Article

Criminality and Income Inequality in Indonesia

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Abstract: We investigate whether a nexus exists between income inequality and criminal activity in Indonesia. Additionally, we examine socioeconomic variables and potential links with criminal actions (i.e., crime rate, murder, rape, physical abuse, robbery, and fraud). We use the generalized method of moments (GMM) approach, employing data for 34 provinces in Indonesia over the period of 2010–2019. The results indicate that income inequality is associated with higher criminal activity. Overall, lower unemployment, larger investment (foreign and domestic), and higher human development (education and health) can help reduce crime in Indonesia. However, higher income can reduce physical abuse and crime rates, but theft and fraud increase with income growth. Rising unemployment increases rape, abuse, robbery, and fraud. Still, unemployment does not affect murder, suggesting that non-economic factors are dominant in explaining murder and violent crimes. Furthermore, income inequality can increase robbery and fraud, although it has no significant effects on murder, rape, and abuse. Government spending on social assistance and more efficient settlement of criminal acts can lower crime rates.

Keywords: crime rate; well-being; income inequality; quality education; human development; life expectancy

1. Introduction

This study examines the nexus between crime rates and aspects related to income inequality, economic activity, and human development in Indonesia. Additionally, we explore whether a nexus exists between crime and economic activity proxied by gross domestic income per capita, unemployment, domestic investment, foreign direct investment (FDI), and infrastructure development. Furthermore, we test whether criminal activity decreases with improvements in human development, measured by the Human Development Index (HDI) and sub-aspects of HDI related to life expectancy, length of schooling, and length of school expectancy.

An economic approach to studying criminal activity has provided important insights into the realm of crime (Wu and Wu 2012). Although crime, understood as a violation, omission, or action against the law, can originate from impulse, rage, mental stress, and other non-economic aspects, the literature suggests a link between crime and economic behavior (Barkan and Rocque 2018). The causes of crime are complex and diverse in dimensions, often explained from a social perspective (Coccia 2017; Lochner 2020), including via medical sociology, health inequalities (Phelan and Link 2015), economic aspects, and others.

Low income, inadequate education, and high unemployment are often associated with higher criminal activity. Braithwaite (1981) conducted studies on the link between social class and crime rates and found that criminality tends to be higher among less affluent

individuals in society. In line with the theory of fundamental causes in medical sociology, the socioeconomic status of individuals is proposed as a fundamental cause of criminal activity (Barkan and Rocque 2018).

Several studies have embarked on examining the link between income inequality and crime. Evidence somehow is mixed. Some studies have supported a positive relationship between income inequality in society and crime (Atems 2020; Choe 2008; Enamorado et al. 2016; Kim et al. 2020). Other studies have failed to provide evidence of the link (Neumayer 2005) or found only a weak relationship. How important the role of income inequality is in crime rates across countries remains an empirical question. Furthermore, earlier studies have often considered aggregate crime levels but not specific crime categories. Therefore, this study attempts to explore the nexus between income inequality and crime by type since different policies may be required for different types of crime.

We employ data for 2010 to 2019, covering 34 provinces in Indonesia. We use data on crime rates, published by Statistics Indonesia. We include criminal offences divided into murder, rape, violent crime, theft, and fraud. Moreover, we employ the Gini ratio estimated at the province level to measure income inequality. Besides income inequality, variables related to economic activity, i.e., income per capita, domestic investment, FDI, infrastructure investment, and unemployment, were utilized as indicators of the economic activity in the country. To observe the role of human development (often highlighted in the literature as an antidote to crime), we employ HDI and sub-components of HDI (e.g., life expectancy, the average length of schooling, and length of school expectancy). In addition, we employ square values for income per capita and FDI often applied to observe long-run effects and explore possible quadratic relations with crime.

This study uses the generalized method of moments (GMM) method to address potential unobserved heterogeneity and autocorrelation in the relationship between crime and socioeconomic aspects (Arellano and Bond 1991). Previous studies investigating the relationship between income inequality and criminality used the GMM approach (Choe 2008; Nguyen 2019), suggesting its capacity to handle unobserved heterogeneity.

This study focuses on the case of Indonesia as it offers a dynamic stage of economic development. Indonesia recorded an average rate of 5.4% growth in its GDP between 2010 and 2019, supported by increasing investment (domestic and foreign) and allocating a substantial share of public expenditure to infrastructure. Similarly, between 2010 and 2019, the average length of school increased from 8 to more than 11 years, and life expectancy increased from 69 to nearly 75 years, signaling a rise in individual quality of life. Furthermore, due to rapid economic growth and welfare programs, the country has lowered its poverty rate to a historical level below 10% (Muryani and Esquivias 2021). Nevertheless, income inequality in Indonesia has increased over time (Muryani et al. 2021; Nugraha et al. 2020; Tadjoeddin 2019; Widyastaman and Hartono 2021). Similarly, crime has increased in some provinces across the country, suggesting unequal distribution caused by increasing economic activity, leading to potential social resentment.

This study contributes to the body of literature by employing data at a lower level of aggregation (province) and on different types of criminal offences, providing new evidence on the inequality–crime nexus. Furthermore, we test whether the economic policy of the past decade in Indonesia (Nugraha et al. 2020; Tadjoeddin 2019; Yusuf and Sumner 2015), which aimed to develop infrastructure, foster a good investment climate and increase human capital, has helped to reduce crime. Finally, we test whether increasing expenditure on social assistance and improving the method of settling crime have an impact on criminal activity. As far as we are aware, no previous studies have explored the nexus between inequality and crime by type in the context of Indonesia.

2. Literature Review

Crime affects both developed (Kim et al. 2020) and developing regions (e.g., Latin America, Asia, and Africa). An increase in crime has forced countries to raise expenditure

on public security and order, causing inefficient usage of resources, both in the public and private sectors.

The literature on crime from the economic perspective includes Becker (1968), whose authors proposed a framework based on a cost-benefit analysis. The benefits relate to the difference between the risks and the opportunity cost of the criminal act as the potential punishment of detained criminals. Ehrlich (1973) argued that inequality induces crime as the returns from honest work are low compared to the expected benefits of effective crime. Several studies have empirically tested such a link between crime and income inequality. In that line, Imrohoroglu et al. (2004) noted that the increased standard deviation (proxy of income inequality) detected in earnings is positively associated with more individuals engaged in criminal activity. A more recent study Enamorado et al. (2016) found that a 1% rise in income inequality (Gini index) was related to >10 homicides (per 100,000 inhabitants) due to drugs in Mexico. In these and several empirical studies looking into the crime–inequality nexus, income distribution is often perceived as a determinant of crime (Imrohoroglu et al. 2004).

Another strand in the literature is related to the theory of fundamental causes within medical sociology. Social and economic aspects related to health issues help link economic–social disparity to criminal behavior (Barkan and Rocque 2018). Another strand of the literature is the so-called crime and place approach, in which inequality is measured at specific spatial areas and tested against crime incidents (Bernasco and Steenbeek 2017). Weisburd (2015) postulated that crime tends to be common and concentrated in micro spaces (identified areas of specific characteristics). For instance, estimating socioeconomic aspects at particular locations and linking them with crime activity can help us understand criminal patterns better.

Li et al. (2019) noted that income polarization could lead to social segregation and income immobility, potentially causing social tension, unrest, and conflict among individuals. Moreover, the literature has pointed out that preserving narrow income equality and welfare may help maintain social stability and cohesion (Li et al. 2019). In societies with rapid economic growth, we must identify whether those patterns of income growth can induce unequal distribution of wealth and unleash criminal activity. Numerous studies have found that development of public infrastructure, investment, and lower levels of unemployment increase income inequality in Indonesia (Muryani et al. 2021). Foreign investment and larger economic growth are mainly associated with larger disparities in welfare (Wicaksono et al. 2017). As such, wide income gaps can lead to more extensive violence and crime incidents in the country (Tadjoeddin 2019).

However, only a few earlier studies have looked into the link between crime incidents and income inequality in Indonesia (i.e., Widyastaman and Hartono 2021). For instance, Cameron and Shah (2014) studied whether income inequality and inclusion errors in the allocation of financial aid (mistargeting) can lead to social unrest and antisocial behavior (i.e., criminality). They found that both increasing income disparity and mistargeting lead to higher probabilities of crime. Meanwhile, Hendri and Muharja (2013) found a positive relationship between poverty and some types of crime in Indonesia (property crime and motor theft). However, they found no significant evidence of an inequality–crime link. Hardiawan et al. (2019) noted that improvements in socioeconomic aspects are positively associated with increasing crime rates. Moreover, Pierskalla and Sacks (2017) indicated that distributional differences in income and access to services are potential sources of violence in Indonesia. Higher levels of unequal income distribution were significant determinants of violence related to elections or justice, although no significant effect on crime was found. De Juan et al. (2015) also found that vertical and horizontal inequalities could be a source of violence in Indonesia. These studies are relevant considering that increasing welfare disparity in Indonesia could be associated with the rising levels of criminal activities and violence.

However, positive aspects of the role of socioeconomic variables in crime can also be highlighted from the literature. In a study on the role of green public spaces on crime,

Sukartini et al. (2021) found that providing green spaces in urban areas in Indonesia can reduce crime. Meanwhile, Pierskalla (2016) suggested that decentralization efforts that promoted more homogeneous ethnicity across districts and more efficient public administration have reduced violence in Indonesia. Similarly, Pierskalla and Sacks (2017) pointed out that improvements in service deliveries help reduce crime. Nguyen (2019) found positive evidence on increasing levels of education, which have helped lower crime incidence in Indonesia, although education's role in reducing crime is weakened by poverty.

Numerous studies have found positive evidence on the role of development in reducing crime. For example, education has been found to help reduce crime, both in developed countries, such as the United States (Bell et al. 2016) and Sweden (Hjalmarsson et al. 2015), and in developing countries, such as Chile (Berthelon and Kruger 2011) and Indonesia (Nguyen 2019). Longer years of compulsory education and longer school hours can be channels via which education lowers crime (Bell et al. 2016; Berthelon and Kruger 2011). Besides, higher levels of schooling offer wider labor opportunities and increase the income level (Muryani et al. 2021). Bell et al. (2016) suggested that higher levels of education may increase citizens' aversion toward criminal activity and raise the opportunity cost of unlawful activities by increasing potential earnings from legitimate activities.

However, important gaps exist in the literature in the context of Indonesia. First, numerous studies have shown that improvements in Indonesia's economic conditions can lead to increasing income disparities. Tadjoeddin (2019) noted that relative deprivation in Indonesia, a situation in which some individuals improve whereas others do not, can represent the micro-source of conflict. As such, the unequal distribution of resources derived from "economic progress" can lead to a rise in criminal acts, as postulated under the fundamental causes of crime (Barkan and Rocque 2018). Second, as economic activity differs across regions in Indonesia, disaggregated data must be provided rather than the national-level data. For instance, using data at the province level could help us observe the dynamics across regions. Third, evidence on the impact of unequal distribution across different kinds of criminal acts remains vague in Indonesia. Studies on other regions determined that some crimes have stronger links to inequality than others (Choe 2008; Pierskalla 2016). Similarly, the role of economic variables and human capital can play a different role in mitigating crime across illicit types of actions (some actions are more prominent than others). Hence, distinguishing the impacts for policy implications is worthwhile.

Although Indonesia has made impressive progress in economic growth, increasing the levels of education, improving infrastructure, lowering poverty, attracting larger inflows of investment, and reducing unemployment and poverty, such aspects are related to higher levels of income inequality in the country (Muryani et al. 2021; Wicaksono et al. 2017). In that line, Campaniello et al. (2016) suggested that larger income associated with higher levels of development (e.g., education) can increase criminal activity by creating higher returns on crime. The evidence on whether improvements in socioeconomic aspects have a significant impact on crime remains open to empirical evidence, and effects can either be positive or negative toward crime.

Crime in Indonesia; Background

In recent times, the number of crimes reported by the Police Registration Data in Indonesia decreased by nearly 15% from 2018 to 2020. The crime rate also decreased by nearly 9% in the same period. The percentage of the population as victims of crime also fell from 1.01% in 2019 to 0.78% in 2020. Compared to other countries, the intentional homicides per 100,000 people in Indonesia in 2017 stood at 0.435, lower than those in neighboring countries such as Thailand (2.6), the Philippines (6.465), and Malaysia (2.129 in 2013). The rate of persons held in prison per 100,000 individuals was 91.9 in 2018, half the rate in Malaysia (188) and 20% less than the rate in Thailand (527). Vietnam reported 135, 32% higher than the rate in Indonesia.

Nevertheless, the figures for crime in Indonesia are surprising, considering the low number of police officers per individual (161 per 100,000 inhabitants), nearly half the figures

in Thailand as cited by Nguyen (2019). The number of prisoners in Indonesia reached nearly 275,000 in 2021. Although the number was lower than that in other countries in percentage terms, Indonesia has the 8th largest number of prisoners in the world. Crime cases reported remain low (no more than 25%). Similarly, as noted in Transparency International's 2020 report, the corruption perception index has deteriorated over time, with the police and the judiciary system as two units perceived as highly corrupt. Indonesia reported low crime cases compared to many developing countries or even developed countries.

Literature on crime in Indonesia has pointed out several efforts that might have helped reduce criminal activity. First, decentralization efforts starting in 1999 transferred political and administrative powers to a local level. Higher administrative power at local level is associated with lower crime rates (Pierskalla and Sacks 2017). Local governments have increasing roles in public education, health care, security, infrastructure, and other public services (Pierskalla and Sacks 2017), which may increase the effectiveness of social programs and raise welfare. Second, on top of decentralization efforts, the local government units increased, from nearly 290 in 1999 to 514 in 2021 (416 districts and 98 cities). Although new boundaries and more government units can have positive effects on public administration, the risk of polarization in society has also been increased (Bazzi and Clemens 2013), (political, ethical, and religious). Third, the creation of new police units and reorganization of police forces (Nurmandi et al. 2016) might result in a more effective police institution. Fourth, social programs and government aid have increased (Sugiharti et al. 2022) in the form of cash transfers, food aid, social health system, energy subsidies, among others, which may help reduce crime. Still, evidence on the effects of individual and community aid on crime remains mixed (Cameron and Shah 2014).

There were increases in cybercrime (Suryono et al. 2021; Prabowo 2012), ethnoreligious violence (De Juan et al. 2015; Diprose and Azca 2019), terrorism, organized crime, and drug-related crime (Kramer and Stoicescu 2021) in Indonesia, posing a great challenge to the country. A number of reforms to the criminal law have been proposed in an effort to facilitate crime and violence control. As noted in Nurmandi et al. (2016), for the past two decades, the police force in Indonesia has embraced substantial reforms in its structure, legal framework, and culture. Structurally, in 1999 a police reform was initiated proposing independent structures between the police and the military. Several bodies have been established or reorganized since then to support anti-corruption efforts (KPK established in 2002), counter-terrorism actions (Diprose and Azca 2019), intelligence, cyber security (Suryono et al. 2021), drugs control, and others. Similarly, a number of amendments to the constitution have been passed, together with revisions of laws and regulations to strengthen the police functions. Culturally, the police have also embraced change by reformulating ethical codes and redefining roles (e.g., away from politics, feudalism, bureaucratization, and militarization).

3. Methodology

This study employs Arellano and Bond's GMM (Arellano and Bond 1991) to estimate the relationship between crime and the subset of the proposed independent variables (e.g., income inequality, economic variables, and development variables). The empirical approach to estimate the link between income inequality and crime in a province is measured by crime rates, as reported by Statistics Indonesia. The following model (1) is used to estimate the impact of income inequality on crime, considered as our based model:

$$\text{CRIME}_{it} = \alpha_0 + \quad \beta_1 \text{CRIME}_{i,t-1} + \beta_2 \ln\text{GRDP}_{it} + \beta_3 \text{UN}_{it} + \beta_4 \text{GINI}_{it} + \beta_5 \ln\text{HDI}_{it} \\ + \varepsilon_i + \Delta u_{it} \tag{1}$$

where i represent the province and t denotes the year. CRIME_{it} represents the incidence of crime per 100,000 people to proxy the total criminality rate. GRDP indicates the gross regional domestic product of each province i at year t, UN captures the unemployment rate. As a proxy for income inequality, the Gini index (GINI) coefficient estimated in each

province i at every year t is employed. We also include the Human Development Index (HDI) to test whether human capital development plays a significant role in crime (Table 1).

Table 1. Description of variables (annual data at province level).

Variables		Description
CRIME	Criminality	Crime rate per 100,000 people in a province.
	Murder	The total number of crimes against life.
	Rape	Total crimes (sexual violence) including rape and sexual abuse.
	Physical Abuse	Crimes of physical abuse including severe abuse (serious injuries) and light abuse (minor injuries).
	Robbery	Total number of crimes against property rights includes robbery, robbery with violence, theft with firearms, severe robbery, and motor vehicle robbery.
	Fraud	The number of crimes related to fraud or fraudulent acts.
GINI	Gini Ratio	The Gini coefficient ranges from 0 to 1. If the Gini coefficient is 0, it means perfect equality; 1 indicates perfect inequality.
GRDP	Gross Regional Domestic Product per Capita	Gross regional domestic product per capita at constant prices (2010).
FDI	Foreign Direct Investment	Annual foreign direct investment realization.
DI	Domestic Investment	Annual domestic investment realization.
UN	Unemployment Rate	The annual open unemployment rate—percentage of the total unemployed against the total labor force.
INFRA	Infrastructure Spending	Regional government infrastructure spending originating from the annual regional revenue and expenditure budget.
HDI	Human Development Index	HDI has a range of 0–100. From lowest 0 to highest 100.
LE	Life Expectancy	Life expectancy after birth.
ALS	Average Length of Schooling	Average length of schooling.
LSE	Length of School Expectancy	Expected length of schooling.
SSA	Spending on Social Assistance	Realization of government spending on social assistance in each province.
SCA	Settlement of Criminal Acts	Percentage of criminal acts settled in each province.

We further develop our based model (Model 1 in Equation (1)) and incorporate variables related to physical investment; FDI indicates Foreign Direct Investment inflows, DI denotes domestic investment, and INFRA is the expenditure on public infrastructure (Model 2).

$$\begin{aligned}\text{CRIME}_{it} = \alpha_0 + \quad &\beta_1\text{CRIME}_{i,t-1} + \beta_2\ln\text{GRDP}_{it} + \beta_3\text{UN}_{it} + \beta_4\text{GINI}_{it} + \beta_5\ln\text{HDI}_{it} \\ &+ \beta_6\ln\text{INFRA}_{it} + \beta_7\ln\text{FDI}_{it} + \beta_8\ln\text{DI}_{it} + \varepsilon_i + \Delta u_{it}\end{aligned} \quad (2)$$

To figure out more detailed estimates on the role of human capital, we also proposed Model 3 and Model 4 (including physical capital variables) in which we test the subcomponents of HDI; life expectancy (LE), average length of schooling (ALS), and length of school expectancy (LSE). HDI in Equations (1) and (2) is substituted for the three subcomponents of HDI (LE, ALS, and LSE) as follows.

$$
\begin{aligned}
\text{CRIME}_{it} = \alpha_0 + \ &\beta_1 \text{CRIME}_{i,t-1} + \beta_2 \ln\text{GRDP}_{it} + \beta_3 \text{UN}_{it} + \beta_4 \text{GINI}_{it} + \beta_5 \ln\text{LE}_{it} \\
&+ \beta_6 \ln\text{ALS}_{it} + \beta_7 \ln\text{LSE}_{it} + \varepsilon_i + \Delta u_{it}
\end{aligned} \tag{3}
$$

$$
\begin{aligned}
\text{CRIME}_{it} = \alpha_0 + \ &\beta_1 \text{CRIME}_{i,t-1} + \beta_2 \ln\text{GRDP}_{it} + \beta_3 \text{UN}_{it} + \beta_4 \text{GINI}_{it} \\
&+ \beta_5 \ln\text{INFRA}_{it} + \beta_6 \ln\text{FDI}_{it} + \beta_7 \ln\text{DI}_{it} + \beta_8 \ln\text{LE}_{it} + \beta_9 \ln\text{ALS}_{it} \\
&+ \beta_{10} \ln\text{LSE}_{it} + \varepsilon_i + \Delta u_{it}
\end{aligned} \tag{4}
$$

Furthermore, to examine whether the impact of socio-specific aspects varies across types of crimes, this study employed five different types of criminal offences: murder, rape, physical abuse, robbery, and fraud. The dependent variable (CRIME) then takes the five different types of crime (separately). A simplified model (results display in a different table) is proposed as:

$$
\begin{aligned}
\text{CRIME}_{it} = \alpha_0 + \ &\beta_1 \text{CRIME}_{i,t-1} + \beta_2 \ln\text{GRDP}_{it} + \beta_3 \text{UN}_{it} + \beta_4 \text{GINI}_{it} \\
&+ \beta_5 \ln\text{INFRA}_{it} + \beta_6 \ln\text{FDI}_{it} + \beta_7 \ln\text{DI}_{it} + \beta_8 \ln\text{HDI}_{it} + \varepsilon_i \\
&+ \Delta u_{it}
\end{aligned} \tag{5}
$$

Table 1 presents the variables. The unobservable time-variant and time-invariant factors are captured in u_{it} and ε_i, respectively.

We transformed all variables in natural logarithms (ln) except for the UN (open unemployment rate) and GINI (Gini ratio). *GMM-DIFF* provides a value of the lagging dependent variable that is valid and produces consistent and efficient parameter estimates (Muryani et al. 2021). The GMM-DIFF estimator generates the first differential error term not correlated with the lagging rate variable. According to Arellano and Bond (1991), these lagging variables are valid instruments based on the moment condition known as orthogonality (no correlation with error term).

We selected the GMM method, considering the possible bilateral causal relationship between the Gini coefficient and the independent variables employed (i.e., economic growth, investment, and public expenditure on infrastructure), as the traditional GMM estimates can produce biased results (Wooldridge 2015). The independent variable (*CRIME*) may be related to unobservable variables that might affect both crime and inequality and the unobservable time-invariant factor (ε_i). Therefore, we adopt the GMM method of first-order difference to address potential endogeneity. Furthermore, we introduce the lag variable theoretically proposed as crime appears to be permanent across specific areas (Weisburd 2015) and might be related to the crime level in the past (Nguyen 2019). The dynamic regression equation is as follows:

$$
\begin{aligned}
\Delta\text{CRIME}_{it} = \alpha_0 + \ &\beta_1 \text{CRIME}_{i,t-1} + \beta_2 \Delta\ln\text{GRDP}_{it} + \beta_3 \Delta\text{UN}_{it} + \beta_4 \Delta\text{GINI}_{it} \\
&+ \beta_5 \Delta\ln\text{INFRA}_{it} + \beta_6 \Delta\ln\text{FDI}_{it} + \beta_7 \Delta\ln\text{DI}_{it} + \beta_8 \Delta\ln\text{LE}_{it} \\
&+ \beta_9 \Delta\ln\text{ALS}_{it} + \beta_{10} \Delta\ln\text{LSE}_{it} + \beta_{11} \Delta X_{it} + \Delta u_{it}
\end{aligned} \tag{6}
$$

where Δ denotes the first difference, and the other variables remain, as in Equations (1)–(5). The GMM approach can help solve the relationships raised by employing instrumental variables (IV) in which the lagged term of the dependent and independent variables are introduced as instruments. It satisfies two essential conditions: relevance and exclusion needed to avoid the endogeneity issue arising between the independent variable and the error term ($\Delta\text{CRIME}_{i,t-1}$ and $\Delta u_{i,t}$) when employing a dynamic model (Nguyen 2019). In this way, the instruments (IV) are used to treat the endogeneity problem. Similarly, the independent variables (i.e., Gini index) could suffer from endogeneity due to unobserved time-variant factors. The independent variables are also presented in the same way in-

struments were introduced for the dependent variable (CRIME). Furthermore, the GMM method of first-order differences could eliminate the transversal fixed effects that can affect the dependent variable when taking first-order differences by solving instrumental variables using a GMM (Equation (2)).

We additionally test the role of government spending on social assistance (SSA) and the role of settlement of criminal acts (SCA) on crime rates. We propose two simplified models as follows:

$$\begin{aligned} \text{CRIME}_{it} = \alpha_0 + \ &\beta_1\text{CRIME}_{i,t-1} + \beta_2\ln\text{GRDP}_{it} + \beta_3\text{UN}_{it} + \beta_4\text{GINI}_{it} + \beta_5\ln\text{HDI}_{it} \\ &+ \beta_6\ln\text{SCA}_{it} + \varepsilon_i + \Delta u_{it} \end{aligned} \tag{7}$$

$$\begin{aligned} \text{CRIME}_{it} = \alpha_0 + \ &\beta_1\text{CRIME}_{i,t-1} + \beta_2\ln\text{GRDP}_{it} + \beta_3\text{UN}_{it} + \beta_4\text{GINI}_{it} + \beta_5\ln\text{EE}_{it} \\ &+ \beta_6\ln\text{MYS}_{it} + \beta_7\ln\text{LE}_{it} + \beta_8\ln\text{SCA}_{it} + \varepsilon_i + \Delta u_{it} \end{aligned} \tag{8}$$

$$\begin{aligned} \text{CRIME}_{it} = \alpha_0 + \ &\beta_1\text{CRIME}_{i,t-1} + \beta_2\ln\text{GRDP}_{it} + \beta_3\text{UN}_{it} + \beta_4\text{GINI}_{it} + \beta_5\ln\text{HDI}_{it} \\ &+ \beta_6\ln\text{SSA}_{it} + \varepsilon_i + \Delta u_{it} \end{aligned} \tag{9}$$

$$\begin{aligned} \text{CRIME}_{it} = \alpha_0 + \ &\beta_1\text{CRIME}_{i,t-1} + \beta_2\ln\text{GRDP}_{it} + \beta_3\text{UN}_{it} + \beta_4\text{GINI}_{it} + \beta_5\ln\text{EE}_{it} \\ &+ \beta_6\ln\text{MYS}_{it} + \beta_7\ln\text{LE}_{it} + \beta_8\ln\text{SSA}_{it} + \varepsilon_i + \Delta u_{it} \end{aligned} \tag{10}$$

We also perform unit root tests to ensure that the variables used in this study do not have unit root problems (Table 2). The unit root test is performed using a panel data structure as it is more robust than the standard unit root test for individual time series. The heterogeneity arising from differences in conditions and degrees of development between regions makes the unit root panel test particularly important.

Table 2. Descriptive statistics.

Variables	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque–Bera
				CRIME Variables				
Crime Rate	179.07	169.00	496.00	14.00	85.27	0.38	2.90	7.35 **
Murder	40.25	26	224	1	39.14	1.75	6.18	261.37 ***
Rape	50.80	39	284	1	48.87	2.32	9.85	800.62 ***
Physical Abuse	1094.03	681	7277	5	1181.55	2.43	10.42	920.98 ***
Robbery	3503.96	2234	18,034	19	3484.59	1.91	6.58	319.92 ***
Fraud	835.62	471	6501	0	1052.20	2.97	13.69	1752.41 ***
				Control Variables				
GRDP	38,134.92	28,575.95	174,136.60	9675.89	29,973.94	2.48	8.87	690.94 ***
UN	5.38	4.96	13.74	1.4	2.04	0.82	3.62	35.96 ***
GINI	0.38	0.378	0.48	0.27	0.04	−0.20	2.51	4.61 *
INFRA	1428.14	833.6	29,036.30	138.30	2600.06	6.73	58.94	38,751.89 ***
FDI	856.46	390.9	7124.90	2.4	1271.39	2.48	9.35	760.92 ***
DI	6456.44	2876.50	62,094.80	1	10,106.06	2.80	11.42	1196.93 ***
ALS	8.04	8.00	11.06	5.60	1.00	0.38	3.29	8.03 **
LE	69.26	69.48	74.92	62.78	2.62	−0.08	2.64	1.87
LSE	12.52	12.52	15.58	8.92	0.95	−0.10	4.90	44.55 ***
SCA	57.01	55.58	109.41	6.28	17.25	0.02	3.19	0.43
SSA	199.19	54.21	4402.33	0.01	493.47	5.76	42.33	18,543.72 ***

Notes: * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

This study also used the Arellano–Bond serial correlation test to avoid autocorrelation problems. AR(1) and AR(2) are diagnostic tests for the accuracy of the estimates that have been generated (Arellano and Bond 1991).

4. Data

This study uses the crime rate as a proxy for crime across 34 provinces in Indonesia. The crime rate is measured as the number of crime cases per 100,000 people in a province. We employ a set of economic and development variables as independent variables (Table 1). Statistics Indonesia provides the data annually for 34 provinces. However, the availability of data limits the period covered in this study. The data covers all provinces in Indonesia (34 regions) from 2011 to 2019, except for Bengkulu (2012–2019), North Kalimantan (2018–2019), West Sulawesi (2017–2019), Maluku (2016–2019), and Papua (2017–2019) due to data limitations. This study uses unbalanced panel data.

The number of criminal actions and the level of risk exposure to crime (crime rate) are common indicators describing crime incidence and vulnerability. Criminal acts can be further grouped according to the seriousness and the targets: assault, burglary, corruption, crimes against public order, fraud, theft, kidnapping, murder, stealing, narcotics, property, rape, robbery, and violence.

In 2010–2019, the average crime rate in Indonesia was 179.07, which means that out of 100,000 people, 179 people were victims of crime. An increase in the crime rate indicates that the situation in society is increasingly unsafe. The highest incidence of crime in Indonesia occurred in 2016 (357,197 reported incidents), whereas the lowest number of criminal acts occurred in 2019 (269,324 incidents). Similarly, the crime rate was at its highest level in 2011 (149) and its lowest in 2019 (103). From 2010 to 2019, crimes against rights/property without violence recorded the highest crime rate (e.g., theft, motor vehicles, destruction of goods, and confiscation). Moreover, in 2010, the theft category had the highest number of criminal actions, 53,734, followed by motor vehicle theft (35,688), and fraud (29,365). Since 2014, crimes related to narcotics and psychotropic crimes have increased substantially, particularly in the Island of Java and some areas in Sumatra.

Among the 34 provinces in Indonesia, police data show that crime incidence fluctuated (2010–2019). In 2010, the Special Region of Yogyakarta experienced the largest criminal rate, whereas in 2011, North Sulawesi reported the highest crime rate. More recently (2019), the highest criminal activity was in West Papua, where 98.51% of crimes reported were conventional crimes, in the form of persecution, theft, fraud, embezzlement, domestic violence, murder, and others. Similarly, in 2010, the province with the lowest crime rate was South Kalimantan Province, and more recently (2019), it was Central Java. Since 2012, Central Java has been the safest province in Indonesia. In 2019, out of 100,000 residents in Central Java, only 30 people were at risk of being exposed to crime. The Central Java Regional Police has been active in reducing the crime rate, mainly related to theft, drugs, and gambling. In 2019, the total number of security posts in Central Java reached 75,753 posts. The extensive presence of security personnel and an active community approach may effectively reduce crime rates. Table 2 presents the descriptive statistics.

5. Results

This section describes the main findings based on several sub-models and data (See Table 2) proposed in the methodology section. In the different models, variables are incorporated gradually (Table 3). This can help validate the robustness of results and test different links between crime and social, economic, and policy variables. In the second part, we present the results of specific types of criminal offences. In the third part, we test the role of spending on social assistance and settlement of criminal cases as specific government intervention to reduce crime.

The variables, including a lag on the crime rate in the previous period, CRIME(−1), have consistently shown a positive and significant sign (Table 3), suggesting that an increase in the crime rate in the preceding period increases the likeliness of the crime rate in the current year (t). Such a relationship is commonly found in the literature (Choe 2008) and indicates the persistent effect of crime in society. Nguyen (2019) also determined that in Indonesia, the incidence of crime positively related to criminal activities from previous years.

Table 3. Estimation results of total crime.

	Model 1	Model 2	Model 3	Model 4
CRIME (−1)	0.2271 ***	−0.0397	−0.0466	−0.1438
	(0.0274)	(0.0386)	(0.0623)	(0.0980)
GRDP	-5.9×10^{-5} **	-1.6×10^{-5} **	-8.8×10^{-6}	-1.5×10^{-5}
	(2.6×10^{-6})	(6.8×10^{-6})	(1.2×10^{-5})	(1.6×10^{-5})
UN	0.0257 ***	0.0316 ***	0.0348 ***	0.0679 **
	(0.0045)	(0.0070)	(0.0132)	(0.0267)
GINI	0.6540 ***	0.4555 **	0.8121 **	0.7455 *
	(0.1814)	(0.1896)	(0.3379)	(0.4279)
HDI	−0.0422 ***	−0.0246 *		
	(0.0057)	(0.0138)		
INFRA		1.8×10^{-5} **		1.5×10^{-6}
		(7.8×10^{-6})		(8.1×10^{-6})
FDI		-6.6×10^{-5} ***		−0.0002 **
		(2.0×10^{-5})		(8.8×10^{-5})
DI		$-1. \times 10^{-5}$ ***		-4.5×10^{-6} *
		(1.9×10^{-6})		(2.8×10^{-6})
EE			0.1126	0.0852
			(0.0727)	(0.1117)
MYS			−0.3479 **	0.0290
			(0.1634)	(0.2491)
LE			−0.1505 ***	−0.3658 **
			(0.0523)	(0.1497)
AR (1)	0.0821	0.1716	0.1967	0.2593
AR (2)	0.1898	0.0664	0.1579	0.2194

Notes: * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$. The number in parentheses is the standard error values. AR (1) and AR (2) values are the probabilities of the autocorrelation test using the Arellano–Bond serial correlation test.

Moreover, the results show that an increase in income per capita (GRDP) could help reduce the crime rate. The higher the income per capita, the less the desire and need to commit a crime, or the higher the opportunity cost to engage in crime. As individuals are more well off, the likelihood of committing crime falls (Braithwaite 1981) because they have a greater opportunity to fulfill their needs without committing a crime. The negative link between income per capita and crime suggest that improvements in well-being are helpful to lower crime. Compared to earlier studies in Indonesia, Nguyen (2019) found that expenditure per capita is positively related to crime, suggesting that although GRDP at the province level may be negatively related to crime, personal income must be considered to obtain more detailed findings.

Meanwhile, the impact of unemployment (UN) on the crime rate is significant and positive (increase criminal activity). In the context of Indonesia, where unemployed people receive minimum assistance from the government, the difficulty of meeting basic needs may force some individuals to engage in criminal acts. In Indonesia, the most extensive illegal activity is related to stealing rather than other forms of crime (e.g., violent crime, murder, gunfire, or complex organizations). There was also a significant link between unemployment and crime in cases such as Mexico (de Hoyos et al. 2016). However, criminal activity was strongly linked to murder and violent activity. By contrast, in cases of advanced countries like England (Wu and Wu 2012) or the United States (Choe 2008), higher levels of unemployment are associated with lower crime, i.e., a higher opportunity cost associated with being criminal.

We employ the Gini ratio (GINI) to study the link between income inequality and crime. The results indicate that the GINI positively impacts the crime rate. An increase in the GINI means that income is unequally distributed, and such disparity in the distribution of wealth increases criminal activity in Indonesia. According to the relative deprivation theory, inequality can lead to social jealousy, envy, frustration, aggression, and other social reactions against better-off individuals. Unequal income distribution triggers a higher

crime as lower-income individuals may resort to crime (e.g., robbery, theft, stealing, larceny, and housebreak) moved by a desire to satisfy their feeling of injustice (Atems 2020). This is in line with the criminal behavior approach of Becker (1968), in which individuals facing lower returns (lower income growth) expect higher utility by pursuing illegal activities. As income gaps increase, criminality also rises. Our findings are in line with earlier studies in the context of the United States (Atems 2020; Choe 2008), Mexico (Enamorado et al. 2016; de Hoyos et al. 2016), England (Wu and Wu 2012), and Indonesia (Nguyen 2019), where increasing inequality has a significant impact on criminal activity.

Furthermore, this study finds a positive impact from infrastructure spending (*INFRA*) on the crime rate. In Indonesia, infrastructure development has been one of the main pillars of government action. However, the increasing levels of infrastructure development have a significant impact on petty crimes and organized crime. During Megawati's presidency, a plan to open a road in Leuser was proposed. Environmental activists protested against it as it would increase informal logging and reduce the area of protected forest where rare wild animals live. In Papua, traditional leaders from various ethnic groups in Jayapura have pointed out that an increase in serious crimes has accompanied the rise in development in Papua. Illegal logging increased significantly when transportation routes were built through protected forests. Additionally, land disputes arise because the land used for access points is considered customary land; thus, land grabs lead to conflicts that produce victims. Additionally, the infrastructure route that opened from the mountains to the cities also opened access to narcotics distribution to mountainous areas that were previously untouched by drugs.

On a different note, the impact of FDI and DI on the crime rate is negative. Increasing investment flows (FDI and DI) can increase employment, thus providing new opportunities for people to work. Moreover, larger investment and the creation of more active business activities can help lower crime, suggesting that in Indonesia, criminality could be tackled by creating more opportunities for people.

Meanwhile, the variable for HDI shows a negative impact on the crime rate. Increasing public health and education will support HDI and lower crime rates. Our results support earlier studies' finding that welfare programs help suppress crime (Rudolph and Starke 2020). Implementation of more generous social expenditure programs may help Indonesia lower the crime rate and lessen possible social tensions resulting from unequal economic growth.

We employ sub-components of the HDI, namely, education expectancy (EE), average education, and life expectancy, to test whether such sub-components could provide more precise links between human capital and crime. The results do not provide significant evidence on the effect of EE on crime. However, the results suggest that the community's average education (MYS—length of schooling) lowers the crime rate. A longer length of schooling indicates a higher education level and more employment opportunities, reducing the tendency to commit a crime. Our findings are in line with Nguyen (2019), who found that districts with higher levels of education in Indonesia experienced lower crime rates, with long years of education helping reduce criminality. For life expectancy (LE), the results suggest a negative effect on the crime rate. Longer LE is often a proxy for a healthy life, indicating that improvements in health can result in lower crime. Healthier individuals are in better shape to work and look for income, suggesting a lower tendency to engage in criminal activities.

5.1. Estimation Results from Specific Criminal Activities

Table 4 shows the estimation results from disaggregated criminal activities. The lagged variable for crime indicates that an increase in murder cases in the previous period by 1% can increase the current murder rate by 0.08%. Although murder cases have decreased nationally over the past three years, an increase in murders occurred in several provinces and specific years. Motives for murder in Indonesia are related to (1) psychological aggressiveness, commonly caused by the surrounding environment and upbringing; (2) sociology,

the process of social interaction increasing competition, and some degree of conflict; (3) media, by displaying a murder scene, potentially encouraging imitation.

Table 4. GMM estimation result by criminal activities.

Independent Variables	Coefficients									
	Murder		Rape		Persecution		Robbery		Fraud	
CRIME (−1)	0.080 **	−0.034	0.073	−0.057	0.039	−0.155 **	−0.336 ***	−0.315 ***	0.279 ***	0.198 ***
	(0.036)	(0.045)	(0.144)	(0.122)	(0.039)	(0.068)	(0.035)	(0.034)	(0.006)	(0.009)
GRDP	−0.966 *	2.527	0.035	1.837	−0.477 **	1.523	−2.331 ***	3.355 ***	0.877 ***	1.601 ***
	(0.519)	(1.762)	(0.686)	(1.407)	(0.206)	(1.119)	(0.522)	(1.020)	(0.143)	(0.524)
UN	−0.022	−0.027	0.179 **	−0.052	0.064 ***	0.059 *	0.057 **	0.116 **	0.038 ***	0.055 ***
	(0.025)	(0.032)	(0.077)	(0.038)	(0.013)	(0.035)	(0.023)	(0.052)	(0.008)	(0.015)
GINI	−0.514	−1.093	1.918	1.330	0.045	−1.107	3.692 ***	9.673 ***	2.934 ***	2.405 ***
	(0.713)	(1.076)	(1.431)	(1.005)	(0.237)	(1.069)	(1.305)	(2.095)	(0.499)	(0.590)
INFRA	−0.019	−0.194	−0.295 **	−0.577 ***	0.127 ***	0.212 *	0.704 ***	0.092	−0.036 **	0.059 *
	(0.122)	(0.143)	(0.129)	(0.189)	(0.039)	(0.122)	(0.098)	(0.069)	(0.015)	(0.033)
FDI	−0.077 ***	−0.063 *	0.030	−0.014	−0.047 ***	−0.056 *	−0.055 **	−0.055 *	−0.075 ***	−0.043
	(0.029)	(0.038)	(0.036)	(0.025)	(0.015)	(0.031)	(0.027)	(0.029)	(0.009)	(0.032)
DI	−0.112 ***	−0.131 ***	−0.026	−0.023 *	−0.062 ***	−0.101 ***	−0.111 ***	0.003	−0.077 ***	−0.071 ***
	(0.013)	(0.021)	(0.023)	(0.013)	(0.007)	(0.019)	(0.004)	(0.013)	(0.006)	(0.014)
LnHDI		−10.74 ***		−6.289 **		−6.508 ***		−8.452 ***		−3.563 ***
		(3.339)		(2.449)		(1.725)		(1.849)		(1.100)
	Probability									
AR (1)	0.21	0.51	0.06	0.15	0.06	0.31	0.07	0.15	0.99	0.82
AR (2)	0.74	0.93	0.41	0.99	0.09	0.07	0.21	0.44	0.99	0.53

Note: * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$. The number in brackets "()" is the standard error.

The increase in rape cases in the previous period did not affect the current rape cases. Cases of rape have shown periods of increase, although no pattern suggests a constant increase. The uncertainty in the number of rape cases is due to the silence of some victims caused by the societal stigma that rape is a shameful thing. Non-governmental organizations in 2016 conducted a survey that stated that of the total respondents surveyed, 90% of victims of rape crimes chose to remain silent and did not report to the police.

The lagged crime variable negatively affects physical abuse, suggesting a decreasing trend in physical abuse-related crimes. Physical abuse is the second most common crime category in Indonesia. Women and children dominate victims of physical abuse. The Coordinating Ministry for Human Development and Culture has reduced physical abuse cases by establishing call center services and building women- and child-friendly villages. Meanwhile, the Ministry of Women's Empowerment and Child Protection provides trauma prevention and recovery assistance for crime victims. Several domestic and international efforts (e.g., Australian partnership) have targeted reducing physical violence in the country.

The variable of lagged crime related to robbery also indicates a negative coefficient, highlighting a reduction of robbery crime. Robbery is the most common crime in Indonesia, so prevention efforts have been conducted for a long time. Along with technological advances, the Indonesian police have taken preventive efforts and implemented CCTV installation in public spaces. A pilot project has been conducted in East Java, where police have access to an extensive network of CCTV devices, facilitating the identification of criminal activity and immediate action against it.

For criminal activities related to fraud, the lagged variable indicates that a 1% increase in the number of fraud cases in the previous period is associated with a 0.19–0.27% increase in the current period (t). Fraud has reported an increasing activity in recent years, which is likely related to technological developments. Even though the government and police authorities have created cyber patrols to deal with crime, fraud is rampant in online-related activities. For example, in the case of credit card fraud, Prabowo (2012) stated that the practice of preventing credit card fraud in Indonesia is still low due to (1) lack of mechanisms for collecting, managing, and distributing fraud data; and (2) lack of effective and efficient identity management practices.

Increasing per capita income by 1% decreases murder crimes by 0.96%. Asongu and Acha-Anyi (2019) explained that regions with high per capita incomes tend to have low murder cases. In contrast, those with medium and low per capita incomes tend to have

relatively high murder cases. The increase in per capita income does not affect the number of rape crime cases. This finding is supported by Basu Roy and Ghosh Dastidar (2018), who determined that rape is not influenced by economic growth or per capita income. Still, rape is more affected by sociocultural conditions. Often rape is associated not with per capita income or poverty but by social structures and conditions.

An increase in income per capita of 1% will reduce cases of physical abuse by 0.47%. Our results support the findings of Vyas and Watts (2009), who stated that improved economic conditions impact the reduction of physical abuse, especially against women. Meanwhile, Uthman et al. (2009) also stated that an increase in wealth status reduces physical abuse.

By contrast, an increase in income per capita of 1% has a significant and positive impact on crimes related to robbery (1.82–3.35%) and fraud crimes (1.60%). This result is consistent with the data on theft and fraud reported in areas with high per capita income, such as DKI Jakarta, West Java, East Java, and North Sumatra. Hipp (2011) noted that robbery more often occurs in areas with high per capita incomes where higher heterogeneity between communities exists. As such, fraud tends to happen to a larger extent in regions with higher income per capita and urban areas (Raval 2021).

An increase in the unemployment rate does not affect murder cases. This result is in line with the findings of Saridakis and Spengler (2012). However, an increase in the unemployment rate by 1% is associated with an increase in rape cases by 0.17%; moreover, an increase in unemployment especially increases the number of rapes if young men dominate unemployment (Caruso 2015). This result is in line with the reported data where the number of unemployed people in the study period was dominated by men of productive age (15–24 years). Similarly, higher levels of unemployment are associated with increasing cases of physical abuse. The increase in unemployment leads to financial problems, so the pressure on the family rises, thus increasing the risk of physical abuse taking place (Anderberg et al. 2016).

In the case of robbery, an increase in the unemployment rate by 1% can increase the robbery cases by 0.11%. This result is in line with unemployment as it is more prevalent among younger people who are more inclined to fall into a robbery when facing a lack of jobs. Furthermore, Caruso (2015) explained that robbery could be strongly related to violence when younger people commit this crime.

Similarly, an increase in the unemployment rate raises the number of fraud cases. The rise in unemployment leads to poor economic conditions that encourage people in financial need to engage in fraud to obtain money (Yost and Croes 2016).

An increase in income inequality in Indonesia is associated with an increase in robbery cases and increased fraud crimes. This result is in line with (Rufrancos and Power 2013), who found that income inequality was highly related to property crimes, such as robbery and fraud. By contrast, an increase in income inequality does not affect the number of murders, rapes, and physical abuse crimes. Di Matteo and Petrunia (2021) investigated the impact of income inequality in various regions in Canada, finding mixed results across geography. As culture, social structures, and economic circumstances differ, positive, negative, or no effects can be expected across regions. In addition, Basu Roy and Ghosh Dastidar (2018) stated that income inequality does not affect violent crime (e.g., murder, rape, and physical abuse), as it is not directly related to income disparity of the population between regions. Sociological, medical, and cultural factors can be more predominant reasons for murder, rape, and physical abuse, rather than economic ones.

The increase in infrastructure spending does not significantly affect the number of murder and robbery crimes. However, an increase in infrastructure spending of 1% can reduce the number of rape cases by between 0.29% and 0.57%. In particular, infrastructure spending by provincial governments can increase infrastructure development, such as road construction, street lighting construction, and increased security (Manomano and Kang'ethe 2015), likely reducing rape. By contrast, an increase of 1% also increased the number of physical abuse cases and fraud. Physical abuse can occur

anywhere as it is more likely to be motivated by societal aspects (conflict among family or social groups). Therefore, infrastructure development does not guarantee fewer opportunities for physical abuse. For fraud crime, increasing technological developments and infrastructure seem to have supported the expansion of fraud. Local government spending on infrastructure must also be considered in crime prevention efforts, for example, by collaborating with the local police.

In general, FDI and DI harm the five types of crime under study. This means that increasing FDI and DI can reduce the number of crime cases in Indonesia. Moreover, FDI and DI can reduce the unemployment rate and promote economic activity (Anowor et al. 2019). Results at the aggregate (crime) and disaggregated level are strongly in line, suggesting that more investment is likely to promote Indonesia's economic welfare and social well-being.

Increased education is very influential in reducing crime in Indonesia. This result is supported by Nguyen (2019), who stated that an educated area is less prone to crime, and secondary and higher education plays a vital role in reducing crime in Indonesia. Education can make individuals more patient or risk-averse, which reduces the propensity to commit crimes (Lochner 2020).

5.2. Settlement of Criminal Acts and Spending on Social Assistance

We also tested the role of government spending on social assistance (SSA) programs and the role of settlement of criminal cases on crime. Provincial governments can use social assistance to ease the burden of spending on poor and vulnerable families. Social spending may reduce poverty rates and inequality, improve social cohesion, and refine the community's social behavior. Similarly, a more efficient system to settle criminal acts can help to discourage crime.

The results reported in Table 5 indicate that a higher settlement rate of criminal cases helps reduce the crime rate (columns 1 and 2). Improvements in the mechanism to solve cases, improvements in transparency, and more efficient administrative-related processes can increase the effectiveness of the authorities in solving crime cases. A higher settlement rate signals that the likelihood of criminals facing the law rises, increasing the opportunity cost of crime. Indonesian authorities should continue improving the mechanisms to effectively solve cases and discourage crime action. Furthermore, spending on social assistance programs (SSA in columns 3 to 6) effectively lowers criminal activities. From 2015 to 2019, the Indonesian government substantially increased the amount of social assistance to reduce economic and social gaps in society. We tested the role of SSA in provinces with the highest and lowest rate of crime. The results indicate that in both cases, social assistance effectively lowers crime, suggesting that regional governments should continue with social programs as an effort to reduce crime. However, the impact is more prominent in provinces with lower crime rates (column 6(B)) than those with higher crime rates (column 5(A)). Additional efforts may be needed for regions with higher crime rates, i.e., policing efforts to combat crime.

The results in Table 5 are also consistent with the main results in Table 3. The Gini variable, our proxy for income inequality, has a positive relationship with crime, signaling that higher income inequality raises the likelihood of crime. By contrast, improvements in the human development index (HDI), years of schooling and life expectancy can help lower criminal activity across provinces.

5.3. Discussion

Comparing our results to previous studies, we can provide the following comments.

First, the literature on criminal activity supports the persistent effect of crime in society (Choe 2008). Our results support the literature as well as earlier studies in Indonesia which found a similar relationship (Nguyen 2019). Second, we find evidence on the nexus between social class and criminality. Both the links between income and crime, and unemployment and crime, suggest that economic welfare is crucial for crime reduction in Indonesia. Our findings do not imply that individuals with lower income or unemployed people are

more likely to commit crimes, but the economic welfare of society is important to reduce crime, in line with the classical study of Braithwaite (1981). Similarly, we find evidence on other economic aspects related to domestic and foreign investment that have explanatory contributions to criminal activity in Indonesia. We then provide empirical evidence to the theory of fundamental causes (Barkan and Rocque 2018), supporting that socioeconomic aspects are important determinants of crime.

Table 5. Estimation results for settlement of criminal acts and spending on social assistance.

	(1)	(2)	(3)	(4)	(5) A	(6) B
CRIME(−1)	0.2032 ***	0.1320 ***	0.3036***	−0.0223	0.4958 *	−0.1654
	(0.0295)	(0.0262)	(0.0357)	(0.0393)	(0.2550)	(0.1383)
GRDP	0.1664	0.4407	0.3798	0.3084	1.6228	−3.7256
	(0.3550)	(0.2923)	(0.2467)	(0.2628)	(1.9251)	(3.1072)
UN	−0.0052	−0.0130	0.0043	−0.0152	0.0300	0.0014
	(0.0070)	(0.0118)	(0.0141)	(0.0232)	(0.0567)	(0.0476)
GINI	0.7626 ***	0.5010 **	1.0230 ***	0.9512 ***	0.9347	4.1730 ***
	(0.1877)	(0.2131)	(0.1744)	(0.1731)	(1.3538)	(0.8061)
HDI	−3.9916 ***		−4.3142 ***	−4.3142 ***	−5.7851	12.4775
	(1.4216)		(0.7309)	(0.7309)	(6.0974)	(11.040)
EE		0.0656		0.3547 ***		
		(0.0398)		(0.0737)		
MYS		−0.4223 ***		−1.0999 ***		
		(0.0572)		(0.1791)		
LE		−0.1335 ***		0.0681		
		(0.0451)		(0.0993)		
SCA	−0.0062 ***	−0.0036 ***				
	(0.0009)	(0.0009)				
SSA			−0.0110 **	−0.0104 ***	−0.0299 **	−0.0431 ***
			(0.0047)	(0.0023)	(0.0145)	(0.0138)
AR(1)	0.1092	0.0626	0.9991	0.1538	0.1115	0.8921
AR(2)	0.2215	0.2093	0.9997	0.3909	0.2495	0.9828

*, **, *** indicate the significance levels of 10%, 5%, and 1%. The number in brackets "()" is the standard error. The number in parentheses is the standard error value. AR (1) and AR (2) values are the probabilities of the autocorrelation test using the Arellano–Bond serial correlation test. Column (5)A includes the 17 provinces that rank highest in terms of crime. Column (5)B includes the 17 provinces that rank the lowest in terms of crime.

Third, we find evidence on the criminal behavior approach of Becker (1968) and Ehrlich (1973) that a larger income gap between individuals (proxied by Gini ratio) can increase criminality. Our results are also in line with the earlier empirical findings in the context of advanced countries (Atems 2020; Choe 2008), (Wu and Wu 2012), as well as developing countries (Enamorado et al. 2016; de Hoyos et al. 2016), (Imrohoroglu et al. 2004) including Indonesia (Cameron and Shah 2014; De Juan et al. 2015; Nguyen 2019). Our evidence suggests that government efforts to close the income gap are fundamental to social cohesion (lower crime). Fourth, we support the findings of Li et al. (2019) that income polarization could lead to social segregation, thus potentially increasing crime. Preserving narrow income equality, supported by increases in human capital (HDI, education, and health) may help to reduce crime, in line with studies in Indonesia (Nguyen 2019), and other regions (Bell et al. 2016), (Hjalmarsson et al. 2015), (Berthelon and Kruger 2011). We argue that government efforts to improve social cohesion (crime reduction) through an increase in social assistance are not effective. Similarly, improvements in the processing and settlement of crime cases can discourage criminal efforts. Finally, although socioeconomic aspects are fundamental to crime in Indonesia, they play a different role in mitigating crime across illicit types of actions.

It is worth noting some limitations of this study that could be addressed in future studies. First, it is crucial to consider the large extension of Indonesia in terms of its population (more than 270 million), land territory (more than 1.9 million square kilometres), geographical complexity (more than 17,000 islands), ethnic diversity (more than 1300 groups), racial mixture, and religious diversity. The large size and diversity of the country suggest that using data at a province level may not capture the entire heterogeneous effects on crime in

the country. Crime in itself is a complex reality, not to mention the complexity of Indonesia. However, no alternative data at a lower level of aggregation were found in terms of length of collection (periods) and reliability. Data provided at a lower level of aggregation (city or regency), either by Statistics Indonesia or the Police Statistics, present large omissions in the reported data and display inconsistency in the indicators. The Indonesia Family Life Survey, a longitudinal survey, stopped collecting data on crime due to lack of observation nearly 10 years ago. This limitation offers an empirical gap for future research.

Second, we looked at possible variables to capture government efforts to combat crime. Public data providing detail from the police are minimal, and the budget allocated for security and social programs is aggregated into different concepts, which makes it hard to identify. As an example, allocation of funds for social programs shifted radically from 2015 onwards, likely as a result of the change of government. While it is true that crime in Indonesia is low, it is also true that data on criminality and crime cases solved is minimal, suggesting that the government needs to increase efforts to collect and provide reliable data for further studies.

6. Conclusions

This study investigated whether a link between income inequality and criminal activity exists in Indonesia. Furthermore, we examined whether increasing economic income, lower unemployment, higher HDI, and more investment (foreign and domestic) were related to criminal activity in Indonesia. We employed data at the province level covering the period 2010–2019. A GMM-diff model was used, helping to capture persistence in criminal activity and control for possible endogeneity in the data.

The results at an aggregate level (province crime rate) suggest that crimes persist, as current levels of criminal actions are related to crime in previous periods. Moreover, income inequality positively correlates with crime, suggesting that unequal income distribution can aggravate criminal activity in Indonesia. Furthermore, increasing income per capita, lowering unemployment, increasing investment, and raising human development (including education and health) can reduce crime in Indonesia.

At a disaggregated level (specific criminal actions), the results suggest that criminal activities related differently to socioeconomic aspects. Persistency in crime is significant for murder and fraud, but it is negative for physical abuse and robbery. Government efforts have been more effective in reducing robbery in some regions. Moreover, higher income growth can help lower crime and abuse, however, the rate of theft and fraud increases as income rises. Higher unemployment can increase criminal activity in rape, abuse, robbery, and fraud, but not in murder, suggesting that non-economic factors play an important role in murders and violent crimes. For income inequality, a larger Gini ratio (unequal distribution) is associated with higher robbery and fraud, although it is not significant for murder, rape, and abuse. Investment in infrastructure also offers mixed results, lowering rape, but it may increase robbery and fraud crime.

Overall, improvements in human development, including length of schooling and health, can help lower crime at aggregate and disaggregate levels (specific crimes). Similarly, increasing foreign and domestic investments helps lower crime. As such, our results strongly suggest that human and physical investments are critical in reducing criminal activity in Indonesia. Recent policies from the national government targeting increasing levels of human and physical capital may then positively impact the reduction of criminal activity in Indonesia. Finally, we find that improving mechanisms for the settlement of criminal actions and raising spending on social assistance can reduce criminal activity in Indonesia.

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