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Linear mixed model approach: The effect of poor people & unemployment rate on various types of crime in 34 provinces in Indonesia

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Abstract

Currently, Indonesia faces serious challenges related to increasing crime rates throughout the country. Various types of crime, such as increasing drug cases, increasingly concerning violations of decency, and disturbing acts of fraud, embezzlement, and corruption, have become a major concern for society and the government. In this context, this research plays an important role in efforts to understand the factors that drive the growth of crime and pursue the vision and mission of Indonesia Emas 2045, which sets targets to reduce poverty to reach zero percent. The main focus of the research is to link poverty and unemployment rates with three key types of crime that affect Indonesia's future. In this study, we try to understand how poverty rates and unemployment rates affect these types of crime in 34 provinces in Indonesia. The study used a statistical method called Linear Mixed Model with the support of R software. Of the 27 models analyzed, several models had a significant impact. The data used in this study was obtained from the Central Statistics Agency (BPS). The results of this study provide valuable insights into the factors influencing crime in Indonesia, which in turn can be used as a basis for designing more effective policies in an effort to achieve the vision and mission of Indonesia Emas 2045.

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INTRODUCTION

Indonesia will experience a golden age in 2045. At that time, Indonesia was even 100 years old, aka a century. According to the Coordinating Minister for Human Development and Culture (Menko PMK) Muhadjir Effendy (2022) At that time, it was targeted that Indonesia had become a developed country and had been on par with superpowers. The resolution covers various aspects of national development, including economic, political, social, cultural, and defense. The economic aspects that include high levels of poverty and unemployment are still high. Unemployment has a strong attachment to poverty. (Dahliah & Nur, 2021). Unemployment factors contribute to high levels of poverty. So, when the unemployment rate is high, it will increase the number of poverties as well

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(Mansi et al., 2020). Meanwhile, in the resolution of Indonesia Emas 2045 according to the Deputy for Economic Affairs of the Ministry of National Development Planning / Bappenas Amalia Adininggar Widyasanti, the vision of Indonesia Emas 2045 in the economic sector is targeted at the poverty rate towards 0% by the government.

A country's progress is considered successful if it is able to overcome issues such as poverty, and unemployment (Pasco, Flores-Gonzalez, & Atkin, 2022; Rehman, Cismas, & Milin, 2022). Challenges, such as poverty alleviation and unemployment, can be overcome through policies that encourage the development and sustainability of MSMEs (Bvuma, S., &; Marnewick, C. 2020). These policies, if implemented, can result in economic growth and improved living standards for the population (Kouadio & Gakpa, 2022). However, if this aspect is still not resolved, various other problems will arise, including an increase in crime rates (Winston, M. 017). According to statistics released by the Central Statistics Agency, the share of the population experiencing crime in Indonesia in the period 2016 to 2018 shows significant variations. There was a decrease of 0.14 percent from 2016 to 2017, which was then followed by an increase of 1.11 percent in 2018. Despite the decline, the crime rate in Indonesia is still relatively high (Dalimunthe & Imsar, 2023). Basically, criminality arises because human nature is influenced by various problems or it can also aim to relieve boredom and obtain social status and social capital (Siregar, Siregar, & Lubis, 2020). Therefore, a person is involved in a criminal because they feel that the benefits or satisfaction gained from illegal acts are more significant than those they get through legitimate acts (Butler, 2023).

Poverty and unemployment produce detrimental effects on human life (Thompson & Dahling, 2019). Such as unemployment, hunger, limited educational opportunities, and an increase in crime such as theft, robbery, murder, and other criminal acts (Evans & Kelikume, 2019). Common features of criminal acts include fraud, lying, and theft. It also includes various forms of fraud, narcotics trafficking, money laundering, embezzlement, bribery, and so on (Nanaghan, Perwari, & Murray, 2023). Drug and psychotropic crimes in Indonesia exceeded 15,455 cases in the first half of 2022 based on data from the National Police Criminal Investigation Agency, which shows narcotics crime to be the second highest in Indonesia. It is estimated that 25-50% of the offenders in drug use are groups of juveniles.Immoral cases in Indonesia, according to the Central Statistics Agency (BPS), are increasingly rife, especially rape and molestation in the last five years, the highest occurred in 2020 with 6,872 cases, which increased by 31.32% from the previous year which was 5,233 cases. Meanwhile, embezzlement, fraud, and corruption have decreased in recent years according to the Central Statistics Agency (BPS) but are still at a fairly high number, for example the case of misappropriation of Indosurya Savings and Loans Cooperative (KSP) funds in 2020 which claimed 23,000 victims (Mulyadi, 2017; Byuma & Marnewick, 2020).

Unemployment has a negative and significant effect on crime in Indonesia. Poverty has a positive and significant effect on crime in Indonesia (Armin & Idris, 2020) Unemployment can be a major reason for the growth in crime rates. If the unemployment rate increases, the opportunity for legitimate income decreases and crime will increase (Kassem, Ali, & Audi, 2019). Increased poverty affects crime as well as the interaction between crime-forming factors (Wheeler & Steenbeek, 2021). This increase includes different types of crimes, such as drug offenses, order violations, property crimes, and violent crimes (Braga et al., 2019). Country With a high crime rate will cause loss and damage to property and creating a feeling of general insecurity in the country itself (Jonathan et al.,2021). Further research is needed to identify the factors that cause crime (Lee & Chang, 2021). Although many studies have been conducted on the influence of poor and unemployed people on crime in Indonesia, such as the journals of Rahmalia, Ariusni, & Triani (2019) and Saputra and Widodo (2023), it turns out that there are still shortcomings with less data and lack of in-depth

analysis on related factors. Phenomenon This is what interests the author to research the effect of poor people & unemployment rate on various types of crime in 34 provinces in Indonesia.

METHOD

The longitudinal model is a form of mixed linear model that analyzes the observation data repeatedly on each subject. So that the data analysis method used in this study is Linear Mixed Models. Longitudinal data can be analyzed by a mixed linear model if the selection of observation subjects is carried out randomly from a population (McCulloch, 2001). A mixed linear model is a model that belongs to a combination of fixed factors (fixed effect) and random factors (random effect). In this model, fixed effect components are generally associated with groups of factors, while random effects relate to variations in different responses over time for each experimental unit.

The mixed linear model is a model consisting of fixed effect factors and random effects. A factor is considered "fixed" if in a study it has included all possible variations of a previously established factor. On the other hand, a factor is considered "random" if it is chosen as a random sample of the population that reflects the characteristics of the population as a whole. This mixed linear model is commonly used in data that is not mutually free and data that is not homogeneous (Henderson, 1984).

Common forms of models without random effects are:

$$Y_{ij} = \beta_0 + \beta_1 t_j + \varepsilon_{ij} \quad (1)$$

For general forms of models with random effects, namely:

$$Y_{ij} = \beta_0 + \beta_1 t_j + \ldots + \beta_n X_n + \alpha_i + \varepsilon_{ij} \quad (2)$$

By is the time of year used. In this study, namely 2020 and 2021 based on the data owned. As for the area in this study is 34 provinces in Indonesia.$i \in [0,1]j$

RESULTS AND DISCUSSION

Data Sources

The scope of this research covers conditions where there are many crime cases that occur and spread across 34 provinces in Indonesia in 2020-2021. The amount of crime rate (in percent) experienced by the Indonesian state is represented as a dependent variable. Especially narcotics crime, decency crime, and KDP (Fraud, Embezzlement, and Corruption) crime in the 2020-2021 period. The representation of independent variables is taken from the unemployment rate (percent) and poverty rate (percent) in 2020 and 2021. The dependent variable in question is the type of sharing of existing crime data, namely narcotics, decency, and KDP which are all sourced from BPS (Central Statistics Agency). With the aim of simplification, we convert data from the number (cases) to percent by dividing the total crime cases that occur with each category, starting from narcotics, decency, to KDP so that the type of crime in each category is obtained in the form of percent. Therefore, our model will have some significant results on different types of crime rates.

Model Analysis

Several models to describe longitudinal evolution will be inspired and compared. From the dataset (see Figure x – x), we get as many as five independent variables in both 2020 and 2021. These independent variables are percentage of poverty, percentage of unemployment rate, percentage of crime rate (narcotics), percentage of crime rate (decency), and finally percentage of crime rate (fraud, embezzlement, corruption). All of these independent variables are taken from the Central Bureau of Statistics publication in 2020 and 2021.

$$\begin{aligned} Y_{ij} &= \beta_0 + \beta_1 t_j + \varepsilon_{ij} \\ \varepsilon_{ij} &\sim N(0, \sigma^2_{res}) \end{aligned} \quad (3)$$

In the first stage, we initially explored each independent variable that had a significant effect on the crime rate of each province without involving random effects. This means that we assume that each province has the same average internal conditions when it comes to committing crime. Furthermore, the results of the exploration from the involvement of each independent variable, it was found that there was no model that had a significant influence from the independent variable, namely model 0, model 9, and model 18. As representatives we introduce equation (3) which relates the time variable (years) with the crime rate.

Table 2. Model summary

	34 Province	Year 2020 &2021	% Poor People	% Unemployment Rate	Year * Poor People	Year * Unemployment Rate	Poor People * unemployment Rate	% Narcotisc	% Immorality	% Fraud
Model 0		✓						✓		
Model 1	✓	✓						✓		
Model 2	✓	✓	✓					✓		
Model 3	✓	✓		✓				✓		
Model 4	✓	✓	✓	✓				✓		
Model 5	✓	✓		✓		✓		✓		
Model 6	✓	✓	✓		✓			✓		
Model 7	✓	✓	✓	✓			✓	✓		
Model 8	✓	✓	✓	✓	✓	✓	✓	✓		
Model 9	✓	✓							✓	
Model 10	✓	✓							✓	
Model 11	✓	✓	✓						✓	
Model 12	✓	✓		✓					✓	
Model 13	✓	✓	✓	✓					✓	
Model 14	✓	✓		✓		✓			✓	
Model 15	✓	✓	✓		✓				✓	
Model 16	✓	✓	✓	✓			✓		✓	
Model 17	✓	✓	✓	✓	✓	✓	✓		✓	
Model 18	✓	✓								✓
Model 19	✓	✓								✓
Model 20	✓	✓	✓							✓
Model 21	✓	✓		✓						✓
Model 22	✓	✓	✓	✓						✓
Model 23	✓	✓		✓		✓				✓
Model 24	✓	✓	✓		✓					✓
Model 25	✓	✓	✓	✓			✓			✓
Model 26	✓	✓	✓	✓	✓	✓	✓			✓

Equation (3) illustrate that there is no significant effect of time change (years) on the high crime rate of a province. This means that under normal conditions (without considering other variables) over time, the crime rate will not be affected. This is evidenced by a p-value year of 0.3220950 at the narcotics crime rate (model 0), a p-value year of 0.479842 at the immoral crime rate, and a p-value year of 0.7412219 at the crime rate of Corruption Fraud Embezzlement. So, then we continued the investigation by adding a random effect in the form of the provincial difference effect and we also did various combinations of independent variables in the model, which then obtained a model that contained a significant influential variable, namely equation (4).

$$Y_{ij} = \beta_0 + \beta_1 t_j + \beta_3 X_2 + \alpha_i + \varepsilon_{ij}$$
$$\alpha_i \sim N(0, \sigma^2_{state}), \varepsilon_{ij} \sim N(0, \sigma^2_{res}) \quad (4)$$

Equation (4) presents the influence of time (year) and the unemployment rate on the drug crime rate by including random state effects. The p-value results for the Unemployment Rate indicate significance and a strong relationship, with a value 7.312841*10-91 and a coefficient of 1.0012674108. This can be interpreted as the unemployment rate having a direct impact on the drug crime rate while considering the influence of the time variable (year). Additionally, this illustrates that the unemployment rate of a province has a significant implication on the drug crime rate. This

aligns with the common occurrence where in various provinces, a high number of unemployed individuals contribute to higher levels of drug-related crimes. On the other hand, the addition of random state effects yields a non-significant p-value for the intercept of the random state effect, which is 0.1524923. This indicates that there are no provinces whose conditions significantly differ from other provinces. This suggests that, on average, each province needs to reduce its Unemployment Rate if it aims to decrease the drug crime rate within its borders.

Subsequently, to find a more significant model, we developed Equation (4) by adding an interaction between the independent variable (time) and the unemployment rate, which was then named Equation (5).

$$Y_{ij} = \beta_0 + \beta_1 t_j + \beta_3 X_4 + \beta_1 t_j * X_4 + \alpha_i + \varepsilon_{ij}$$
$$\alpha_i \sim N(0, \sigma^2_{state}), \varepsilon_{ij} \sim N(0, \sigma^2_{res}) \quad (5)$$

It was found that the independent variable of the unemployment rate had a significant effect and remained with static implications for the narcotics crime rate. However, the interaction between the independent variable Unemployment Rate and time (Year) does not have a significant effect on the unemployment rate of crime. But on the other hand, the addition of these interaction components adds a little value to the residual variance of the model. This means that the model is not getting better at estimating the value of data because in the model structure, it does not have a significant influence. So from these two models, it can be concluded that the average narcotics crime rate is greatly influenced by the unemployment rate and it is proven that the interaction of the unemployment rate each year has no influence on the narcotics crime rate. So there is no need to consider the influence of the year on the narcotics crime rate.

Table 3. Model significance value results

model3 tTable

Value	value	Std.Error	DF	t-value	p-value
Intercept	-0.00029903	0.00203242	33	-0.1471322	8.84E-01
Year 1	0.000598069	0.000408048	32	1.4656842	1.52E-01
Unemployment Rate	1.001267411	0.000287023	32	3488.45713	7.31E-91

	Variance	StdDev
(Intercept)	1.38E-04	0.011732663
Residual	2.75E-06	0.001657815

model5 tTable

	value	Std.Error	DF	t-value	p-value
Intercept	-0.00028996	0.001999645	33	-0.1450082	8.86E-01
Year 1	0.018052342	0.012248363	31	1.4738576	1.51E-01
Unemployment Rate	1.001192537	0.00029193	31	3429.5638472 4.7472e-88	4.75E-88
Year: Unemployment Rate	0.14424269	0.101163261	31	1.4258406	1.64E-01

	Variance	StdDev
(Intercept)	1.33E-04	0.011539274
Residual	2.75E-06	0.001659627

Table 3 provides the p-value of the Unemployment Rate at $7.31 * 10^{-91}$, indicating that the Unemployment Rate has a highly significant influence on the drug crime rate. However, when the

unemployment rate is interacted with the year variable, it does not yield significant results. The lack of significance in the interaction can be observed from the p-value of the Unemployment Rate and year, which is only 0.16.

Then to find a more significant model, we developed Equation (4) by adding another independent variable, the Poor Population Rate.

$$Y_{ij} = \beta_0 + \beta_1 t_j + \beta_2 X_1 + \beta_3 X_2 + \alpha_i + \varepsilon_{ij}$$
$$\alpha_i \sim N(0, \sigma^2_{state}), \varepsilon_{ij} \sim N(0, \sigma^2_{res}) \quad (6)$$

Equation (6) presents the effects of time (years), poverty rate, and unemployment rate by including the *Random State Effect*. The p-value of the poor population level showed a strong significance and engagement relationship of 4.146740*10-9 with a value of -0.0094431481. The p-value of the Unemployment Rate showed significance and a strong engagement relationship of 3.960976*10-88 with a value of 1.0013381597. This can be interpreted that the Poor Population Rate and the Unemployment Rate have a direct influence on the narcotics crime rate by considering the influence of time variables.

Table 4. Model significance value results

model4 tTable

	value	Std.Error	DF	t-value	p-value
Intercept	-0.00028887	0.001189546	33	-0.2428383	8.10E-01
Year 1	-0.00057773	0.000416173	31	1.3882075	1.75E-01
Unemployment Rate	1.00133816	0.000290272	31	3449.65472	3.96E-88
Poor People	-0.00944315	0.001170702	31	-8.0662301	4.15E-09

	Variance	StdDev
(Intercept)	4.52E-05	0.006723704
Residual	2.86E-06	0.001691318

Table 4 provides the values from model 4, indicating that the unemployment rate has a significant influence on the drug crime rate, as evidenced by the p-value of $3{,}96 * 10^{-88}$, and the poverty rate also has a significant influence on the drug crime rate, with a p-value of $4{,}15 * 10^{-9}$.

By adding the independent variable Poor Population Rate with Unemployment Rate and both show significant results, but do not stop there, then we add the variavel of interaction between time (Year) and Unemployment Rate to find out whether the value of time interaction (Year) with the Unemployment Rate from equation III will change in the new model which we call Equation (7).

$$Y_{ij} = \beta_0 + \beta_1 t_j + \beta_2 X_1 + \beta_3 X_2 + \beta_1 t_j * X_4 + \alpha_i + \varepsilon_{ij}$$
$$\alpha_i \sim N(0, \sigma^2_{state}), \varepsilon_{ij} \sim N(0, \sigma^2_{res}) \quad (7)$$

Table 5. Model significance value results

model7 tTable

	value	Std.Error	DF	t-value	p-value
Intercept	-0.00027926	0.001160071	33	-0.2407272	8.11E-01
Year 1	0.019846026	0.012430142	30	1.5966049	1.21E-01
Poor People	-0.00931017	0.001144946	30	-8.1315352	4.46E-09
Unemployment Rate	1.001256674	0.000295931	30	3383.41485	2.73E-85

Year 1: Unemployment Rate	0.159227097	0.10265857	30	1.5510356	1.31E-01

	Variance	StdDev
(Intercept)	4.28E-05	0.006544028
Residual	2.89E-06	0.001699482

As can be seen from table 5 which ilustrates model 7, we know that the variable interaction between time (Year) and the Unemployment Rate does not have a significant influence but the p-value becomes smaller, this suggests that the model is getting better but not maximized. We can know that this variable has very little influence, meaning that changes in the unemployment rate each year do not have a large influence on the number of drug crime rates.

Furthermore, to develop further, we added 2 interaction variables, namely the interaction of time (year) with the poor population rate and the interaction between independent variables, namely the poor population rate and the unemployment rate. We wanted to find out whether the interaction between the poor and the unemployment rate had an influence on the drug crime rate. The next equation will be referred to as the Equation (8).

$$Y_{ij} = \beta_0 + \beta_1 t_j + \beta_2 X_1 + \beta_3 X_2 + \beta_4 t_j * X_1 + \beta_5 t_j * X_2 + \beta_6 (X_1 * X_2) + \alpha_i + \varepsilon_{ij}$$
$$\alpha_i \sim N(0, \sigma^2_{state}), \varepsilon_{ij} \sim N(0, \sigma^2_{res}) \quad (8)$$

Table 6. Model significance value results

model8 tTable

	value	Std.Error	DF	t-value	p-value
Intercept	0.089086944	2.85E-03	33	31.210763	4.48E-26
Year 1	-0.00402904	2.35E-03	28	-1.711183	9.81E-02
Poor People	-0.11583338	3.41E-03	28	-33.987484	2.61E-24
Unemployment Rate	1.744893018	2.29E-02	28	76.290824	4.98E-34
Year 1: Poor People	-0.00023798	7.72E-05	28	-3.084614	4.55E-03
Year1: Unemployment Rate	-0.03212425	1.94E-02	28	-1.654995	1.09E-01
Poor People : Unemployment Rate	-0.8763925	2.70E-02	28	-32.512842	8.78E-24

	Variance	StdDev
(Intercept)	2.00212E-05	0.004474501
Residual	8.28032E-08	0.000287756

Table 6 representing model 8 from the experiment, provides the interaction between the poor population and the unemployment rate, with a p-value of $8{,}78 * 10^{-24}$. This indicates that indeed both variables significantly influence the drug crime rate in each province.

With the addition of 2 interacting variables, it shows increasingly clear that the unemployment rate and the poor population rate are indeed very influential on the narcotics crime rate, even after interacting it still shows significant results with a p-value of $8{,}78009 * 10^{-24}$ and a value of -0.8763925007. Other interaction variables also have a significant influence, namely Time (Year) and unemployment rate which have a p-value of $4{,}551566 * 10^{-3}$ and a value of -0.0002379804. from

this we can know that only in this model the time variable (Year) has an influence, that is, after interacting with the poor population level. This means that when each variable is separated, it will not affect each other but after interaction, it will have an effect, meaning that changes in the poor population level each year have a major influence on the narcotics crime rate.

Next it repeats the same experiment but overrides the dependent variable. This is done to test other crime rates that are likely to be influenced by variables that have been collected. We replaced the variable narcotics crime rate with immoral crime rate.

After carrying out the same 9 models on the immoral crime rate, it turned out that none of the models that significantly affected the immoral crime rate were obtained. And will be represented by equation VII which displays all variables entered into the model.

$$Y_{ij} = \beta_0 + \beta_1 t_j + \beta_2 X_1 + \beta_3 X_2 + \beta_4 t_j * X_1 + \beta_5 t_j * X_2 + \beta_6 (X_1 * X_2) + \alpha_i + \varepsilon_{ij}$$
$$\alpha_i \sim N(0, \sigma^2_{state}), \varepsilon_{ij} \sim N(0, \sigma^2_{res}) \quad (9)$$

Table 7. Model significance value results

model17 tTable

	value	Std.Error	DF	t-value	p-value
Intercept	-0.00296011	0.110855144	33	-0.0267025	0.9788579
Year 1	-0.10312727	0.216471247	28	-0.4764017	0.6374849
Poor People	0.056604109	0.131797391	28	0.4294782	0.6708622
Unemployment Rate	-0.35615796	0.921115237	28	-0.3866595	0.7019313
Year 1: Poor People	-0.00529749	0.007574787	28	-0.6993585	0.4900975
Year 1: Unemployment Rate	-0.79768545	1.783670923	28	-0.4472156	0.6581599
Poor People: Unemployment Rate	0.418276222	1.085357532	28	0.385381	0.702867

	Variance	StdDev
(Intercept)	0.000676549	0.02601055
Residual	0.000823339	0.02869388

Table 7 displaying model 17, reveals that in all experiments regarding the indecent crime rate, none of the variables had a significant influence. This can be observed from the relatively large p-values, all of which are above 0.05 or greater than alpha.

This is due to the dissemination of non-extreme crime rate data between provincial random variables. Where the average approaches variance so that it is difficult to find differences. In addition, we can conclude that immoral crime is not influenced by time variables (years), unemployment rates, and poor population rates. immoral crime is most likely also influenced by other variables outside of our current research, so this can be a development in future research to find out what are the causes of immoral crime.

Next it repeats the same subsequent experiment but replaces the bound variable. This is done to test other crime rates that are likely to be influenced by variables that have been collected. We replace the next dependent variables which are fraud, embezzlement, and corruption.

The models that influence the results of modeling on fraud crime, embezzlement, and corruption rates have 3 significant models. Equation (9) shows significant results on time variables (Years) and the interaction between time (Years) and the unemployment rate. But while the time

variable alone does not produce a significant model, it shows that changes in the unemployment rate each year will have significant results in the crime rate of fraud, embezzlement, and corruption.

$$Y_{ij} = \beta_0 + \beta_1 t_j + \beta_3 X_4 + \beta_1 t_j * X_4 + \alpha_i + \varepsilon_{ij}$$
$$\alpha_i \sim N(0, \sigma^2_{state}), \varepsilon_{ij} \sim N(0, \sigma^2_{res}) \quad (10)$$

Table 8. Model significance value results

model23 tTable

	value	Std.Error	DF	t-value	p-value
Intercept	0.0421901	0.16371364	33	0.2577067	0.79823362
Year 1	6.78133118	1.95173464	31	3.474515	0.00153423
Unemployment Rate	-0.01407263	0.04651575	31	-0.3025348	0.76426513
Year 1: Unemployment Rate	56.6795619	16.11873427	31	3.516378	0.00137145

	Variance	StdDev
(Intercept)	8.38E-01	0.9153364
Residual	7.24E-02	0.2689854

Table 8 displays model 23, indicating that the year variable has a significant level of 0.00153423, but the unemployment rate does not. However, after being interacted, both the year and the unemployment rate have a significant influence on the fraud, embezzlement, and corruption crime rate, namely at 0. 001371451.

It is found that the independent variable of the unemployment rate does not have a significant effect but after interacting with time (Year) will have a significant impact on the crime rate of fraud, embezzlement, and corruption. This shows that changes in the Unemployment Rate each year show a more significant impact on fraud, embezzlement and corruption. With a p-value of 0.001371451 and a value of 56.67956190. This is a huge value and shows how increasing Fraud, Embezzlement, and Corruption are growing every year.

Continuing the investigation, the next influential model was the IX model, but this model was similar to Equation (10) and had similar results, the addition of the poor population level variable did not greatly affect other variables. And even making the variance even greater, meaning that the poor really do not affect the crime rate of fraud, unemployment, and corruption.

$$Y_{ij} = \beta_0 + \beta_1 t_j + \beta_2 X_1 + \beta_3 X_2 + \beta_1 t_j * X_1 + \alpha_i + \varepsilon_{ij}$$
$$\alpha_i \sim N(0, \sigma^2_{state}), \varepsilon_{ij} \sim N(0, \sigma^2_{res}) \quad (11)$$

Continuing the investigation, the next influential model was model 26, but this model is similar to Equation (11) and Equation (10) and has similar results, the addition of the interaction variable between time (years) and poor people does not really affect other variables. but making the variance smaller, meaning that the interaction of time (Years) with the Poor has little influence on the Crime Rate, Fraud, Embezzlement, and Corruption. Likewise, the addition of variables of interaction between the Poor and the Unemployment Rate.

(12)

$$Y_{ij} = \beta_0 + \beta_1 t_j + \beta_2 X_1 + \beta_3 X_2 + \beta_4 t_j * X_1 + \beta_5 t_j * X_2 + \beta_6 (X_1 * X_2) + \alpha_i + \varepsilon_{ij}$$
$$\alpha_i \sim N(0, \sigma^2_{state}), \varepsilon_{ij} \sim N(0, \sigma^2_{res})$$

Table 9. Model significance value results

model25 tTable

	value	Std.Error	DF	t-value	p-value
Intercept	0.04216446	0.16516986	33	0.2552794	0.80009171
Year 1	6.63705713	1.95638098	30	3.3925177	0.00196183
Poor People	-0.1174552	0.16277265	30	-0.7215905	0.47613305
Unemployment Rate	-0.01193702	0.04654815	30	-0.2564447	0.79935797
Year 1: Unemployment Rate	55.48809088	16.15717592	30	3.4342692	0.0017575

	Variance	StdDev
(Intercept)	0.8544251	0.9243512
Residual	0.07205559	0.2684317

Table 10, which represents model 26, indicates that the addition of the interaction variable between the poor population and the unemployment rate resulted in non-significant values based on the p-value. Furthermore, it did not significantly alter the magnitude of the year variable, with values almost identical to those before the addition. Similarly, the interaction variable between the year and the unemployment rate showed nearly identical values. This suggests that the poor population has no influence on fraud, embezzlement, and corruption.

Table 10. Model significance value results

model26 tTable

	value	Std.Error	DF	t-value	p-value
Intercept	2.974257	2.0479445	33	1.4523131	0.15585713
Year 1	5.868295	2.2913314	28	2.5610851	0.01611145
Poor People	-3.598976	2.4354529	28	-1.477744	0.15063754
Unemployment Rate	24.388832	16.9911358	28	1.4353856	0.16225479
Year 1: Poor People	-0.014833	0.0756626	28	-0.1960414	0.84599359
Year 1: Unemployment Rate	49.327944	18.8878512	28	2.6116228	0.0143215
Poor People : Unemployment Rate	-28.755726	20.0241483	28	-1.4360524	0.16206655

	Variance	StdDev
(Intercept)	0.7667503	0.8756428
Residual	0.080342	0.2834466

CONCLUSION

Based on the simulation results of all models that contain variables that have a significant effect on several crime rates, it can be concluded that the unemployment rate variable has a major effect on the crime unemployment rate with a positive coefficient value. It also explains that the unemployment rate has a positive effect on the narcotics crime rate. even after interacting with other variables, such as the interaction of the unemployment rate with time (Years) also produces a significant model.

For modeling looking for influences on the immoral crime rate did not get any significant results, meaning that these variables were not influenced by any of the influence variables that we have compiled. This is due to several factors, namely, the difference in immoral data that is not extreme and also the immoral crime rate is influenced by other variables.

For modeling looking for influence on crime rate fraud, embezzlement, and corruption only have influence by unemployment rate. Having the unemployment rate interacted with time (Time) also produces a significant model. But after adding other variables did not have a significant impact. This indicates that both the unemployment rate and the interaction of time (Year) with the unemployment rate have a very significant impact on the crime rate of fraud, embezzlement, and corruption.

This study involves an overview and explanation of the variables of Unemployment Rate and Poor Population Rate that affect several crime rates significantly. In addition, this study also provides an explanation that the interaction between these variables has a significant impact on the crime rate. In addition, this research can assist the government in the preparation of regulations and implementation related to follow-up on variables that can affect the crime rate to achieve community welfare from crime.

However, this study is limited to seeing and describing the effect of the unemployment rate and poor population rate on the crime rate of each province. In future research, it is hoped that further exploration of variables that have a significant effect on modeling the crime rate can be made and a more efficient method can be made in variable selection that can facilitate the selection of variables that have a significant effect on the model. In addition, it is expected that there will be further research that can produce products from the results of the analysis of the influence of variables on the crime rate and the poor population rate on the crime rate and can improve community welfare from crime.

AUTHOR CONTRIBUTIONS

Each author of this article played an important role in the process of method conceptualization, simulation, and article writing

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