The Effect of Increasing Temperature on Crime

ABSTRACT

Climate change is often associated with society's socioeconomic conditions, impacting people's welfare. On an ongoing basis, the level of interest will affect the crime rate in an area. This study aims to determine the effect of temperature changes on theft and abuse. The data used in this study are temperature data and data on theft and abuse. Besides that, this study also uses other data such as regional status, GRDP per capita, and village classification to test the model. This research uses the multiple linear regression method. The results obtained in this study showed that an increase in temperature impacted the theft and abuse that occurred in an area. Gradually increasing temperature reduces people's productivity, which will affect the level of people's welfare. The government's role is to handle this problem quickly and thoroughly. In addition, mitigating public interest due to the impact of climate change is an essential issue in maintaining the stability of the socioeconomic conditions of the community.

Keywords: Climate, Theft, Abuse, Multiple Linear Regression, Indonesia

INTRODUCTION

Crime is a social negative that must be eradicated so that the level of public safety can increase sustainably. However, in terms of economic factors, crime occurs because society's adequacy in their daily activities cannot improve their welfare. Crime in Indonesia is still rife; demands for necessities of life and environmental conditions drive an individual or group of people to commit criminal acts.

In aggregate, the crime rate in Indonesia has fluctuated, namely from 2015-2017, which consists of the number of crime incidents or criminal acts. National Police data shows the number of crime incidents (total crime) in 2015 was 352,936 cases, increased to 357,197 cases in 2016 and decreased in 2017 to 336,652 cases. Several studies reveal climate variability and change's substantial and significant impact on both violent conflict and crime[1].

Climate change is often associated with society's socioeconomic conditions, which impacts people's welfare[2]. On an ongoing basis, the level of interest will affect the crime rate in an area. Someone will try their best to meet the basic needs of life, such as food, clothing, and shelter. Someone often justifies any means to get the necessities of life[3].

Areas with minimal resources will depend on the primary business sector, such as agriculture. The agricultural industry tends to rely on the climate. Low or extreme rainfall will trigger crop failure. The crop failure that occurs will disrupt the socioeconomic conditions of the community. This condition will activate unemployment, school enrollment, and public health and not infrequently cause criminal acts in society.

Climate change will encourage crime by increasing tensions, reducing social control, weakening social support, and cultivating traits conducive to crime. High temperatures and low rainfall are considered easier to trigger one's emotions, so it can cause conflict between individuals[4]. The hot temperature is deemed to be able to ignite the fire of commotion in the community quickly. This relates to a person's psychological reaction. Increased body temperature due to hot weather results in increased heart rate, testosterone, and metabolic reactions that can trigger the sympathetic nervous system and 'activate' the fight-or-flight response, making a person tend to fight[4], [5].

For violent conflict, a global study compiling findings from 10,000 BC to the present found a correlation between climate and conflict. Climate change towards warmer temperatures or more extreme rainfall increased the frequency of interpersonal violence by 4% and intergroup conflict by 14%. Another study examined the potential impact of global climate change on armed conflict in sub-Saharan Africa and found that temperature variations were strongly associated with conflict incidents over historical periods, with a one °C increase in temperature causing a 4.5% increase in the civilian population. As for violent crimes, Field[6]shows the impact of temperature on violent crime based on forty years of annual, twenty years of quarterly data and ten years of monthly data for reportable crimes in England and Wales. Cohn[7]found that most violent crimes against people were linearly correlated with heat. Mares dan Moffett[8]showed that each degree Celsius increase in annual temperature was associated with an average rise in the homicide of nearly 6%.

Based on the background above, it is known that climate influences a person's emotional condition. This research will examine the impact of the environment on the socioeconomic conditions of society, as measured by regional crime. This study uses microdata at the village level to obtain more representative results. The results of this study imply that climate change has a positive impact on regional crime.

DATA AND METHODOLOGY

The data used in this study are temperature data sourced from the Meteorology, Climatology and Geophysics Agency, as well as data on theft and abuse originating from the 2018 Village Potential data collection (PODES) carried out by the Central Statistics Agency (BPS). In addition to criminal data, this study also uses other data such as regional status, GRDP per capita, and village classification. The model to be built in this study is as follows:

$$Theft = \alpha + + \beta_i X_{temperture} + \beta_i X_{city} + \beta_i X_{grdp\ percapita} + \beta_i X_{island} + \varepsilon$$

$$Persecution = \alpha + + \beta_i X_{temperture} + \beta_i X_{city} + \beta_i X_{grdp\ percapita} + \beta_i X_{island} + \varepsilon$$

This research uses the multiple linear regression method. This study uses several control variables to determine the strength of the model formed. A good model will have the same direction and coefficient significance.

RESULTS AND DISCUSSION

Based on the results of the regression calculation, it is known that an increase in temperature impacts an increase in theft. As an illustration, an area where most of the population is farmers would expect good rainfall conditions. If frequent crop failures occur due to high-temperature conditions, the affected people will try to get money to meet their basic needs. This condition is often done by justifying any means. This phenomenon causes theft to increase. In urban areas, relatively few acts of theft. This is because urban areas tend to find it easier to find alternative jobs. In addition, relatively few residents of urban areas are engaged in the agricultural sector, so the impact of climate change is not significant.

Regions that have good economic conditions, one of which will be characterized by a relatively high per capita GRDP value. The higher the value of GRDP per capita will reduce theft in the local area. The good economic condition of the community is often associated with criminal acts that occur in the local area. Regions with a good economy indicate that the community can meet the basic needs of life, so that criminal acts can be minimized because there is no encouragement due to the community's economic conditions.

Table 1. Effect of Temperature on Theft in Indonesia

Variables	Indonesia		
	Model 1	**Model 2**	**Model 3**
Temperature	0.019**	0.016**	0.017**
	(0.008)	(0.008)	(0.008)
City		-0.182***	-0.167***
		(0.018)	(0.019)
GRDP percapita			-0.043**
			(0.020)
Constant	0.710***	0.821***	0.803***
	(0.221)	(0.221)	(0.221)
Observations	13,027	13,027	13,027
R-squared	0.000	0.006	0.007

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Based on table 1 it is known that temperature consistently has a positive coefficient of 0.019 (model 1), 0.016, and (model 2), and 0.017 (model 3). The urban area variable consistently has a negative variable of -0.182 (model 2) and 0.167 (model 3). Meanwhile, GRDP per capita has a negative coefficient of -0.043. Each model is added gradually influencing variables so that the strength of the model can be known.

Based on the islands in Indonesia, the islands of Bali and Nusa Tenggara are the islands that have the highest and most significant temperature coefficients. The islands of Bali and Nusa Tenggara are islands that are still heavily dependent on the agricultural sector. So that climate change is very influential on the farming sector because plant growth and productivity are vulnerable to climate change. The impacts of climate change, such as increasing air temperature, changes in rain patterns, and extreme climates, hurt crop production systems.

Table 2. Influence of Theft by Island in Indonesia

Variables	Sumatera	Jawa	Bali and Nusa Tenggara	Kalimantan	Sulawesi	Maluku and Papua
Temperature	0.109***	-0.006	1.351***	0.246	0.097	-0.588**
	(0.036)	(0.009)	(0.522)	(0.198)	(0.094)	(0.232)
City	-0.159***	-0.100***	-0.316***	-0.174**	-0.070	-0.142**
	(0.034)	(0.031)	(0.077)	(0.075)	(0.060)	(0.065)
GRDP percapita	-0.083**	-0.081**	-0.164*	0.063	-0.123**	0.049
	(0.033)	(0.033)	(0.098)	(0.088)	(0.061)	(0.070)
Constant	-1.653*	1.307***	-36.042**	-5.456	-1.343	17.407***
	(0.972)	(0.230)	(14.448)	(5.410)	(2.582)	(6.364)
Observations	3,718	3,750	1,110	1,089	1,994	1,366
R-squared	0.012	0.005	0.026	0.007	0.006	0.007

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Similar to the case of theft, the temperature has a positive and significant influence on acts of persecution. In urban areas, acts of persecution tend to be more than in rural areas, and the availability of alternative jobs in urban areas causes this phenomenon. In general, the regression results on maltreatment are the same as theft, both in the direction of the coefficient and significance. Theft and abuse are two types of criminal acts that can harm society. Theft has the impact of losing a person's/institution's valuables, while the object of abuse tends to be humans. Persecution can be in the form of physical or non-physical violence, such as words. Both of these actions have criminal sanctions in the eyes of the law when there are people who commit them.

Table 3. The Influence of Temperature on Persecution in Indonesia

Variables	Indonesia		
	Model 1	Model 2	Model 3
Temperature	0.009***	0.009***	0.009***
	(0.003)	(0.003)	(0.003)
City		-0.014*	-0.014*
		(0.008)	(0.008)
GRDP percapita			0.000
			(0.008)
Constant	-0.164**	-0.155**	-0.155**
	(0.069)	(0.068)	(0.068)
Observations	13,027	13,027	13,027
R-squared	0.000	0.001	0.001

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Based on table 3 it is known that temperature consistently has a positive coefficient of 0.009 (models 1, 2 and 3). The urban area variable consistently has a negative variable of -0.014 (models 2 and 3). Meanwhile, GRDP per capita has a coefficient of 0.000 but not significant (model 3). Each model is added gradually influencing variables so that the strength of the model can be known.

Based on the classification of islands in Indonesia, the following is the effect of temperature on cases of persecution:

Table 4. Effect of Temperature on Persecution by Island in Indonesia

Uraian	Sumatera	Jawa	Bali and Nusa Tenggara	Kalimantan	Sulawesi	Maluku and Papua
Temperature	-0.023*	0.007***	0.018	-0.049	-0.015	0.377***
	(0.013)	(0.003)	(0.220)	(0.072)	(0.039)	(0.121)
City	-0.000	0.005	0.045	-0.023	-0.006	-0.042
	(0.011)	(0.013)	(0.040)	(0.026)	(0.022)	(0.041)
GRDP percapita	-0.005	0.000	-0.022	0.008	-0.008	-0.023
	(0.010)	(0.015)	(0.048)	(0.032)	(0.023)	(0.046)
Constant	0.690*	-0.140*	-0.385	1.404	0.527	-10.154***
	(0.364)	(0.072)	(6.117)	(1.966)	(1.056)	(3.292)
Observations	3,718	3,750	1,110	1,089	1,994	1,366
R-squared	0.001	0.001	0.001	0.002	0.000	0.008

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In line with Shen's[9]study, there is a strong positive linear relationship between temperature and violent Robbery, assault, and rape. Especially at temperature-rape up to 0.883. However, there is no linear temperature-robbery relationship which means that for every one °C increase, there will be a 0.38 increase in violent robbery incidents per million people per month. Meanwhile, strong correlations were also found with seasonal temperature values, relative humidity and crime rates which can be interpreted by RA Theory[10].According to RA Theory, higher but not extreme temperatures and relative humidity tend to increase mobility and social interaction, increasing the likelihood of environmental suitability.

Targets that occur and therefore more crime possibilities. According to the Crime Pattern Theory, crime is not random but planned or opportunistic, and it occurs when the victim's or target's activity space intersects with the perpetrator's. Under higher but less extreme temperatures and relative humidity, outdoor activity is usually more frequent, and intersecting activity spaces may attract more perpetrators and victims and thus lead to more crimes. A positive correlation between seasonal temperature (and relative humidity) and crime rates is expected. Seasonal fog was also a significant predictor of violent burglary and rape, with R values of 0.24 and 0.327, respectively. And for violent Robbery and rape, the significance is lower than 0.05. The correlation between haze and violent Robbery and the correlation between moisture and rape was negative[9].

Human discomfort and therefore, can lead to crime. However, these theories cannot always explain the relationship between temperature and violent crime. Some research results show a less significant relationship between robbery temperature and violence. This is consistent with our recent study examining the differences between Robbery and violence in Beijing, China. When human discomfort is beyond a threshold where the criminal's motivation to escape from an uncomfortable situation exceeds the reason to be aggressive, violent Robbery will no longer increase or even decrease with increasing heat stress. So influenced by opportunity, target, guardian, and human convenience, the relationship between Robbery and violence and temperature is more complex and less significant than the relationship between Robbery and violence and temperature[11].
In summary, the correlation between several types of property and violent crime and temperature is good due to seasonality in the crime and temperature data, which can be reasonably explained by The Routine Activity (RA) theory[10]. This is not to say that heat stress doesn't play a role. Even within the RA framework, the occurrence or absence of a crime is closely related to the perpetrator's motivation and incentives. In some cases, individual-level motivations and incentives may have little to do with temperature (and other climate variables). Still, in other cases, they may be affected by temperature (and other climate variables) due to e.g. human discomfort.

Mitigation is needed as an antidote to the occurrence of criminal acts. The economic conditions of society often cause the emergence of crime. During global climate change, the government should prevent crop failures, especially in rural communities that depend heavily on their agricultural sector income. Through reasonable assistance, it is hoped that the community can maintain productivity so that it has an impact on welfare.

CONCLUSION

Crime has a variety of negative impacts on society. Crime is often associated with education, economics, and psychological conditions. In this study, it is known that economic factors triggered by temperature conditions hurt an area. Poor handling and mitigation of criminal acts can exacerbate the comfort of the community. The government's role is to handle this problem quickly and thoroughly. In addition, mitigating public welfare due to the impact of climate change is an essential issue in maintaining the stability of the socioeconomic conditions of the community.

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