

## Determinants of Crime in Malaysia: Evidence from Developed States

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### ABSTRACT

Despite the alarming statistics and growing concerns over crime, the study of crime in Malaysia has received little attention and is largely neglected by the literature on crime in general. Thus, this study is an attempt to add to the existing literature on crime research in developing countries, specifically, in Malaysia. This study aims to determine the socioeconomic and socio-demographic determinants of crime in four developed states of Malaysia from 1990 to 2008. The study utilises fixed effects to examine the determinants of crime in selected states. The findings reveal that GDP per capita, unemployment rate, population density and the number of police officers are significant determinants of total and property crime. On the other hand, violent crime is determined by population density and number of police officers only. The robustness test shows that both population density and the number of police officers are the determinants of property and violent crimes.

**Keywords:** crimes, developed states, fixed effect, socio-demographic determinants

**JEL Classification:** J24, K42

### INTRODUCTION

Crime is a major public concern and has received considerable attention through extensive coverage in newspapers and electronic media in recent years. It can be defined an activity that is against the laws of a nation. However, the meaning of the term ‘crime’ itself varies across countries depending on the respective laws of the nations. In other words, what is legal in one country may be illegal in another country. The importance of crime study has been highlighted by Glaeser (1999). He argues that crime is a major social problem that has been a focus in

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most developed countries and the time spent combating criminal activities is a social loss as that time could have been spent on something more productive.

Definitely, crime has many effects on the daily lives of the citizens. The consequences of criminal activities are most of the costs incurred—including direct costs (immediate impact) and indirect costs (long-term effect). Examples of indirect costs include fear of crime, lower life satisfaction level, psychological issues, decreased quality of life and other non-monetary costs. Thus, crime not only affects the victims but also threatens the non-victims and the society as a whole. In addition, dealing with crime adds a burden to the government expenditure. This is due to the costs of increasing the number of police officers, imprisonment, providing mental health services and organising campaigns and programmes designed against criminal activities.

In Malaysia, crime rates have increased significantly in recent years. In total, 70% of the street crime in Malaysia was accounted for by four developed states: Kuala Lumpur, Johor, Selangor and Pulau Pinang. In 2005, Kuala Lumpur recorded the highest number of crimes at 1,265 per 100,000 of the population, followed by Selangor (885.6), Pulau Pinang (783.3), and Johor (760.2). The *New Straits Times Press* (2006) reported that the National Crime Index showed that 130,457 cases were reported in the first seven months of 2006 compared with 177,200 cases during that same period in 2005; this shows an increase of more than 11% in the number of cases reported. Although the Overseas Security Advisory Council (OSAC) reported that in February 2007, the overall crime rate in Malaysia was medium in severity, there was also an increase in the total crime index (OSAC, 2007). A recent report by the Government Transformation Programme (GTP) states that the overall index crime rates have increased from 746 reported crimes per 100,000 of the population in 2007 to 767 in 2008, which accounted for nearly 3% increases (Malaysia, GTP, 2010).

Despite the alarming statistics and growing concerns of crime, the study of crime in Malaysia has received little attention and is largely neglected by the literature. There is considerably more literature on crime in developed countries compared with that on crime in developing countries (Glaeser, 1999). Thus, the present study is an attempt to add to the existing literature on crime research in developing countries, specifically, in Malaysia. The rising crime situation is not a new phenomenon either in this country or around the world, and what triggers criminal behaviour among Malaysians is yet to be understood. As there are many factors involved, the root cause of the problem needs to be determined in order to address the situation. Thus, this study aims to fill the gap in the literature by finding some empirical evidence on criminal activities in Malaysia. The main objective of this study is to analyse the socioeconomic and socio-demographic determinants of crime in four developed states of Malaysia: Johor, Kuala Lumpur, Pulau Pinang and Selangor. The developed states significantly contributed to the growth of Malaysia, but at the same time, they have the highest crime rate per 100,000 population.

By referring to the seminal theoretical model of crime (Becker, 1968; Ehrlich, 1973), this study complements the few existing studies on the determinants of crime in Malaysia by focusing on the various types of crime on the state level, which will provide a clearer picture on the crime situation in this country. In particular, we use panel data techniques for four states covering the period 1990–2008. Our study differs from previous studies done in Malaysia because, to our knowledge, this is the first paper on crime determinants in Malaysia that uses

state-level data. Existing studies used the overall crime rate of Malaysia to measure the level of criminal activity. For instance, a study by Meera (1990), focused on socioeconomic variables and their relationship with crime rates and Malaysia. The study used the overall Malaysia Crime Index and other Malaysian socioeconomic and demographic variables as crime determinants. State-level data allows us to better understand the criminal activities related to specific states and demography. We use panel data which allows us to control for unobserved or omitted variables. Additionally, we separate the crime measurement into two broad categories—property crimes and violent crimes—as well as specific types of crime under each broad category. Furthermore, this study is different from a study done by Matin in 1998 which performed a comparative assessment of crime in the context of only one state, i.e. Kelantan, Malaysia. The research also compared the crime level in Malaysia with that of Singapore and the USA.

The paper is organised as follows. The reviewed literature is in the next section. In section 3, we discuss the data and the main variables. Section 4 is the model specification. The results and analysis are in section 5 and section 6 concludes the study.

This study has few limitations in the context of coverage and data collection. In terms of coverage, it covers four states in Peninsular Malaysia: the federal territory Kuala Lumpur, Selangor, Johor and Pulau Pinang. Next, the data for the crime rates are based on the crime recorded either by the victim or a witness, or sometimes on the initiative of the police. The recorded crime statistics exclude crimes that have not been reported to the police. A gap exists between the officially recorded criminality and actual criminality, as the Royal Malaysia Police (RMP) only records crime about which people are aware.

The process of data collection for this study encountered bureaucratic obstacles especially when consulting the police department and a few government agencies such as in the case of Jabatan Pendaftaran Negara, particularly in obtaining some of the demographic variables. The Department of Statistics (DOS) Malaysia, however, provided complete cooperation. Due to the limitation, only some of the demographic variables were gathered and were limited to certain years.

## LITERATURE REVIEW

The research on the economics of crime was pioneered by Gary Becker in 1968. Becker's work was later extended by Ehrlich in 1973, and since then, economic contributions in the area of crime have increased. Previously, the study of the economics of crime used the Becker-Ehrlich model, specifically, for estimating the effect of deterrence as well as the costs and benefits of committing crime. On the basis of Becker's model, crime is considered a type of work, even though it is illegal and can generate economic benefits. Becker's model also assumed that committing crime is a rational decision when the expected benefit from the illegal work is higher than the cost. He explains that individuals will choose whether they should involve in criminal activities by comparing the returns from the activities to those from working legally. Other studies such as the seminal work done by Block and Heineke (1975) and several other researches on the economics of crime have been conducted to explain illegal activity and its relationship with the social background, socioeconomic factors and the behaviour patterns of individual criminals in a society.

More recently, some researchers tested the relationship between social indicators, socio-demographic factors and new economic activities that may influence criminal acts. It has been found that more studies on crime issues have concentrated on developed countries than on crime issues in developing countries (Becsi, 1999; Buonanno and Montolio, 2005; Raphael and Winter-Ebmer, 1998). In developed countries, it is acknowledged that the study of the economics of crime interacts with different heterogeneous fields such as sociology, criminology, geography and other related areas (Buonanno, 2003). Hence, several studies (Cohen, 2005a; Comanor and Phillips, 2002, Fajnzylber *et al.*, 2002) have been conducted to highlight various aspects of crime and factors that contribute to criminal activities. In developing nations, there is an interest in studying crime, but due to limited data, the study of the economics of crime is not as much as that in developed states.

Only recently, a number of local researchers developed interest in studying crime in Malaysia. The trend of crime rates in the selected states shows that crime study is important in Malaysia. For instance, per the RMP's annual report, the crime trends show that crime cases in Kuala Lumpur is mostly include property crime. Accordingly, results of the overall crime index in Selangor are dominated by the results of the property crime index. The property crime index in this state is heavily influenced by motorcycle theft and housebreaking at night. The studies on crime determinants in Malaysia were headed by Meera (1990), Meera and Jayakumar (1995), Habibullah and Baharom (2009), Tang (2009, 2011) and recently by Habibullah *et al* (2014). The increase in crime research in this country is in line with the Malaysian government action to eradicate crime through the GTP launched in 2010. Throughout 2010, the Ministry of Home Affairs via the RMP (Polis DiRaja Malaysia or PDRM) and other agencies made fighting crime a priority in this country.

## **DETERMINANTS OF CRIME**

Previous literature has observed that, theoretically, there are three categories of variables commonly used in determining crime: socioeconomic, socio-demographic, and deterrence variables (Gumus, 2004; Masih and Masih, 1996; Meera, 1990; Meera and Jayakumar, 1995).

The unemployment factor has been acknowledged as an important determinant of the supply of criminal offenders and the overall crime rate (Reilly and Witt, 1992). The existing empirical literature has found that unemployment rates are positively associated with crime (Gould *et al*, 2002). Generally, most reviews of unemployment and crime literature (Edmark, 2005) have reported that the effect of unemployment on crime is more consistent for property crime, whereas unemployment is said to have lesser effect on violent crime. Edmark (2005) pointed out that increased unemployment was significant for aggregate property crime, burglary, car theft and bike theft, while the relationship between violent crime (e.g., murder, assault, sexual assault and rape) and unemployment was insignificantly related. Nevertheless, the study of the relationship between crime and unemployment may have mixed findings.

Research by Vold *et al* (2002) criticised the inconsistency of the results of studies on the relationship between unemployment and crime. This issue was further supported by Buonanno (2003), who asserted that the existence of a relationship between crime and unemployment

is ambiguous, both in its nature and its robustness. The mixed findings of the relationship between the two might be influenced by the different measures of unemployment, or the statistical analysis used.

The educational level of the population is another important economic variable in determining crime. The argument that education levels affected crime is not new. According to Witte and Wit (2000), many social scientists argue that crime is closely related to work, education and poverty. Lochner (2007) extensively discusses the negative correlation between educational attainment and most types of crime. In the study, Lochner explains four primary reasons why schooling might affect crime. First, education raises the wage rate, which as per Lochner, raises the opportunity costs of crime. Second, according to Lochner, education may directly affect the financial or 'psychic' rewards from crime. Third, Lochner contends that education may alter peoples' preferences for risk-taking or patience. Lastly, based on the study, the social networks or peers of individuals may be affected by schooling.

In another study, Buonanno (2003) also noted the importance of education as a factor influencing crime incidence. He argued that crime appears to be strictly related to the level of education attained and to an individuals' economic and social background. Buonanno (2005) stated that the level of education will enhance the opportunity to obtain higher returns, and thus, will increase the opportunity cost of criminal behaviour that eventually affects the decision of whether to engage in crime.

Demographic factors are closely linked to criminal activities. According to previous literature, demographic factors can contribute to the intensity of violent criminal activities (Fajnzylber *et al.*, 2000). For example, the connection between the tendencies of urban areas influencing crime has been studied by criminologists and economists. Urbanisation as a factor affecting crime incidence was first examined by Shaw and McKay (1942) as one of the socioeconomic/socio-demographic variables in their social disorganisation theory. According to this theory, urbanisation may create racial or ethnic heterogeneity, where the existence of different races, cultures and languages creates the perception of insuperable barriers. People begin to isolate themselves and avoid interaction with different groups.

In Gumus (2004), a study on crime in urban areas, the findings revealed that population size, as a measure of urbanisation, was an important determinant of urban crime. As urban areas become larger, the rate of crime in these areas also increases. These findings are compatible with the research of White and Habibis (2005) on the levels of urbanisation. They researchers found that, in general, urbanisation is associated with higher rates of property crime.

However, some research findings on demographic factors reveal an ambiguous relationship between crime and urbanisation. For example, Buonanno and Montolio (2005) reported that there is no clear evidence suggesting a positive relationship between the rate of urbanisation and crime, apart from minor crimes against a person. This is due to the different nature of the crime considered. As commonly argued in the existing crime literature, socioeconomic factors are more likely to determine property crimes, while crimes against a person can depend on other factors difficult to account for with aggregated data

The deterrence factor has also been considered a variable influencing crime. Becker (1968) and Erlich (1973) discussed the deterrence factor as a main variable affecting crime in addition to economic factors. Becker used the probability of conviction and the severity of punishment

as exogenous variables in the supply-of-offences function. Kovandzic and Sloan (2002) used the total number of police employees as their deterrence variable. The study found that an increased number of police employees reduced most types of crime. Although a common deterrence measure is the number of police officers or police expenditure, there are also studies that use the clear-up rate or number of prisoners (for example, Buonanno and Montolio, 2005). A study by Di Tella and Schardgroski (2004) also identified the causal effect of police presence on car thefts. They estimated the effect of police presence on crime absent direct data on the distribution of police forces. In their study the post attack distribution of the protected institutions stands in for the presence of police forces. The study was quite different as they were analysing the effect of police after the 1994 terrorist attack in Buenos Aires, Argentina. Using data on the location of car thefts before and after the attack, they found a large deterrent effect of observable police presence on crime. The effect is local with no appreciable impact outside the narrow area wherein the police officials are deployed. Chalfin and Mc Crary (2012) in their study used new panel data set on crime in medium to large cities of the USA during 1960–2010 found elasticities of police with respect to three lagged crime aggregates: violent crimes, property crimes and a cost-weighted crime index which weights the prevalence of each crime by an estimate of the social damages associated with that crime. These elasticities range from 0.004-0.012 for violent crimes to 0.008-0.019 for property crimes, suggesting that a 10% increase in crime would lead to no more than a 0.2% increase in police which is a weak association between crime and number of policemen.

## DATA AND METHODOLOGY

Our panel dataset comprises annual observations from four developed states in Malaysia from 1990 to 2008. In choosing the variables to explain the incidence of crime, this study followed Becker's model (1968) of crime and the recent extension of the model that emphasises the sociological and demographic aspects. The dependent variable used in this study is the crime index, which is used officially by the RMP for measuring crime. The crime index comprises two broad categories of crime: violent and property crime. The total crime is measured as the total number of violent crimes plus the total number of property crime offences reported to the police. The total crime rate is then divided by the total population and multiplied by 100,000. In addition, in the second part of our analysis, we also use different types of crime under the violent and property crime categories. The crime data are taken from the RMP statistics.

To examine the determinants of crime in Malaysia, the explanatory variables used in this study were divided into three groups: socioeconomic variables, deterrence variables, and demographic variables. The socioeconomic variables included are the real GDP per capita, unemployment rate and enrolment, which represent the level of education. These data are gathered from the DOS and the Economic Planning Unit (EPU). We use population density as an indicator for demographic variable. Although we managed to get data for the divorce rate as our additional demographic variable, it is insufficient for our analysis. Lastly, the deterrence variables are the number of police officers and the number of cases solved, which are obtained from the RMP.

On the basis of prior studies, several factors have been identified as being related to crime rates, which include the aforementioned variables. Our real GDP per capita data are taken from the unpublished report of the EPU. It has been adjusted for inflation as including indicators of the standard of living in the Malaysian economy. This is the proxy for the general level of prosperity in the country and the level of development in each state. Real GDP per capita by state is calculated using the prices of 2001 (as base year) for Malaysia. This is because the DOS of Malaysia does not publish the data of the Consumer Price Index (CPI) on the state level for the public as it is released to be used internally by DOS only. Therefore, using the 2001 CPI for Peninsular Malaysia was considered acceptable for the purpose of this research.

Another type of economic variable that influences the decision to commit crime is the unemployment rate. Previous studies have revealed that unemployment and crime is positively correlated. The existing empirical literature has revealed that unemployment rates are positively associated with crime (Gould *et al.*, 2002). Additionally, the research done by Meera and Jayakumar (1995) in Malaysia discovered that the unemployment rate is one of the factors directly contributing to increases in crime levels.

The unemployment rate includes both active and inactive unemployed persons (Malaysia, 2008)<sup>1</sup>. The third economic variable is the enrolment rate in secondary schools, a proxy for the educational level in this country. The expectation is that individuals with higher levels of education receive higher incomes.

The demographic variable is the population density for each state. To calculate the population density, we use the population data divided by the total land area, measured in square kilometres (km<sup>2</sup>). Following Entorf and Spengler (1998), we use the number of solved cases by the types of crime and the number of the police officers as the deterrent variables. The number of solved cases is defined as the percentage of the number of crimes solved by the police to the total number of crimes reported, for both property and violent crimes for each year. The data for the number of police officers are obtained from the Department of Public Relations of the RMP.

## MODEL SPECIFICATION

The framework of our research is based on Becker (1968) and Erlich (1973). This study proposes an econometric model to test the hypothesis of the economic model of crime in four developed states of Malaysia. The following empirical model is then formulated to study the determinants of crime:

$$CRIME_{i,t} = \alpha_i + \alpha_t + \alpha_1 GDP_{i,t} + \alpha_2 UNEM_{i,t} + \alpha_3 EDUC_{i,t} + \alpha_4 DENS_{i,t} + \alpha_5 POL_{i,t} + \alpha_6 SOLV_{i,t} + \varepsilon_{i,t} \quad (1)$$

where  $i$  and  $t$  represent the state and time period, respectively;  $\alpha_i$  is the state fixed effect,  $\alpha_t$  is the time fixed effect. The remaining variables are as follows:

<sup>1</sup> The DOS (2008) defined unemployed persons including both actively and inactively unemployed persons as those who did not work during the reference week but were available for work and were actively looking for work during the reference week. Inactively unemployed includes persons who did not look for work because they believed no work was available or that they were not qualified, those who would have looked for work if it had not been for bad weather, those who were waiting for answers to job applications and those who looked for work prior to the reference week.

$CRIME_{i,t}$ : Crime rate (Total index, violent or property crime)

$GDP_{i,t}$ : Real GDP per capita

$UNEM_{i,t}$ : Unemployment rate

$EDUC_{i,t}$ : Secondary enrolment

$DENS_{i,t}$ : Population density

$POL_{i,t}$ : Number of police officers

$SOLV_{i,t}$ : Number of cases solved

As all the variables are measured in different units, we transformed the variables into natural logarithms. According to Wooldridge (2009, p 191), by taking the log, it can mitigate, if not eliminate, the heteroscedastic or skewed distribution. Moreover, Wooldridge also discusses that taking logs can narrow the range of the variable, in some cases, by a considerable amount.

To estimate the crime model, we utilise the panel data method. According to Greene (2000), panel data provides a rich environment for the development of estimation techniques and theoretical results. Additionally, the use of panel data will allow this study to check for the existence of heterogeneity among the individual units (states). One advantage of panel data is that it creates more variability by combining variation across micro units with variations over time less multicollinearity problems. Hence, a more efficient estimation can be made with more informative data. As stated by Wooldridge (2003, p. 13), having multiple observations on the same unit allows us to control certain unobserved characteristics of states in Malaysia (for example, cultural factors, or differences in business practices across companies) (Torres-Reyna, 2009).

To incorporate the best estimation method, we run two different methods: random effects (RE) and fixed effects (FE). The RE model assumes the individual effect as a random variable (Koop, 2008). It is written as an individual effects model.

$$Y_{i,t} = \alpha_i + \beta X_{i,t} + \mu_{i,t} \quad (2)$$

The RE model estimates variance components for groups and error, assuming the same intercept and slopes.

The FE model is a useful specification for accommodating individual heterogeneity in panel data (Greene, 2001). FE explores the relationship between predictor and outcome variables within an entity (such as a country, person, or company). The FE model examines group differences in intercepts by assuming the same slopes and constant variance across group. To choose between these two models, we run the Hausman Test which evaluates whether there is a systematic difference between the coefficients calculated by FE and RE. The test indicates that the hypothesis by which the individual effect is correlated with some explicative variable cannot be rejected<sup>2</sup>.

<sup>2</sup> The Chi Squared statistics for the Hausman test is  $\chi^2(6) = 128.9$  which is highly significant. Thus, it revealed a preference for the FE model to the RE model. Therefore, the FE model was applied throughout the analysis.



## EMPIRICAL RESULTS

### Descriptive Statistics

We present the descriptive statistics and the correlation matrix in the appendix (Tables 3 and 4). The total number of observations for each variable is 76, except for the number of cases solved which is 64 due to missing values. Briefly, the maximum number of crimes committed is 58,592, of which 11,706 are violent crimes and the remaining 47,271 are property crimes. The average number of police officers in each state is around 5799, while the unemployment rate ranges from 0.7% to 3.7%. As for the correlation, real GDP per capita is positively correlated with crime. This is also true for the number of police officers, the number of cases solved and the unemployment rate. Education level is the only variable that is negatively correlated with crime.

### MAIN FINDINGS

The results obtained from the regression are presented in Table 1 and Table 2. Column 1 in Table 1 presents the results of estimating the determinants of the total crime index, while columns 2 and 3 are the results for violent and property crimes, respectively.

Table 1: Determinants of Crime in Developed States in Malaysia

VARIABLES	(1) Total Crime	(2) Violent Crime	(3) Property Crime
GDP <sub>i,t</sub>	-0.222*** (0.035)	-0.195 (0.112)	-0.232** (0.043)
Unemployment <sub>i,t</sub>	0.246** (0.057)	0.256 (0.129)	0.242** (0.049)
Education <sub>i,t</sub>	0.180 (0.104)	0.0179 (0.151)	0.202 (0.097)
Density <sub>i,t</sub>	4.232*** (0.513)	3.971** (0.982)	4.297*** (0.448)
Police <sub>i,t</sub>	-2.346** (0.493)	-2.021* (0.739)	-2.412** (0.462)
Solve <sub>i,t</sub>	-0.035 (0.032)	0.033 (0.029)	-0.044 (0.033)
Constant	3.192* (1.313)	0.189 (1.679)	3.235* (1.328)
Observations	64	64	64
R-squared	0.915	0.830	0.916

Note: Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0. All regression is without time effects as indicated by the testparm results.

The table shows that the socioeconomic variables (real GDP and unemployment) are highly significant, except for the level of education. From a theoretical point of view, the real GDP per capita is expected to be positively related to crime. However, the result shows that a higher level of GDP is expected to decrease the number of crimes committed by 22%. The increase in the real GDP per capita (which is a proxy for the cost of living) is accompanied by better public amenities that made the area a more attractive place to live; in turn, the productivity of the workers will increase. Thus, it can explain the negative relationship between the two variables. Moreover, this finding is also in line with that of Ochsen (2010). Unemployment and crime are positively related as explained by Tang and Lean (2007). The positive effect can be interpreted as the impact of criminal motivation. When more people were unemployed, they lost their source of income, which eventually will increase the possibility of committing crimes. In our sample, the level of education does not affect the total number of crimes committed.

The demographic variable (population density) is highly significant with expected sign. The relationship between high crime rates and population density is in line with Nolan (2004) and Harries (2006), both of which concluded that higher crime rates were found in densely populated cities. The deterrence variables show a mixed result. The number of police officers has a negative and statistically significant effect on the total number of crimes in the developed states of Malaysia. A 1% increase in the number of officers leads to a 234% decrease in the crime rate, which is a quite large effect. The finding agrees with earlier literature such as Di Tella and Schardgroski (2004), Lin (2009) and Chalfin and McCracy (2012). This is also supported by Levitt (2004) who suggested four factors that decreased crime rates in the 1990s — ‘increases in the number of police, the rising prison population, the waning crack epidemic and the legalisation of abortion’. On the contrary, the effect of the number of cases solved is insignificant.

When we analyse the determinants of crime by category, the results are quite different. As shown in column 2 of Table 1, there are only two significant determinants of violent crime. Population density is positively and highly correlated with violent crime. On the contrary, the number of police officers is negatively correlated with this crime category. Other determinants have the expected signs but are insignificant. Furthermore, property crime exhibits similar results with total crime. All determinants but the level of education and number of cases solved are highly significant with the expected sign.

On the basis of the analysis above, we can conclude that total crime is explained or determined by the level of GDP, unemployment rate, population density and the number of police officers, which is also true for property crime. However, it seems that violent crime is better explained by the demographic variable (population density) and the deterrent variable (number of police officers). Socioeconomic variables (real GDP, unemployment and the level of education) do not have any impact on violent crime in the states of interests. These findings are supported by earlier studies by Buonanno and Montolio (2005) and Edmark (2005). The former study finds that property crime is more likely to depend on economic motivations, while for crimes against people, other factors such as deterrence and socio-demographic factors are seen to be more correlated. Conversely, the Edmark’s study confirms that socioeconomic variables are not directly related to violent crime.

Table 2: Robustness Test: Determinants of Crime (types of crime) in Developed States, Malaysia

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Murder	Rape	Armed	Robbery	Assault	Burglary	Car	M/cycle	Lorry/van	Larceny
GDP <sub>it</sub>	0.0432 (0.196)	0.222 (0.317)	-0.836** (0.234)	-0.151 (0.150)	-0.272* (0.108)	-0.531 (0.456)	0.143 (0.790)	1.926* (0.795)	0.255 (0.953)	1.300 (0.982)
Unemployment <sub>it</sub>	0.381* (0.124)	-0.003 (0.171)	0.474 (0.269)	0.442** (0.117)	-0.102 (0.151)	-0.147 (0.219)	0.417 (0.201)	-0.043 (0.448)	0.192 (0.150)	-0.232 (0.796)
Education <sub>it</sub>	-0.175 (0.169)	-0.008 (0.083)	0.150 (0.158)	0.055 (0.222)	0.061 (0.114)	1.038** (0.209)	0.166 (0.319)	0.329 (0.265)	0.0831 (0.250)	0.596*** (0.083)
Density <sub>it</sub>	3.104*** (0.499)	1.744 (0.981)	4.270* (1.459)	3.941* (1.241)	3.933*** (0.540)	0.406 (2.918)	-3.808** (0.993)	-4.462* (1.458)	0.594 (2.262)	-7.263 (5.116)
Police <sub>it</sub>	-2.380** (0.534)	-0.090 (1.035)	-3.248 (2.120)	-1.904 (0.882)	-2.314** (0.630)	0.813 (2.797)	2.197 (1.502)	-0.375 (0.947)	-1.736** (0.299)	7.757 (4.866)
Solve <sub>it</sub>	-0.025 (0.093)	-0.066 (0.071)	-0.408 (0.201)	0.0623 (0.069)	-0.107 (0.123)	-0.392 (0.174)	0.225 (0.221)	-0.212 (0.242)	-0.080 (0.224)	-0.868** (0.257)
Constant	3.598 (2.245)	-8.159 (3.904)	12.77 (9.952)	-1.862 (2.201)	2.756 (1.912)	-2.831 (6.938)	7.085 (8.047)	16.98* (5.734)	11.88* (3.751)	-26.64 (13.54)
Observations	64	64	64	64	64	64	64	64	64	64
R-squared	0.617	0.715	0.392	0.774	0.724	0.250	0.132	0.421	0.065	0.176

Note: Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. All regression is without time effects as indicated by the testparm results in Stata.

## Robustness Check

Additionally, we re-estimate our empirical model for different types of crime under each category. There are five types of crime under violent crime: murder, rape, armed robbery, robbery and assault. Property crime comprises five types: burglary, car theft, motorcycle theft, lorry/van theft and larceny. The robustness check is to determine the robust types of determinants (socioeconomics, demographic and deterrence) on each crime. Table 2 below reports the results of the analysis. The findings need to be explained with caution as the number of crimes under each type is quite small and thus restricts a meaningful regression analysis. However, for most types, we manage to get at least one significant determinant.

Real GDP per capita is a significant determinant for armed robbery and assault. Although it is also one of the determinants for motorcycle theft, the sign of the variable is positive. Unemployment, on the contrary, is positively correlated with murder and robbery. Level of education is now positive and significant for burglary and larceny. The results indicate that formal education is beneficial for committing these types of crimes, as the crime offenders may gain and learn the knowledge and skills from formal institutions but apply them to the wrong place and situation. The demographic variable is significant and positive in most types of crimes. Further, the number of police officers shows a consistent negative relationship with the types of crime but is only significant in murder, assault and lorry/van theft. Lastly, the number of cases solved appears to be negative and significant in larceny, which confirms earlier findings.

The results from the robustness analysis can be concluded as follows. The determinants of crime studied in the first part of the analysis are also significant predictors of different types of violent and property crimes. Population density and the number of police officers are the most robust determinants for both violent and property crimes. Real GDP per capita and unemployment rate do not appear to be significant in column 2 of Table 1, but the result changes when we analyse the different types of violent crimes. The level of education and the number of cases solved are also insignificant in Table 1, but the results change in Table 2.

## CONCLUSION

This study empirically explores the interactions between total, property and violent crime rates and their determinants in the developed states of Malaysia from 1990 to 2008. Using fixed effects estimation, the study finds that the real GDP per capita, unemployment rate, population density and number of police officers are significant determinants of total and property crimes. Additionally, we find that violent crime is significantly correlated by demographic and deterrent variables only, i.e. population density and the number of police officers. The robustness test using different types of crime under each category shows that population density and the number of police officers are robust determinants of total, property and violent crimes.

The negative relationship between the number of police officers and the crime rate suggests an important policy formulation to Malaysia and the developed states in particular. The deterrence effects exert strong negative influences for all types of crimes. It shows that with higher number of law enforcement officers, the number of crimes committed will be lower.

Thus, the government of Malaysia should consider the outcome of this study in future policies for fighting crime. Future research should also consider social factors and other deterrence variables such as the number of divorcees and the number of prisoners.

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**APPENDIX**

Table 3: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Total Crime	76	21595.5	12941.750	5768	58592
Violent Crime	76	3397.737	2373.377	745	11706
Property Crime	76	18197.760	10688.140	4972	47271
GDP	76	28470.830	16882.010	5789	80012
Unemployment	76	2.4	0.644	0.7	3.7
Density	76	1855.356	2349.457	55.789	6705.350
Education	76	2.979	1.296	1.535	5.976
Police Officer	76	5798.684	1268.007	4211	10424
Cases Solved	64	25.360	13.402	8.680	52.190

Table 4: Correlation Matrix

Variable	Crime	Property	Violent	GDP	Density	Unemployment	Police	Education	Cases Solved
Crime	1								
Property	0.999	1							
Violent	0.967	0.955	1						
GDP	0.867	0.871	0.806	1					
Density	0.001	-0.010	0.046	-0.043	1				
Unemployment	0.268	0.259	0.303	0.099	-0.161	1			
Police	0.766	0.757	0.787	0.728	-0.280	0.452	1		
Education	-0.457	-0.433	-0.586	-0.249	0.178	-0.204	-0.571	1	
Cases Solved	0.406	0.415	0.334	0.623	0.073	0.262	0.362	0.333	1