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The Relationship between Crime and Economic Growth in Malaysia: Re-Examine Using Bound Test Approach

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Abstract

This study is an attempt to re-examine the relationship between crime and economic growth in Malaysia for the periods of 1980 to 2013. The ARDL method was used to establish the long-run relationship as well as the direction of causation between variables. The standard model, the bivariate relationship was estimated. The models exhibit strong evidence on long-run cointegration. The impact of economic growth towards crime in the long run was found to be positive and statistically significant. In the short run, bidirectional causation between crime and economic growth was also found to be significant. This study is consistent with the economist arguments that good economies tend to create more crime, and the opposite occurs during bad economies. Thus, government should not only aim for economic growth, but also to provide more employment opportunities, increase wage rate, and provide more basic necessities to every citizen especially during good times as well as tighten the enforcement of crime laws so that crime will be continuously reduced and under control.

Keywords: *Economic Growth, Crime, Cointegration, Malaysia.*
JEL Codes: F21, F30, O40

1 Introduction

Malaysia is a highly open, upper-middle income and newly industrialised market economy. Malaysia was one of 13 countries identified by the Commission on Growth and Development report to have recorded an average growth of more than 7 percent per year for 25 years or more (Commission Growth Report 2008). The Gross Domestic Product (GDP) in Malaysia was worth 338.10 billion US dollars in 2014. The GDP value of Malaysia represents 0.55 percent of the world economy. The GDP in Malaysia averaged 75.73 USD Billion from 1960 until 2014.

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Growth was accompanied by a dramatic reduction in poverty from 49.3 percent in 1970 to 1.0 percent in 2014. Real income of the bottom 40 percent of households increased by an average of 6.3 percent per year between 2009 and 2012, compared to 5.2 percent for the average household, suggesting that income disparity has been reduced. However, with the growing economy, violent crime rate also appears to be on the rise especially in major cities like Kuala Lumpur. Higher economic growth and income disparity may have contributed to Malaysia's rising crime levels.

The motivation behind this study arises mainly from a lack of study on the broader effects of GDP on crime rates. Since GDP per capita can be used as a good proxy for personal wealth, GDP per capita should have a measureable effect on violent crime rates. This study is an attempt to investigate the relationship between economic growth and crime in Malaysia for the period 1980 to 2014. As this study is only in the context of Malaysia, it should be adapted when used in other countries facing the same problems, using their respective data.

2 Literature Review

There are many studies which have been conducted to examine the determinants of crime all over the world. Some of them use time series, panel and some are country level studies. There is a significant body of research on crime, and the economic factors that could be correlated to criminal activity as well as the effects of crime on the economy. Unemployment and poverty are widely touched upon subjects, but few studies have looked at GDP as an influencing factor to criminal activity within Malaysia.

Generally, crime is treated as the unexpected behavior of an individual which goes against the law. There are many reasons due to which an individual produces this behavior. Sometimes crime is committed by a person because of mental stress and sometimes crime is committed without any reason because some people are habitual to do so (Aurangzeb 2012).

From the theoretical point of view, there are two views in explaining the relationship between crime activities and economic growth according to Roman (2013). Criminologists claim that tough economic times make more people willing to commit crimes. This means bad economies lead to more property crimes and robberies as criminals steal coveted items they cannot afford. On the contrary, Economists tend to argue the opposite that better economic times increase crime. To illustrate, better economic times also means more people are out and about flashing their shiny new smartphones and tablets, more new cars sit unattended in parking lots, and there are more big-screen TVs, computers, laptops in homes to steal. There is also a higher demand for drugs and alcohol, and the violence that often accompanies their consumption.

A number of empirical studies have been conducted to understand the determinants of crime (e.g., Dreze & Khera, 2000; Sharma, G., 2011; Fajnzylber et al., 2002a, 2002b, Pridemore, 2011 in cross country context). Most of the published literature focused on the determinants of crime. However, crime as one of the determinants of economic growth largely remains neglected in macroeconomic frameworks (Detotto & Otranto, 2010).

In a study done on the relationship between GDP per capita and crime rates from the US Department of Justice at the state level during the recession from 2007 until 2010, the findings concluded that those states hit hardest by the recession had the biggest drop in crime rates (The Economist, 2011). In other words, crime rates decrease in those states experiencing bad economies. In a different study, Roman (2013) conducted research to examine the relationship between GDP and violent and property crime rates from 1960 until 2013. He begins by outlining the difficulty in testing the hypothesis that big macroeconomic factors explain crime trends. He found out that crime obviously affects macroeconomic factors as well as being affected by them, thus causing an interdependent relationship among the two. Looking on the paradigm context, Becker (1968) provides economic rational to criminal activities. Criminals respond to economic incentives in the same way as the law-abiding citizens do. This model predicts that law enforcement depends on the probability of detection of a crime and severity of the punishment. Likewise, Ehrlich (1973) models the participation of individuals in non-market, legal and illegal activities, and predicts an unspecified effect of crime on economic development. Moreover, he finds that inequalities increase the level of crime.

Besides the aforementioned studies, some contributions have theoretically tried to establish the relationship between crime, growth and development (e.g., Bourguignon, 2001; Fajnzylber et al., 2002a, Mauro & Carmeci, 2007) and some studies quantify economic and social cost of crime for different countries [Australia (Mayhew, 2003); France (Palle & Godefroy, 2000); the United Kingdom (Brand & Price, 2000); New Zealand (Roper & Thompson, 2006); the United States (Miller et al., 1996); Italy (Detotto & Pulina, 2012); for some Latin America States (United Nations, 2007) and Colombia (Poveda, 2012)]. Overall, the econometric results show that crime leads to a negative effect on real per capita output and employment.

In addition to that, Peri (2004) in a study based on panel data of Italian provinces for the period of 1951-1999, observed that crime statistically has a significant negative effect on economic output and employment, indicating the possibility of nonlinearities in the crime-growth relationship. In particular, while she finds a statistically significant adverse violent-crime effect on growth, the impact of property crime is weak and in some specifications perverse. A World Bank study on the other hand, using a sample of 43 countries for the period of 1975-2000, found a strong negative relationship between crime and growth even after controlling for human-capital accumulation and income inequality (World Bank, 2006). Similarly, Càrdenas (2007) finds a significantly negative association between crime and per-capita output growth in a panel of 65 countries using homicides data for 1971-1999. Moreover, time-series studies (e.g., Dettoto & Pulina 2009; Dettoto & Otranto, 2010) using single country data also find a negative association between crime and income levels.

However, study by Chatterjee and Ray (2009) based on a large cross-country sample for the period of 1991-2005 and controlling for human capital and institutional quality, find no strong evidence of a uniformly negative association between crime and growth. This result is in line with a study using US county level data which found no clear connection between central city crime and per capita income growth (Burnham et al., 2004).

Most of the above cited studies are in the context of developed countries and measure the effects of crime on economic performance in terms of level of income. However, studies done on developing and emerging countries especially the effects of economic growth on crime activities are still lacking.

3 Methodology

Analysis of long run and short run relationship between variables is conducted using the ARDL bound test approach. While the existence of a unit root or stationarity test is performed using Augmented Dickey-Fuller approach, the ADF test (Dickey & Fuller, 1981). ARDL bound test approach (Pesaran, Shin and Smith, 2001) for cointegration analysis to determine the long run movement between variables can be written in a general form as follows:

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 x_{t-1} + \sum_{i=1}^{m} \beta_i \Delta y_{t-i} + \sum_{j=0}^{m} \gamma_j \Delta x_{t-j} + u_t \qquad (1)$$

where α_0 is constant and u_t is white noise disturbance error. According to Pesaran et al. (2001), two separate statistics used to test the existence of long run relationship between the variables which are *F*-test for the joint test of the lagged coefficients (in levels) in equation (1) where $H_0: \alpha_1 = \alpha_2 = 0$ and *t*-test for the null hypothesis, $H_0: \alpha_1 = 0$. However, the cointegration analysis in this study will adopt the F-test. Two borders asymptotic critical value given for co-integration test when independent variables are $I(d)$ (where $0 \leq d \leq 1$): at the bottom, the regressor is assumed to be $I(0)$ and at the top, the regressor is assumed to be exactly $I(1)$. If the test statistic is greater than the above (upper) critical value, it can be concluded that there exist cointegration relationship between the variables. If the test statistic is less than the below (lower) critical value, then the null hypothesis of no cointegration cannot be rejected. But if the test statistic is between the above critical value and the below critical value, then the existence of co-integration test results cannot be determined. The main advantage of this method is that it can be applied regardless of whether the regressors are $I(0)$ or $I(1)$ and can be applied without pre-test for stationarity. In addition, this approach is also suitable to be used on time series data that may be affected by the structural change. However, in situations where there is $I(2)$ variable, the F-statistic distribution developed by Pesaran et al. (2001) is no longer valid because it is based on the assumption that the variables must be $I(0)$ or $I(1)$ only. Therefore, the unit root testing is still needs to be done in the ARDL procedure to ensure there is no variable that have higher levels order of integration more than one. This technique is also suitable and highly capable in analyzing small samples size and limited data (Pesaran et al., 2001).

The existences of causal relationship in this study were then tested using the error correction model based on the ARDL framework (ECM-ARDL). Based on cointegration testing procedures, if both y_t and x_t cointegrated with the definition of $\hat{u}_t \sim I(0)$, then the cointegration vector need to be used as an error correction term in modeling the short run relationships between the variables. ECM equation based on ARDL framework in general can be written as follows:

$$\Delta y_t = \alpha_0 + \sum_{i=1}^{m} \beta_{1i} \Delta y_{t-i} + \sum_{j=0}^{m} \gamma_{1j} \Delta x_{t-j} + \alpha_1 u_{xt-1} + \varepsilon_t \quad (2)$$

$$\Delta x_t = \alpha_0 + \sum_{j=1}^{m} \gamma_{2j} \Delta x_{t-j} + \sum_{i=0}^{m} \beta_{2i} \Delta y_{t-i} + \alpha_1 u_{yt-1} + \varepsilon_t \quad (3)$$

where u_{yt-1} and u_{xt-1} is an error correction term or cointegration vector derived from co-integration test. The x_t causes y_t if all the γ_{1j} in equation (2) is significant regardless of β_{2i} in equation (3). On the other hand, y_t causes x_t if all the β_{2i} in equation (3) is significant regardless of γ_{1j} in equation (2). While the bidirectional causality exist between y_t and x_t if both γ_{1j} and β_{2i} respectively are significant. The coefficient, α_1 in both equations is referring to the error correction coefficients that also describe the degree of adjustment speed towards equilibrium.

The analysis in this study involves the use of annual data from 1980 - 2013 which consists of 34 observations. Data for crime rate as a proxy to crime activities (CR) and the real GDP per capita as a proxy to economic growth (RGDPK) were obtained from the Department of Statistics, Malaysia and Thomson Datastream. Both variables, the CR and RGDPK are then transformed into logarithmic form.

4 Empirical Results

Rough inspection on the series variables shows that in general, both variables, the crime activities and economic growth exhibits increasing trend across the periods, except in years in which the is a fall in the CR and RGDPK series. For example in 1986 until 1989, a series of CR showed a downward trend. Similarly, in 1999-2000 and 2008-2013 in which a series of CR showed decreasing trend as shown in FIGURE 1.

However, this observation is somewhat surprising. Is it possible that the decline is due to the impact of the Asian financial crisis that occurred in 1997-1998, or may also be due to the implementation of a fixed exchange rate policy and capital control by the government in September 1998? Besides, is there possibility that a decline in 2008-2013 caused by the impact of the global financial crisis in 2007-2009 and also the increase in world crude oil prices? If this is true, then the existence of an economic crisis (unstable economic) which gives negative impact to the domestic economy may also lead to a decrease in criminal activities. This means there is a significant relationship between the economic crisis or economic instability with criminal activities. In short, these macroeconomic data gives the impression that the good economies can increase criminal activities and the opposite is hold. Bad economies may reduce the criminal activities. Thus showing a positive relationship between the development or economic growth with criminal activities.

Compared to criminal activities, the trend of the economic growth represented by the RGDPK increased continuously except in the years in which the Asian and financial crises occurred. However, this situation has certainly expected and not surprising.

Summary descriptive statistics for crime rate (LCR) and real GDP per capita (LRGDPK) in the logarithmic form shown in TABLE 1. Compared to LRGDPK, LCR has higher first and second moments (i.e. mean and standard deviations). However, both the LCR and LRGDPK have not much different in terms of third and fourth moments (i.e. skewness and kurtosis). Both have relatively small and negative values of skewness and the kurtosis values are also small and less than 3 showing both the data characterized by normal distribution and less affected by structural change asymmetric effect. The normal assumption is met and supported by the Jarque-Bera statistic which is relatively small and insignificant.

Although the cointegration testing procedure using ARDL approach does not require pre-test for unit root, this test is still needs to be done to ensure that no variable has the order of integration beyond the *I*(1). Unit root test based on the ADF_c statistic (assuming constant hold) and $ADF_{c,t}$ (assuming constant and trend hold) in TABLE 1 shows that both the LCR and LRGDPK stationary at first difference and have similar level of integration of *I*(1) showing the cointegration test based ARDL approach is suitable to be used and the cointegration results are shown in TABLE 2. By using ARDL method with 8 maximum lags for both dependent and dynamic regressors, the chosen (best) model with the lowest Schwarz Information Criterion (SIC) value was ARDL (3, 0) out of 72 models evaluated. The top 20 models selected based SIC are shown in FIGURE 2.

Cointegration test results using ARDL bound test showed a significant relationship between crime activities with economic growth in the long run. This indicated by the significant *F* statistic and greater than the upper critical value at one percent (1%) significance level (i.e. 5.74 > 5.58) as shown in TABLE 2. This in turn gives the indications of both variables tend to integrate and move together towards long run equilibrium.

The coefficients of the long run equation between criminal activities with economic growth are shown in TABLE 3. As expected and previously discussed, the relationship between crime activities and economic growth is positive in which economic growth gives positive impact on the criminal activities but harmful, as shown by the positive coefficient of LRGDPK (i.e. 0.931) and significant at one percent (1%) level. While the long run mean average for criminal activities is amounted to 2.47.

Analysis of short run relationships between criminal activities and economic growth using ECM based ARDL framework is shown in TABLE 4. The test results showed the significant bidirectional causality between criminal activities and economic growth. This means, economic growth affects or is the cause of criminal activities, and criminal activities also affect or is the cause of economic growth. These were demonstrated by the significant *F* statistics as in TABLE 4. While a temporary disequilibrium in the long run is corrected through a long run adjustment indicated by the error correction coefficient (ECT). In this case, the correction of the disequilibrium and speed of adjustment towards long run equilibrium is at slow and moderate pace by about 35 percent.

In addition, almost the entire estimation on the short run model surpassed the diagnostic test as shown in TABLE 4. Furthermore, through stability testing using Cumulative Sum (CUSUM), the parameters (coefficients) and the variance of the model also appeared to be stable as shown in FIGURE 3.

5 Conclusion

Simple logic indicates that, in good economic conditions, criminal activity should decrease. The better a country's economy means more jobs created, less unemployment, improving income levels and consequently less criminal activity. However, this does not always happen. The opposite is true where criminal activity tends to increase although at the time of good economies.

In this study, we re-examine the relationship between crime and economic growth in Malaysia for the periods of 1980 to 2013 using ARDL method to establish the long-run and short run relationship as well as the direction of causation between variables. We found strong evidence of long-run cointegration where the impact of economic growth towards crime in the long run was found to be positive and statistically significant. In the short run, bidirectional causation between crime and economic growth was also found to be significant. Eventually, this study is consistent with the economist arguments that good economies tend to create more crime, and the opposite occurs during bad economies.

Therefore, the government should not only aim for economic growth, but must ensure that more employment opportunities are created, wage rates are increased and basic necessities are provided to every citizen especially during good times, as well as tighten the enforcement of crime laws so that crime will be continuously reduced and under control. Although this study in not comprehensive, it proved fruitful in indicating that real GDP per capita has an effect on violent crime rates in Malaysia. Hopefully, this study provides some useful information to policy makers.

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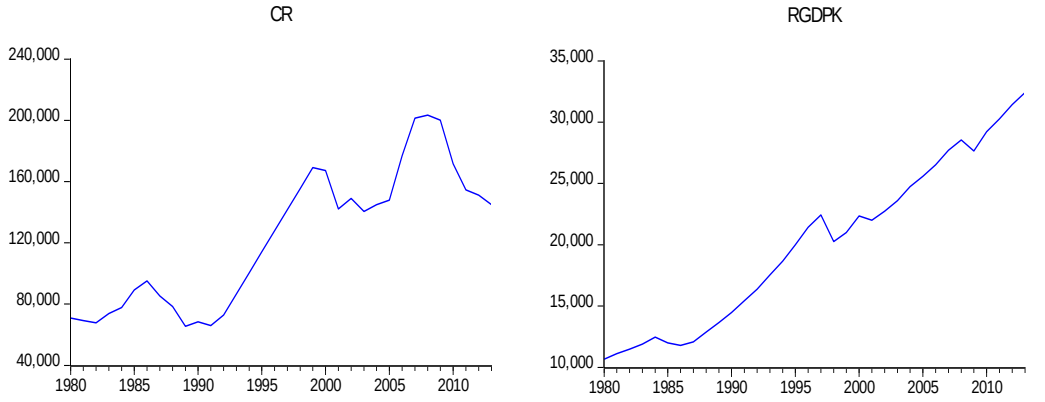

FIGURE 1: Crime Rate and Real GDP Per Capita

TABLE 1: Summary Descriptive Statistics

	LCR	**LRGDPK**
Mean	11.648	9.848
Standard Deviation	0.384	0.355
Skewness	-0.132	-0.189
Kurtosis	1.508	1.643
Jarque-Bera Statistic	3.251	2.812
ADF_c	$I(1)$	$I(1)$
$ADF_{c,t}$	$I(1)$	$I(1)$

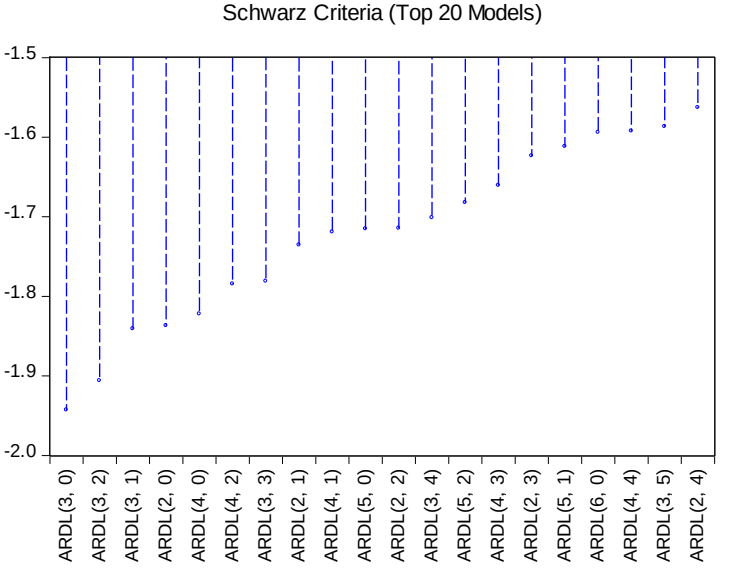

FIGURE 2: Top 20 Models Selected By SIC

TABLE 2: ARDL Bound Test

***F*-Statistic**	**Critical Value Bounds**					
	***I*(0)**			***I*(1)**		
5.739***	**10%**	**5%**	**1%**	**10%**	**5%**	**1%**
	3.02	3.62	4.94	3.51	1.16	5.58

Notes: ***, ** and * denote rejection at 1%, 5% and 10% significance levels respectively.

TABLE 3: Long Run Regression

Dependent Variable: LCR		
Variable	**Coefficient**	**Standard Error**
Constant	2.471*	1.412
LRGDPK	0.931***	0.142

Notes: ***, ** and * denote rejection at 1%, 5% and 10% significance levels respectively.

TABLE 4: Short Run Relationship (Causality)

Null Hypothesis: ΔLRGDPK Does Not Causes ΔLCR		
	F-Statistic	ECT
$\Delta LRGDPK \nRightarrow \Delta LCR$	4.132*	-0.347***
Diagnostic Test		
JB	0.524	
χ^2_{SC}	0.450	
χ^2_{ARCH}	0.379	
Null Hypothesis: ΔLCR Does Not Causes ΔLRGDPK		
	F-Statistic	ECT
$\Delta LCR \nRightarrow \Delta LRGDPK$	648.084***	0.073***
Diagnostic Test		
JB	36.207***	
χ^2_{SC}	0.288	
χ^2_{ARCH}	0.021	

Notes: ***, ** and * denote rejection at 1%, 5% and 10% significance levels respectively. $\nRightarrow$ denotes 'does not cause to'.

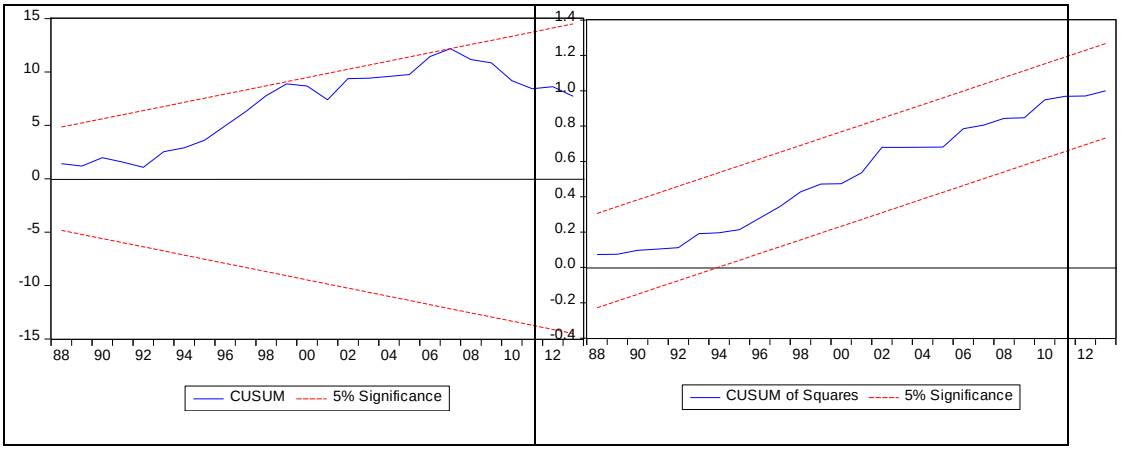

FIGURE 3: CUSUM and CUSUM of Squares Test