

Analyzing the Far-reaching Effects and Causality: Investment, Corruption, Unemployment, and Economic Growth in Asia-Pacific Nations Over Time

M. Julian Tama¹

Corresponding author. Email: mjuliantama97@gmail.com

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Abstract

This study investigates the causal connections and both short-term and long-term associations among corruption, investment, unemployment, and per capita economic growth across twenty-two Asia-Pacific nations spanning from 2012 to 2020. The research employs Granger causality and Vector Error Correction Model methodologies to tackle the research inquiries. The empirical results unveil bidirectional causality between corruption and per capita economic growth, whereas the unemployment rate and per capita economic growth share a unidirectional relationship. Conversely, no causal linkage is found among the remaining variables. In the short run, corruption has no significant impact on per capita economic growth and unemployment but does significantly and adversely affect the investment rate. On the other hand, in the long run, corruption significantly and negatively influences per capita economic growth. The investment rate and unemployment, in the long term, exhibit a substantial and positive influence on per capita economic growth. Thus, corruption serves as an obstacle to economic growth rather than a facilitator.

Keywords: unemployment; investment; corruption; economic growth; Vector Error Correction Model (VECM); causality.

¹ Faculty of Economics and Business, University of Lampung.

I. Introduction

Economic growth is the process of increasing per capita output and serves as a measure of a country's economic development success. Therefore, economic growth is a critical indicator in the analysis of a country's economy. Economic Dynamism in Asia-Pacific and East Asian regions boast rapid economic growth and dynamic markets, offering diverse investment opportunities. It is evident that the Gross Domestic Product per capita has shown an increasing trend (World Bank, 2023). Many factors can influence a country's economic growth, and this is closely tied to the role of macroeconomic variables as determinants of the economy.

One of the determinants of a country's economic growth is the flow of foreign investment in the form of foreign direct investment (FDI). Foreign direct investment plays a role in accelerating a country's output productivity due to the transfer of technology, management, and expertise brought by the investing country. This increased productivity has an impact on the growth of output, both for domestic consumption and for exports. In other words, the more foreign direct investment flows into a country, the more it contributes to the economic growth of that country.

Furthermore, another important consideration is the unemployment rate of a country, as various countries have their definitions and methods of calculating unemployment rates, leading to differing impacts on each country's economy. Generally, the unemployment rate has a negative effect on the economy, as reflected by economic growth as its indicator. In line with Imran et al. (2015), who state that a higher unemployment rate has a negative and significant impact on the decline of GDP per capita (a proxy for economic growth) in Asian countries. On the other hand, the impact of unemployment is not always contradictory to economic growth. As stated by Kim et al. (2020), in some Asian countries, the unemployment rate correlates positively with economic growth.

From the explanations above, foreign direct investment (FDI) and the unemployment rate as determinants of economic growth, viewed from a macroeconomic perspective, do not fully guarantee the economic conditions of a country. On the other hand, what needs attention is the level of corruption in a country, including in the Asia-Pacific region. This is because corruption is a complex phenomenon that is almost a problem in every country, both in developing and developed countries. The impact of corruption becomes a deep focus because it affects nearly all aspects of social and economic life. According to the United Nations (2018), it is estimated that every year, \$1 trillion is spent on bribes, and \$2.6 trillion is stolen through corruption.

Economists have engaged in a lengthy debate regarding the relationship between corruption and economic growth, with differing opinions on whether corruption distorts economic growth. In general, corruption disrupts economic activities and tends to harm the efficient allocation of resources within an economy. Many economists argue that corruption tends to hinder economic growth.

Shleifer, Andrei, Vishny (1993) argue that corruption tends to distort economic growth. Consistent with this, (Tanzi, 1998) suggests that corruption distorts markets and resource allocation, thus reducing efficiency and economic growth. Blackburn et al. (2006) state that corruption is one of the causes of low income and is believed to play a crucial role in causing poverty traps. Ahmad et al. (2012) find that a decrease in the corruption rate will enhance economic growth in an inverted U-shaped pattern. Del Monte & Papagni (2001) in

the Italian context, highlight that corruption not only directly limits average worker income but also reduces private investment, ultimately decreasing the efficiency of public investment spending and slowing economic growth. Gyimah-Brempong, (2002) shows results indicating that corruption reduces economic growth and increases income inequality in African countries. Johnson et al. (2011) discovered that corruption plays a significant and causal role in reducing economic growth and investment across states. Dridi (2013) reveals that the negative effects of corruption on growth are primarily transmitted through impacts on human resources and political instability. Mauro (1995), who conducted systematic cross-country empirical research linking indicators of honesty and bureaucratic efficiency to economic growth, found a significant negative relationship between corruption and both investment and economic growth.

In addition to the impact of corruption on economic growth, what needs to be considered further is the impact and causality between corruption and macroeconomic variables that are related to economic growth. The results of the study by Yu et al. (2023) indicate that corruption reduces economic growth along with other variables, namely the level of health and unemployment. W & Sheu (2015) present findings that corruption and the growth of unemployment are positively related in the long run to economic growth.

In previous research, many researchers have focused solely on the impact of macroeconomic variables and corruption on economic growth, without considering causal relationships among them. Meanwhile, each country in the Asia-Pacific region has its own unique economic conditions, levels of investment, varying unemployment rates, and differing levels of corruption. Therefore, it becomes intriguing to investigate whether there is a cause-and-effect relationship (causality) between economic growth and macroeconomic variables as well as corruption levels in the Asia-Pacific countries. Additionally, this research also aims to examine both the short-term and long-term relationships between economic growth, macroeconomic variables, and corruption levels in the relevant countries.

II. Methods

This research employs a quantitative method. It utilizes panel data to combine time series data with cross-sectional data. The total number of observations used is 792, comprising time series data from 2012 to 2020 and cross-sectional data from 22 countries in the Asia-Pacific region (Indonesia, South Korea, Singapore, the Philippines, Malaysia, Myanmar, India, China, Vietnam, Japan, Thailand, Cambodia, Laos, Bangladesh, Pakistan, Nepal, Sri Lanka, Afghanistan, Timor-Leste, Papua New Guinea, Australia, and New Zealand). The corruption levels and per capita economic growth data are subjected to natural logarithm (Ln) transformation before data processing. This transformation aims to address situations where there is a non-linear relationship between variables and to make the data initially non-normally distributed become normal or approach normality (Benoit, 2011).

To tackle the concerns raised in this study, the Vector Error Correction Model (VECM) methodology is applied. This approach enables the exploration of both short-term and long-term reactions of each variable under consideration. The identification of cointegration among the variables implies that the error structure in the Vector Auto Regression (VAR) method can be estimated, preventing the loss of long-term information in the analysis. This model is commonly known as the VECM model, which essentially restricts the VAR model. The steps involved in implementing VECM in this research are as follows:

One of the prerequisites for conducting cointegration tests is the assumption of stationarity. The widely used unit root test is the Augmented Dickey-Fuller (ADF) test. Dickey & Fuller developed the Augmented Dickey-Fuller (ADF) test to examine the presence of a unit root in a variable in a model AR with an order greater than one or (AR(P)). In the ADF unit root test, the residuals in the model are assumed to be autocorrelated or have a relationship. Data is considered stationary if the ADF test method's probability is less than the 5% significance level.

$$Y_t = \delta Y_{t-1} + U_t \dots\dots\dots(1)$$

$$Y_t - Y_{t-1} = \delta Y_{t-1} - Y_{t-1} + U_t \dots\dots\dots(2)$$

$$\Delta Y_t = (\delta - 1) Y_{t-1} - U_t \dots\dots\dots(3)$$

or it can be stated as follows :

$$\Delta Y_t = \beta Y_{t-1} + U_t \dots\dots\dots(4)$$

Based on equation 4, the hypothesis of stationarity for the ADF test is as follows (Gujarati & Porter, 2013):

$H_0: \beta = 0$ (has a unit root/non-stationary)

$H_1: \beta < 0$ (does not have a unit root/stationary)

Subsequently, the process involves identifying the suitable lag order. However, prior to that, the initial step is to ascertain the maximum lag duration for a stable model. The model's stability can be assessed by examining the values of the inverse roots derived from its characteristic AR polynomial, which are evident in the AR roots table. When all the modulus values of the AR roots are less than one, the model is deemed stable. If the maximum lag length is determined to be stable, it ensures the reliability of the results obtained from the Impulse Response Function (IRF) and Variance Decomposition (VD).

Table 1. Variable Description and Source

Variable	Description	Indicator	Source
FDI	Foreign Direct Investment	Percent	World Bank
LNKOR	Corruption	Index	Transparency International
UN	Unemployment	Percent	World Bank
LNGDP	Gross Domestic Product Per Capita	US\$	World Bank

VECM estimation is highly sensitive to the lag length chosen. Determining the optimal lag is one of the crucial procedures in model formation. One of the methods that can be used to determine the criteria for the optimal lag length is the Akaike Information Criterion (AIC), which is defined as follows:

$$\text{Ln(AIC)} = \ln \frac{\sum_1^2 i}{n} + \frac{2k}{n} \dots\dots\dots(5)$$

is the sum of squared residuals, where k represents the number of independent variables, and n represents the number of observations. The optimal lag length is determined by the minimum AIC value. The smaller the AIC value, the better the model used (Machmudin & Ulama, 2012).

Cointegration is closely related to the long-term relationship or long-term equilibrium among variables, which, although not individually stationary, can become stationary through linear combinations of these variables. (Engle & Granger, 1987) If time series data are cointegrated, there is a long-term relationship among these time series data. In this study, cointegration testing is performed using the Johansen cointegration test. This test employs the trace test statistic and/or the maximum eigenvalue statistic with a significance level of 5%, as expressed below:

Trace Test Statistic :

$$LR_{tr}(r|k) = -T \sum_{i=r+1}^k \log(1 + \lambda) \dots\dots\dots (6)$$

Testing hypotheses:

H_0 = there are no r cointegration equations

H_1 = there are r cointegration equations

Granger causality is a test used to examine the causality or reciprocal relationship between two variables, allowing us to determine whether there is a statistically significant causal relationship between the two variables (Engle & Granger, 1987). The hypotheses used in this study at a 5% significance level are as follows:

H_0 = no causality >5%

H_1 = causality <5%

VECM disregards exogenous variables, meaning that the model views all variables as variables that can mutually influence or be influenced by each other, also known as endogenous variables. Consistent with the previous explanation, this study examines the causal relationship between corruption, foreign direct investment, unemployment, and economic growth in Asia-Pacific countries with the equation:

$$\text{LnGDP} = C_1 + a_{1i} \sum_{i=1}^k \text{LnKOR}_{t-k} + a_{1i} \sum_{i=1}^k \text{FDI}_{t-k} + a_{1i} \sum_{i=1}^k \text{UN}_{t-k} + \varepsilon_1 \dots\dots (7)$$

The dependent variable is per capita economic growth (LNGDP) in equation (7). Meanwhile, corruption (LNKOR), foreign direct investment (FDI), and unemployment (UN) are the independent variables that will affect per capita economic growth (LOGGDP).

$$\text{LnKOR} = C_2 + a_{2i} \sum_{i=1}^k \text{LnGDP}_{t-k} + a_{2i} \sum_{i=1}^k \text{FDI}_{t-k} + a_{2i} \sum_{i=1}^k \text{UN}_{t-k} + \varepsilon_2 \dots\dots (8)$$

Equation model (8) examines the influence of per capita economic growth (LNGDP), foreign direct investment (FDI), and unemployment (UN) on the level of corruption (LNKOR) in Asia-Pacific.

$$\text{FDI} = C_3 + a_{3i} \sum_{i=1}^k \text{LnGDP}_{t-k} + a_{3i} \sum_{i=1}^k \text{LnKOR}_{t-k} + a_{3i} \sum_{i=1}^k \text{UN}_{t-k} + \varepsilon_3 \dots\dots (9)$$

Equation model (9) indicates that per capita economic growth (LNGDP), corruption level (LNKOR), and unemployment (UN) affect the investment level reflected by foreign direct investment (FDI).

$$\text{UN} = C_4 + a_{4i} \sum_{i=1}^k \text{LnGDP}_{t-k} + a_{4i} \sum_{i=1}^k \text{LnKOR}_{t-k} + a_{4i} \sum_{i=1}^k \text{FDI}_{t-k} + \varepsilon_4 \dots\dots (10)$$

In equation model (10), we will examine the response of the unemployment rate (UN) in the Asia-Pacific region to changes in per capita economic growth (LNGDP), corruption level (LNKOR), and investment level (FDI).

III. Result, Analysis, and Discussion

In Table 2, the Stationarity Test shows the output results indicating that only one variable is stationary at the level, which is the corruption level (LNKOR) with a probability of 0.0072, where this probability is smaller than the 5% significance level. Meanwhile, investment (FDI), the unemployment rate (UN), and per capita economic growth (LNGDP) are not stationary at the level because their probabilities are greater than the 5% significance level. Since only one variable is stationary at the level and the rest are not, differencing is required to eliminate unit roots in the data. First-order differencing, also known as the first difference, is performed by taking the difference between the data at time t and the data at time $t - 1$ (SIANIPAR et al., 2016).

After conducting the stationarity test on the first differences, it is shown that each variable, including corruption level (LNKOR), investment (FDI), the unemployment rate (UN), and per capita economic growth (LNGDP), has probability values below the 5% significance level. Therefore, it can be concluded that this research is stationary in first differences.

Table 2 Stationary Test

Variable	Level	1 st difference		
	Probability	Information	Probability	Information
FDI	0.2215	Non-Stationary	0.0209	Stationary
LNKOR	0.0072	Stationary	0.0001	Stationary
UN	0.0865	Non-Stationary	0.0047	Stationary
LNGDP	0.5127	Non-Stationary	0.0276	Stationary

Source: Data is Processed

Table 3 Optimal Lag Length Test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	15.09490	NA	9.13e-06	-0.252157	-0.139551*	-0.206791
1	48.61193	63.22530	6.14e-06*	-0.650271*	-0.087240	-0.423440*

Note: The * sign shows the lag that has the best value according to the criteria

Source: data is processed.

Table 3 presents the results of the optimal lag length based on the criteria used, which is the Akaike Information Criterion (AIC). The selected optimal lag length is the first lag

with an AIC value of -0.650271 . Determining this optimal lag length is useful for understanding the duration of interdependence periods between the variables and their influence on other endogenous variables (Nizar, 2015). Therefore, the subsequent testing will use the first lag length.

Based on the selected optimal lag length, which is the first lag, the stability of the chosen optimal lag length needs to be tested. Table 4 presents the stability test of the optimal lag, indicating that all of its roots have modulus values below one (<1). This suggests that the optimal lag length chosen for further testing is stable.

Table 4 Optimal Lag Stability Test

Root	Modulus
-0.659845	0.659845
-0.377785	0.377785
0.328593	0.328593
-0.029437	0.029437

Source: data is processed.

Figure 1 illustrates the output results of the inverse roots of the AR characteristic polynomial, indicating that the lag length of 1 has stabilized and is suitable for further testing. This is evidenced by the fact that none of the roots are outside the circle, or in other words, all unit root values have modulus values within a range of less than <1 .

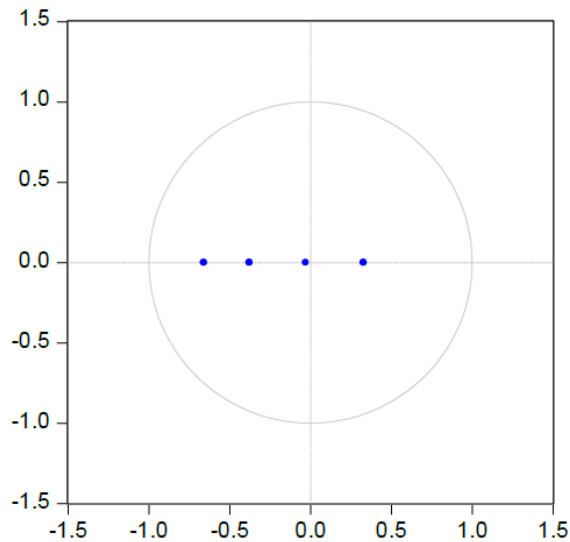


Figure 1. Inverse roots of AR characteristic Polynomial

Source: Data is Processed

As seen in Table 5, the Johansen cointegration test results indicate that starting from the hypotheses of none, at most 1, at most 2, and at most 3, both the trace test and the maximum eigenvalue statistics have probabilities lower than the 5% significance level.

Additionally, if we examine the trace statistics values at the 5% level, the none hypothesis is 228.8470, which is greater than the critical value of 40.17493. The same pattern is observed for at most 1, at most 2, and at most 3. Likewise, when looking at the maximum eigenvalue test statistics at the 5% level, the none hypothesis is 98.01598, exceeding the critical value of 24.15921. This holds true for at most 1, at most 2, and at most 3. Therefore, it is suggested by the cointegration test results that there is cointegration among corruption, investment, unemployment, and economic growth per capita, indicating a long-term equilibrium relationship among them. Subsequently, VECM analysis can be conducted.

Table 5 Cointegration Test

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.524099	228.8470	40.17493	0.0000
At most 1 *	0.373033	130.8310	24.27596	0.0000
At most 2 *	0.295760	69.20529	12.32090	0.0000
At most 3 *	0.159406	22.92129	4.129906	0.0000

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.524099	98.01598	24.15921	0.0000
At most 1 *	0.373033	61.62572	17.79730	0.0000
At most 2 *	0.295760	46.28400	11.22480	0.0000
At most 3 *	0.159406	22.92129	4.129906	0.0000

Source: data is processed.

Based on the Granger causality test results presented in Table 6, it is found that the variables with a causal relationship (either one-way or two-way) at the 5% significance level are as follows:

1. The corruption level (LNKOR) significantly influences per capita economic growth (LNGDP) with a p-value of 0.0159, which is less than the 5% significance level. Conversely, per capita economic growth (LNGDP) significantly and proportionally affects the corruption level (LNKOR) with a p-value of 0.0008, also below the 5% significance level. Thus, it can be concluded that there is a two-way causal relationship or mutual influence between the corruption level (LNKOR) and per capita economic growth (LNGDP).

2. The unemployment rate (UN) significantly influences per capita economic growth (LNGDP) with a p-value of 0.0057, which is less than the 5% significance level. However, per capita economic growth does not significantly affect the unemployment rate, with a p-value of 0.1364, exceeding the 5% significance level. Therefore, there is only a one-way causal relationship from the unemployment rate to per capita economic growth. Meanwhile, foreign direct investment (FDI) does not exhibit any significant bidirectional relationship with the corruption level, economic growth, and unemployment rate.

Table 6. Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.
FDI does not Granger Cause LNGDP	176	2.48197	0.1170
LNGDP does not Granger Cause FDI		0.13245	0.7164
LNKOR does not Granger Cause LNGDP	176	5.93430	0.0159
LNGDP does not Granger Cause LNKOR		11.5302	0.0008
UN does not Granger Cause LNGDP	176	7.82781	0.0057
LNGDP does not Granger Cause UN		2.23927	0.1364
FDI does not Granger Cause LNKOR	176	0.00257	0.9596
LNKOR does not Granger Cause FDI		0.15017	0.6988
UN does not Granger Cause LNKOR	176	3.10209	0.0800
LNKOR does not Granger Cause UN		0.60423	0.4380
UN does not Granger Cause FDI	176	0.07843	0.7798
FDI does not Granger Cause UN		0.45400	0.5013

Source: data is processed.

3.1. VECM Estimation Results

The estimation results for the short term, specifically at lag 1, with the variable LNGDP (per capita economic growth) as the dependent variable and LNKOR (corruption), FDI (investment), and UN (unemployment) as independent variables, reveal the following:

1. Gross Domestic Product per Capita (LNGDP) significantly affects itself at the 5% significance level, with a t-statistic value of $[-3.45735]$. This value is greater than the t-table value of 1.962968, indicating a negative impact of -0.313995. In other words, if there is an increase of one standard deviation in per capita economic growth (LNGDP) in the previous period, it will decrease per capita economic growth in the current period by the coefficient of LNGDP (per capita economic growth), which is -0.313995.

2. When corruption (LNKOR) is the dependent variable, followed by per capita economic growth (LNGDP), investment (FDI), and unemployment (UN) as independent variables, two variables show significance. Firstly, corruption (LNKOR) is significant and negatively correlated, with a value of $[-2.80625] > t$ -table 1.962968 at the 5% significance level. This indicates that in the short term, an increase of one standard deviation in corruption (LNKOR) in the previous period will lead to a decrease in corruption (LNKOR) in the current period by -0.180662. Secondly, investment (FDI) is significant and negatively correlated, with a t-statistic value of $[-6.80773] > t$ -table 1.962968 at the 5% significance level. This means that an increase of one standard deviation in investment (FDI) in the previous period will result in a decrease in corruption (LNKOR) in the current period by -0.020494.

Next, when the investment variable (FDI) becomes the dependent variable, while per capita economic growth (LNGDP), corruption level (LNKOR), and unemployment (UN) are considered as variables influencing it (independent variables), two variables show significance:

1. Corruption (LNKOR) is significant and negatively correlated with a t-statistic value of $[-3.85137] > t$ -table 1.962968 at the 5% significance level. This implies that when there is an increase of one standard deviation in corruption level (LNKOR) in the previous period, it will result in a decrease in investment level in the current period by the coefficient of the corruption level (LNKOR), which is -6.186906.
2. Investment level (FDI) itself is significant and negatively correlated with a t-statistic value of $[-8.46535] > t$ -table 1.962968 at the 5% significance level. This means that an increase of one standard deviation in investment level (FDI) in the previous period will lead to a decrease in investment level in the current period by the coefficient of the investment variable itself, which is -0.635893.

Next, unemployment (UN) becomes the dependent variable influenced by per capita economic growth (LNGDP), corruption level (LNKOR), and investment (FDI). Two variables show statistical significance:

1. Investment (FDI) is statistically significant and positively affects the unemployment rate with a t-statistic value of $[3.03035] > t$ -table 1.962968 at the 5% significance level. This suggests that when there is an increase of one standard deviation in investment (FDI) in the previous period, it will result in an increase in the unemployment rate (UN) in the current period by 0.072496.
2. Unemployment rate (UN) is statistically significant and negatively correlated in the short term with a t-statistic value of $[-5.45997] > t$ -table 1.962968 at the 5% significance level. Thus, when there is an increase of one standard deviation in the unemployment rate (UN) in the previous period, it will lead to a decrease in the unemployment rate (UN) in the current period by its coefficient, which is -0.543995.

In the long-term equilibrium, the significant variable is the corruption level (LNKOR) with a t-statistic value of $[-9.76765] > t$ -table 1.962968 at the 5% significance level. The corruption level (LNKOR) is significant and negatively impacts per capita economic growth in the long term, with its influence coefficient being -18.96743. This

implies that when there is an increase of one standard deviation in the corruption level, it will decrease per capita economic growth by -18.96743. This finding aligns with the results of (Thach et al., 2017), who stated that corruption has a negative and significant impact on economic growth, meaning that corruption acts as a hindrance to economic growth in ASEAN countries.

Table 7. Short Term VECM Estimation Test

VECM Short-Term				
Error Correction:	D(LNGDP,2)	D(LNKOR,2)	D(FDI,2)	D(UN,2)
CointEq1	0.001024 [0.17846]	0.043223 [8.96223]	-0.620647 [-5.15738]	-0.109922 [-2.86805]
D(LNGDP(-1),2)	-0.313995 [-3.45735]	-0.021485 [-0.28148]	1.175244 [0.61706]	-1.039516 [-1.71375]
Error Correction:	D(LNGDP,2)	D(LNKOR,2)	D(FDI,2)	D(UN,2)
D(LNKOR(-1),2)	0.005193 [0.06779]	-0.180662 [-2.80625]	-6.186906 [-3.85137]	-0.631143 [-1.23364]
D(FDI(-1),2)	0.001201 [0.33539]	-0.020494 [-6.80773]	-0.635893 [-8.46535]	0.072496 [3.03035]
D(UN(-1),2)	0.006522 [0.43720]	-0.008619 [-0.68743]	0.528575 [1.68960]	-0.543995 [0.09963]
R-Squared	0.085674	0.658862	0.733164	0.295528

Note: the sign (-1) is the lag length & the sign [] is the absolute sign

Source: data is processed.

Furthermore, the variable that is significant in the long term is the investment level (FDI) with a t-statistic value of [6.05362] > t-table 1.962968 at the 5% significance level. Investment level is significant and positively responds to per capita economic growth in the long term, and the response coefficient is 0.866155. This means that if there is a change of one standard deviation in the investment level, it will be responded to by an increase in per capita economic growth by 0.866155.

Additionally, the unemployment rate (UN) is significant in the long term. The unemployment rate is significant and positively influences per capita economic growth with a t-statistic value of [2.95807] > t-table 1.962968 at the 5% significance level. This indicates that when there is an increase of one standard deviation in the unemployment rate, it will enhance per capita economic growth by the coefficient of the unemployment rate, which is 1.421170.

In summary, in the short term, the corruption level does not have a significant impact on per capita economic growth. However, in the long term, the corruption level hinders per capita economic growth by reducing economic growth itself. Moreover, in the short term,

the corruption level has a significant and negative effect on foreign direct investment (FDI) in general. This is consistent with findings by Sarkar and Hasan (2001), which suggest that an increase in corruption levels leads to a decrease in investment. In contrast, countries with lower corruption levels tend to attract more foreign direct investment (Canare, 2017).

However, the short-term positive correlation between the unemployment rate and per capita economic growth contradicts Okun's law, which posits an inverse relationship between the two variables. This supports the findings of (Lal et al., 2010) and (Kim et al., 2020), which suggest that Okun's law does not apply in some Asian countries.

The Impulse Response Function (IRF) is used to track the marginal effects of a shock to one variable on other variables (Lütkepohl, 2010). Figure 2 presents the results of the impulse response function analysis of LNGDP from the previous VECM estimation model. The horizontal axis represents the reaction period in years, while the vertical axis shows the response values in percentage terms. Figure 2 illustrates the responses of LNGDP itself, LNKOR, FDI, and UN.

Table 8. Long Term VECM Estimation Test

VECM long-term				
Cointegrating Eq:	D(LNGDP(-1))	D(LNKOR(-1))	D(FDI(-1))	D(UN(-1))
CointEq1	1.000000	-18.96743 [-9.76765]	0.866155 [6.05362]	1.421170 [2.95807]

Note: the sign (-1) is the lag length & the sign [] is the absolute sign

Source: data is processed.

In the first period, LNKOR, FDI, and UN do not exert any shocks on LNGDP. Moving into the second period, LNGDP responds with a decreasing shock to itself, while LNKOR has a negative impact, and FDI and UN have positive effects. Subsequently, in the third period, LNGDP's response increased, and LNKOR also experienced an increased response, while FDI and UN had decreased responses. After the third period, LNGDP responds to its own influence with a stable response in subsequent periods. However, the effects of LNKOR, FDI, and UN become fluctuating after the third period. This indicates that when there is an initial shock to per capita economic growth, it responds with a decrease, while corruption levels, investment, and unemployment do not shock it. Furthermore, when per capita economic growth responds with an increase due to its own shock, the levels of corruption, investment, and unemployment start exerting fluctuating influences on per capita economic growth.

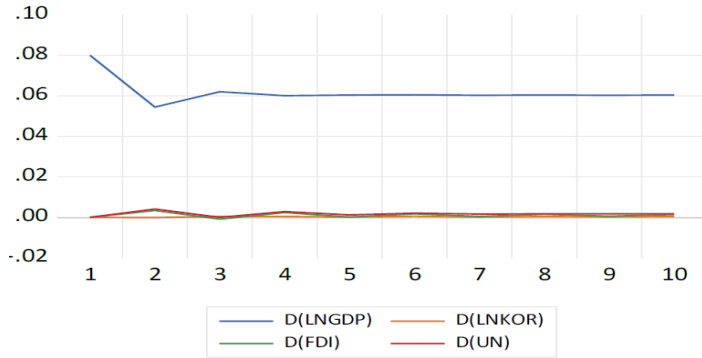


Figure 2. Impulse Response Function of LNGDP
 Source: Data is Processed

Figure 3 illustrates the impact of LNKOR on itself, LNGDP, FDI, and UN. Starting in the second period, LNKOR responds to its own shock with a sharp decrease, followed by an increase in LNGDP, FDI, and UN. Moving into the third period, there is an increase in LNKOR, followed by a decrease in LNGDP, FDI, and UN. After the third period, the responses of LNKOR, LNGDP, FDI, and UN become highly fluctuating.

Thus, when there is a sharp decrease in corruption levels, it is followed by an increase in per capita economic growth, investment, and unemployment. In contrast, when the response of corruption levels increases, per capita economic growth, investment, and unemployment respond with a decrease.

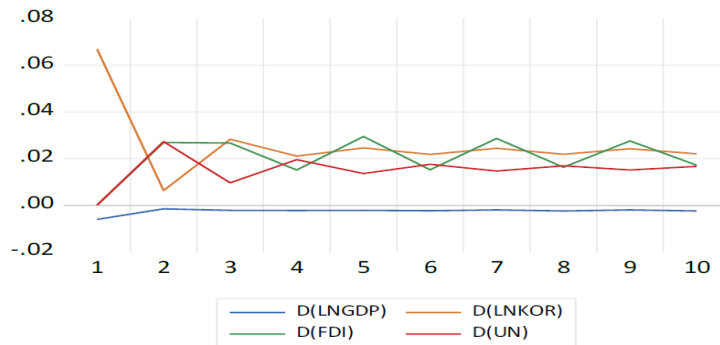


Figure 3. Impulse Response Function of LNKOR
 Source: Data is Processed

Figure 4 represents the response of FDI to itself, followed by LNGDP, LNKOR, and UN. In the initial period, FDI responds positively to LNGDP and itself but does not respond to UN. Entering the second period, when there is an increase in LNKOR, FDI, LNGDP, and UN decrease. After the third period, FDI responds to all impulses with high fluctuations.

This indicates that when corruption levels increase, it has an impact on decreasing investment, economic growth, and unemployment rates. (Podobnik et al., 2008) also suggests that an increase in the CPI (reduction in corruption levels) leads to higher per capita economic growth and attracts investors, resulting in an increase in foreign direct investment.

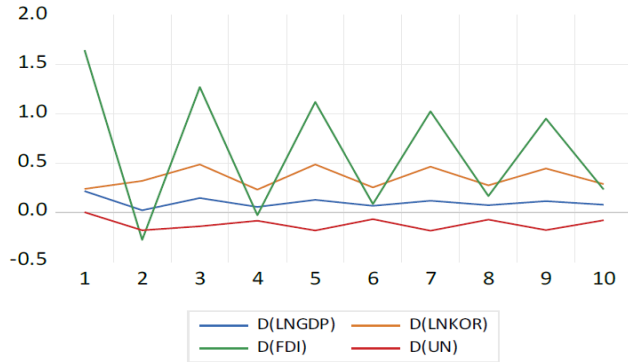


Figure 4. Impulse Response Function of FDI

Source: Data is Processed

Figure 5 illustrates the impact of UN on itself, followed by LNGDP, LNKOR, and FDI. In the initial period, UN responds positively to shocks from itself and LNKOR but negatively to LNGDP and FDI. Entering the second period, when there is a shock to LNKOR with an increase, UN responds with a decrease, and a proportional response is observed in LNGDP and FDI. As we move into the third period, the responses of UN, LNGDP, LNKOR, and FDI fluctuate, extending into subsequent periods.

This indicates a negative relationship between the unemployment rate, per capita economic growth, investment level, and the corruption rate in the short term. In the long term, the relationship between these variables becomes fluctuating.

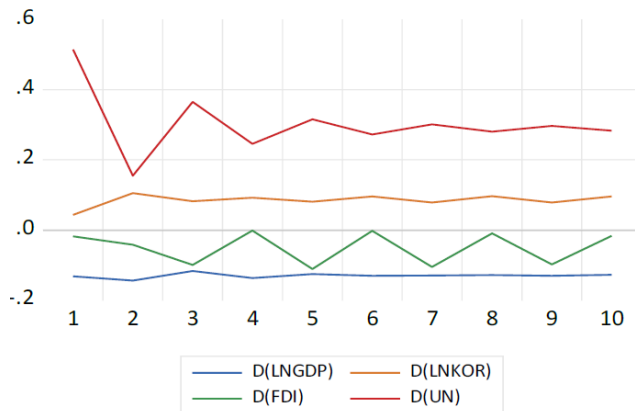


Figure 5. Impulse Response Function of UN

Source: Data is Processed

In summary, in the short term, an increase in the corruption rate leads to a decrease in per capita economic growth, investment levels, and the unemployment rate. This indicates that, in the short term, the corruption rate has a significant impact on per capita economic growth, investment levels, and the unemployment rate in the Asia-Pacific region. However, over the long term, the influence of corruption on economic growth, investment, and unemployment varies. This suggests that predicting the long-term effects of corruption is

challenging and can contribute to economic instability and uncertainty. Such uncertainty can lead to various consequences, including increased costs associated with corruption, and uncertainty about when and how much bribery should be paid to investors, further worsening the economy. Campos et al. (1999) found evidence that unpredictable corruption leads to more adverse effects.

Variance Decomposition in the VECM model aims to separate the individual influence of each variable on the response of other variables. In other words, variance decomposition is used to determine the contribution or composition of a variable that plays the most significant role in explaining changes in another variable.

At the beginning of the period, the largest composition in influencing the variance of per capita economic growth is the shock of economic growth itself, accounting for 100%. Then, in the second period, the corruption rate, investment level, and unemployment rate begin to influence per capita economic growth, with the largest contribution coming from the unemployment rate at 18%, followed by the investment level at 11.5%, and the corruption rate at 0.015%. This change in contribution values continues to fluctuate until the 10th period, with the largest contribution to changes in per capita economic growth still coming from per capita economic growth itself.

The variance decomposition for the corruption rate is presented. In the initial period, the majority of the variation in the corruption rate is explained by the shock to the corruption rate itself, accounting for 99%, followed by per capita economic growth at 84%. In the second period, there is a decrease in the contribution of the corruption rate to its changes, which amounts to 75%, and per capita economic growth contributes 67%. In this second period, the investment rate and the unemployment rate start to contribute to explaining the changes in the corruption rate, each at 12%. Subsequently, from the third period to the tenth period, the contributions of the corruption rate to itself and per capita economic growth declined further. However, the investment rate and the unemployment rate show increasing influence in each subsequent period.

The variance decomposition for the investment rate. In the initial period, the most substantial composition in explaining changes in the investment rate is attributed to the shock from the investment rate itself, amounting to 96%. This is followed by the corruption rate at 2% and per capita economic growth at 1.65%. In the initial period, the unemployment rate does not contribute to explaining changes in the investment rate. Moving into the second period, the contribution of the investment rate to itself starts to decrease significantly, with a share of 92%, followed by the corruption rate at 5% and the investment rate at 1.5%. In this period, the unemployment rate begins to have an influence in explaining changes in the investment rate, amounting to 1%. Entering the third period and beyond, the composition of the investment rate's influence in explaining changes in itself continues to decline. Conversely, the impact of the corruption rate increases with the passage of time. However, the effects of per capita economic growth and the unemployment rate fluctuate in line with the periods.

The variance decomposition for the unemployment rate. The most significant role in explaining variations in the unemployment rate is attributed to the rate itself, accounting for 93% in the initial period. This is followed by per capita economic growth at 6%, the corruption rate at 0.62%, and the investment rate at 0.12%. In the second period, the impact of the unemployment rate on itself starts to decrease substantially to 84%, with per capita

economic growth at 11%, the corruption rate at 3.7%, and the investment rate at 0.64%. From the third period onward, the composition given by the unemployment rate in explaining changes in itself continues to decrease parallel to the increasing periods, but the unemployment rate itself still provides the largest contribution. Per capita economic growth briefly experiences a decrease in its role in explaining changes in the unemployment rate in the third period, but it escalates from the fourth period onward. Similarly, the corruption rate amplifies as the periods progress, except for the investment rate, which fluctuates.

IV. Conclusion and Recommendation

Utilizing the Granger Causality and VECM techniques, this study investigated the causal connections and both short-term and long-term associations among corruption, investment, unemployment, and economic growth in twenty-two Asia-Pacific nations.

The empirical results reveal that there is a two-way causal relationship between the level of corruption and Gross Domestic Product per Capita (GDP per Capita), while a unidirectional causal relationship is observed between the unemployment rate and GDP per Capita, but not the other way around. Furthermore, there is no causal relationship, whether one-way or two-way, between foreign direct investment (FDI) and corruption, unemployment, and GDP per Capita.

In the short term, when GDP per Capita becomes a variable influenced by other variables such as corruption, investment, and unemployment, only GDP per Capita itself is significant and negatively influential. Other variables, namely corruption, foreign direct investment (FDI), and unemployment, do not have significant effects. Subsequently, when corruption becomes the dependent variable with GDP per Capita, investment, and unemployment as independent variables, it is found that corruption and investment significantly and negatively affect corruption. However, GDP per Capita and unemployment do not have a significant impact.

Furthermore, when foreign direct investment (FDI) becomes the influenced variable, only corruption and investment have a significant and negative impact, while GDP per Capita and unemployment do not have a significant influence. Lastly, when unemployment becomes the dependent variable, two significant variables are identified: foreign direct investment (FDI), which has a significant and negative impact, and unemployment itself, which has a significant and negative influence. On the other hand, GDP per Capita and corruption do not significantly affect unemployment.

Overall, in the short term, an increase in corruption leads to a decrease in GDP per Capita, investment, and unemployment. However, in the long term, the impact of corruption on economic growth, investment, and unemployment tends to be fluctuating. This indicates that in the long term, the effects of corruption are challenging to predict, potentially worsening economic conditions and increasing uncertainty. These findings are consistent with previous research suggesting that uncertainty resulting from corruption can have detrimental effects on the economy.

Meanwhile, in the long term, the corruption rate has a significant and negative impact on Gross Domestic Product per Capita in the Asia-Pacific region. This indicates that corruption acts as an economic hindrance rather than a lubricant for the economy. Furthermore, in the long term, the investment rate has a significant and positive impact,

meaning that a higher level of foreign direct investment (FDI) entering the region will have a substantial effect in supporting the Gross Domestic Product per Capita or the economic level of Asia-Pacific countries. Additionally, the unemployment rate has a significant and positive impact on per capita economic growth in the Asia-Pacific region.

Due to its negative influence on GDP growth as shown by data from various Asia-Pacific countries studied, from a public policy perspective, this study recommends suppressing corrupt practices in various state and business administration activities.

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