), capture nonlinear relationships between dependent and independent variables specified in different regimes or states under the assumption of normally distributed errors.

The general from of smooth transitions between regimes is proposed by discrete switching models expressed in equation [5].

$$\mathbf{Y}_t = x'_t\varphi + (x'_t\theta).G(y,c;s_t) + \mu_t \ \rightarrow \ t = 1,2,\ldots,T \qquad [5]$$

Where, $\varphi_i and\ \theta_i$ = the parameter vectors, x_t= the vector of endogenous and exogenous variables, μ_t = independent identically distributed errors and G indicates a continuous transition function bounded between 0 and 1. The slope parameter γ of the transition function depends on the transition variable S_t (Kavkler et al, n.d). $\gamma > 0$ indicates how quickly the transition occurs between two states, 0 and 1. The threshold parameter, C, shows where this transition happens. Usually, the transition variable, S_t is one of the explanatory variables or the time trend.

By following the linear equation [4], a non-linear equation for the STR model can be written in equation [6].

$$GDP_t = (\beta_{10} + \beta_{11}TOP_t + \beta_{12}FDI_t + \beta_{13}EMR_t + \beta_{14}EXR_t + \beta_{15}INR_t + \beta_{16}PTD_t)d[q_t \leq \gamma] + (\beta_{20} + \beta_{21}TOP_t + \beta_{22}FDI_t + \beta_{23}EMR_t + \beta_{24}EXR_t + \beta_{25}INR_t + \beta_{26}PTD_t)d[q_t > \gamma] + \mu_t \quad [6]$$

5. Results and Discussion

It is also important to check stationarity issues with unit root testing for each variable used in this study. Table V.1 provides the results of unit root testing with Phillips Perron (PP). Besides, it is a common to check the existence of correlation between dependent and independent variables because authors are building regression models. So, authors first perform the Pearson test. In table V.2, Pearson correlation testing results between dependent variable and independent variables are provided. Based on those presenting results, it indicates that the variables are correlated between GDP annual growth and selected independent variables. That is interpreted upon p-value of variables that are less than critical value of α (0.05). Thus, these data can be used to continue regression modeling.

Table V.1 Unit Root Tests with Phillips Perron (PP)

Variables	Phillips Perron (PP)			
	Constant without Linear Trend		Constant with Linear Trend	
	Adj. T-Value	P-Value	Adj. T-Value	P-Value
GDP	-3.653730*	0.1055	-4.273277*	0.2497
TOP	-3.539383	0.0132	-4.273277*	0.0412
FDI	-3.653730*	0.0756	-4.273277*	0.1399
EMR	-3.653730*	1.0000	-4.273277*	0.7906
EXR	-14.77568	0.0000	-10.82647	0.0000
INR	-3.053083	0.0406	-5.722355	0.0003
PTD	-3.653730*	0.4812	-4.273277*	0.7919

Notes: * denotes indicates the significance at 1%. The lag-length automation for PP (1988) unit root is selected by Newey-West Bandwidth. These tests are applied to the level.

Table V.2 Pearson Correlation Testing Results

Variable	Correlation Coefficient	P-value
TOP	0.811369	0.0000
FDI	0.601932	0.0002
EMR	0.811590	0.0000
EXR	0.317156	0.0676
INR	0.659582	0.0000
PTD	0.738264	0.0000

Table V.3 below shows the results obtained from running multiple linear regression model using OLS method. The model estimation based on given assumptions resulted that TOP, FDI, EMR, EXR and INR variables are significant predictors of dependent variable GDP except PTD. R-squared value indicates how much percentage of factors relating GDP annual growth rate is explained by selected independent and control variables in this model. And, 79.5% proves a good fit of model with this dataset. The coefficient value of intercept term is the estimated value of GDP annual growth when all independent variables equal zero. The findings of the results revealed that one percent increase in trade openness brings an increase of approximately 0.15% in economic growth of Myanmar. We also found that GDP annual growth rate declines

about 0.76% by a rise of each percent in foreign direct investment, net inflows (% of GDP) while controlling other variables. As expected, every 1 percent increase in employment in total population ratio (aged 15+) produces economic growth of Myanmar around 1%. Furthermore, the results indicated that the larger inflation rate (consumer price index), the slower economic growth of Myanmar during 1990-2022. In addition, the Durbin-Watson (DW) statistic is a test for autocorrelation in the residuals. DW Statistic value at 1.5 < 2 means that this model does not capture all the factors that influence economic growth of Myanmar.

Table V.3 OLS multiple linear regression model estimation results

Variable	Coefficient	T-Value	P-Value	Std. Error
Intercept	-56.92492	-7.007017	0.0000	8.123987
TOP	**0.150498**	**2.817056**	**0.0091**	**0.053424**
FDI	**-0.762571**	**-2.334168**	**0.0276**	**0.326699**
EMR	1.009605	7.818967	0.0000	0.129123
EXR	-297.4153	-3.079906	0.0048	96.56636

INR	-0.301184	-4.098583	0.0004	0.094
PTD	-1.683860	1.611538	0.3057	1.611538
R-squared(R^2)		0.794974		
F-Statistic		16.80217		
Durbin Watson Statistic		1.500347		

GDP = -56.92492 +0.150498*TOP - 0.762571*FDI+1.009605*EMR-297.4153*EXR-0.301184*INR-1.683860*PTD

Table V.4 displays the results obtained from ESTR model estimation. In the linear column, it shows the coefficients of parameters, standard errors, and p-values for each variable while the non-linear column demonstrates corresponding values plus the slope of parameter and threshold variable. From the values of coefficient, and Probability in both linear and non-linear component of TOP revels a statistically significant relationship while FDI has no significant relationship. These findings partially support our findings from using OLS linear regression model above.

Table V.4 Exponential Smooth Threshold Regression (ESTR) Estimation Results

Linear	Coefficient	Std. Error	P-value	**Non-linear**	Coefficient	Std. Error	P-Value
TOP	**3.923251**	**0.660485**	**0.0000**	**TOP**	**-3.900717**	**0.639570**	**0.0000**
FDI	**-0.939989**	**1.776012**	**0.6035**	**FDI**	**0.994829**	**1.951128**	**0.6167**
EMR	0.306353	0.235543	0.2107	EMR	-0.151013	0.229521	0.5194
EXR	-5383.765	1649.598	0.0046	EXR	5137.458	1690.674	0.0074
INR	-6.174569	1.335017	0.0002	INR	6.170386	1.307387	0.0002
PTD	-165.3181	37.24470	0.0004	PTD	161.6069	36.91588	0.0004

	γ	**5.7839 8**	**1.323 597**	**0.00 04**
	C_t	**6.7065 81**	**0.052 738**	**0.00 00**

In Table V.5, the results of the Additive Nonlinearity testing are provided. The hypotheses are structured based on different orders of the Taylor expansion (i). The F value and P Value for each hypothesis signifies the nonlinearity effects of variables. Additionally, we computed RMSE, MAE and MAPE to compare two models used in this study (see the results in Table V.6). The results point out that ESTAR model offers better forecasting accuracy.

Table V. 5 Addictive Nonlinearity Testing Results

Hypothesis	F-Value	P-value
H_1: $\beta_1 = 0$	2.148408	0.1399
H_2: $\beta_1 = \beta_2 = 0$	4.332675	0.0174
H_3: $\beta_1 = \beta_2 = \beta_3 = 0$	4.314804	0.176
H_4: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$	3.544943	0.0349

Note: H_i test uses the i-th order Taylor expansion ($\beta_j = 0 \; for \; all \; j > i$).

Table V. 6 Forecasting Comparison between linear regression and non-linear regression

Estimation Model	RMSE	MAE	MAPE
Ordinary Least Squares (OLS) Linear Regression model	2.556	2.117	33.964
Exponential Smooth Threshold Regression (ESTR) model	1.526	1.077	14.445

VI. Conclusion and Policy Recommendation

The results derived from Ordinary Least Squares (OLS) multiple linear regression model and Exponential Smooth Threshold Regression Model, computed using EViews software, reveal that trade openness has positive influence on GDP annual growth rate of Myanmar. Surprisingly, the results show foreign direct investment (% of GDP) has no evidence to support economic growth of Myanmar. But we found that employment in total population ratio aged 15+ has a positive influence on GDP annual growth rate of Myanmar Since employment and trade openness have positive impact on GDP annual growth rate in Myanmar, the government and policy makers should consider to implement policies and initiatives that really address job creations and trade liberalization. In this way, the economic

growth can be sustained and the socio-wellbeing of individuals in Myanmar shall be brought to a better status.

This paper is geographically limited to Myanmar formerly known as Burma. Future study is encouraged to adopt models that can capture short-/long-run relationships between dependent and independent variables.

References

Acemoglu, D., Johnson, S., & Robinson, J. A. (2001). The colonial origins of comparative development: An empirical investigation. *American Economic Review, 91(5)*, pp. 1369-1401. DOI: 10.1257/aer.91.5.1369

Balassa, B. (1965). Trade liberalization and "revealed" comparative advantage. *The Manchester School, 33(2)*, pp. 99-123. Doi: 10.1111/j.1467-9957.1965

Chowdhury, A., & Kabir, R. (2017). Economic reforms and Myanmar's transition to democracy. *Asian Economic Papers, 16(3)*, pp. 61-79.

E. Nketiah et al. (2020). Foreign Direct Investment, Trade Openness and Economic Growth: Evidence from Ghana. *Journal of Business and Management, 8, pp. 39-55*. Doi: 10.4236/ojbm.2020.81003

Greene, W. H. (2012). *Econometric analysis* (7th ed.). New York: Pearson Education.

Hayashi, F. (2000). *Econometrics*. Princeton University Press. ISBN. 0-691-01018-8

Hauke, J. and Kossowski, T. (2011). Comparison of value of Pearson's and Spearman's Correlation Coefficient on the same sets of data. *Quaestiones Geographicae, 30(2)*, pp.87-93, Doi: 10.2478/v10117-011-0021-1.

HYE, Q. M. A, & LAU, W. Y. (2012). Trade Openness and Economic Growth: Empirical Evidence from India. *Journal of Business Economics and Management, 16(1),* pp. 188-205.

Kavkler et al. (n.d.). Nonlinear Econometric Models: The Smooth Transition Regression Approach.

Kennedy, P. (2008). *A guide to econometrics* (6th ed.). Oxford: Wiley-Blackwell

Kmenta, J. (1986). *Elements of econometrics* (2nd ed.) New York: Macmillan.

Kyaw, N. Y. (2013). Political transition and economic development in Myanmar. *Journal of Developing Societies, 29(1),* pp. 1-22.

Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics, 22*(1988), pp. 3-42.

Nem, C. D. (2020). An Assessment of the Relationship between Foreign Trade and GDP Growth of Myanmar. *The Myanmar Journal, 7(1),* pp. 156-173.

Nketiah, et al. (2020). Foreign Direct Investment, Trade Openness and Economic Growth: Evidence from Ghana. *Journal of Business and Management, 8,* pp. 39-55.

Oh, J. & Thant, K. C. (2016). Impact of Myanmar's Trade Liberalization on the country's international trade environment: A Gravity Approach. *Applied Econometrics and International Development, 16(2),* pp. 143–156.

Ramzan et al. (2013). Impact of Trade Openness and Macroeconomic Variables on GDP Growth of Pakistan. *Journal of Commerce, Economics, and Social Sciences, 7(1),* pp. 37-47.

Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy, 98(5*), pp. S71-S102.

Stock, J. H., & Watson, M. W. (2014). *Introduction to econometrics* (3rd ed.). New York: Pearson Education.

Sijabat, R. (2023). The Association between Foreign Investment and Gross Domestic Product in Ten ASEAN Countries. *Economies 2023, 11 (7),* 188. Doi: 10.3390/economies11070188

Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics, 70(1),* pp. 65-94.

Phillips, P. C. B. and Perron, P. (1988). Testing for a Unit Root in Time Series Regression. *Biometrika, 75(2),* pp. 335-346. https://doi.org/10.1093/biomet/75.2.335.

Wooldridge, J. M. (2015*). Introductory econometrics: A*

modern approach (6th ed.). Boston: Cengage Learning

This page left intentionally blank