Multi-Factor Crime in Malaysia, 1980 – 2013: Bounds Testing of Level Relationships and Granger Non-Causality Analysis

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***Abstract* - This study examines the relationship between criminal activities and the multi-macroeconomic factors of economic growth, unemployment, poverty, population and inflation in Malaysia from 1980 to 2013. The ARDL bounds testing of the level relationship was used to establish the long-run relation, and the Toda-YamamotoAugmented VAR approach was used to test the short-run impact based on partial Granger non-causality analysis. Empirical results suggest that economic growth, inflation, poverty and population are significant factors affecting criminal activities in Malaysia with economic growth and poverty recording positive effects, whereas negative effects were recorded for inflation and population in the long-term. Further investigation using Granger non-causality analysis revealed that only population does Granger caused the criminal activities in the short-run. The findings provide useful information for policymakers to strengthen the existing crime-related policies in order to improve safety and security while maintaining economic sustainability in Malaysia.**

***Keywords* -** *Malaysia, crime, macroeconomic factors, bounds test, augmented VAR*

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I. Introduction

About four decades ago, growth in the Malaysian economy was largely driven by growth in the manufacturing and agricultural sectors. In 1980, Malaysia‘s Gross Domestic Product (GDP) at constant prices was approximately RM147 billion and increased to RM191 billion in 1984 with a growth rate of 5% to 7% (DOSM, 2017). Malaysia’s population in 1980 was 13.8 million people which increased to 15.4 million in 1984. Meanwhile, the poverty rate in 1980 was relatively high at 34.1% which decreased to 20.7% in 1984. A decade later, Malaysia’s GDP grew to RM263.4 billion in 1990 with a growth rate of around 9%. This achievement was accompanied by an increase in population to 18.1 million people in the same year. The poverty rate continued to decline to 15.1%. This positive achievement was driven by the implementation and reinforcement of the existing government policies such as Malaysia’s national plans, new economic policies, tax system reforms, privatisation policies and more effective budgeting strategies as well as the effects of economic recovery that took place during the period.

A decade later, Malaysia’s GDP once again experienced an increasing and positive growth in 2000 to RM523.4 billion with a growth rate of approximately 8.8% despite challenges and pressures following the Asian financial crisis in 1997-1998. At the same time, Malaysia’s total population grew to 23.4 million people with a poverty rate dropping to 7.7%. In 2013, more than a decade later, Malaysia’s GDP increased almost twofold to

RM955.2 billion with a moderate growth rate of 4.7%. Meanwhile, the population grew steadily to 30.2 million in 2013 with a relatively low poverty rate of about 1.2% (DOSM, 2017).

According to Malaysian statistics, inflation and unemployment rates are at stable levels except where inflation and unemployment rates recorded relatively higher values due to pressure on the economy such as economic recession and financial crisis. For example, in 1980, 1981, 1982, 1998 and 2008, inflation was recorded at 6.7%,9.8% 5.7%, 5.2% and 5.4% respectively (DOSM, 2017). On the other hand, the unemployment rate was relativelyhigher at more than 5% from 1984 to 1989 with the highest recorded in 1986 of 7.4%. In 1980, the inflation and unemployment rates were 6.7% and 5.3% respectively. However, this figure decreased and stabilised at 2.1% and 3.1% respectively in 2013.

Despite this encouraging economic environment achievement, positive growth in the Malaysian economy is also accompanied by an increase in the crime index (violence and property crimes). In 1980, the number of crimes recorded was 70,816 cases which increased more than double two decades later to 167,173 cases in 2000. This number increased to a record of 203,440 cases in 2008 but started to decrease in subsequent years to 144,944 cases in 2013 (DOSM, 2017; RMP, 2017). This reduction may be due to the Royal Malaysia Police's strategic plan to reduce the crime rate in line with the Government Transformation Plan (GTP) under New Key Result Areas (NKRAs) (Teh, 2015). However, this number is still alarmingly high.

Table 1: Selected World Crime Index, 2018

Rank	Country	Crime Index	Safety Index
1	Venezuela	82.59	17.41
2	Papua New Guinea	79.95	20.05
3	Honduras	78.89	21.11
4	South Africa	75.71	24.29
5	Trinidad And Tobago	72.22	27.78
6	Brazil	70.55	29.45
7	El Salvador	69.72	30.28
8	Bangladesh	68.52	31.48
9	Namibia	68.22	31.78
10	Syria	67.74	32.26
11	Jamaica	66.87	33.13
12	Puerto Rico	64.94	35.06
13	Peru	63.91	36.09
14	Nigeria	63.12	36.88
15	Malaysia	63.05	36.95

Source: Numbeo (2018a).

Table 2: Selected Asia Crime Index, 2018

Rank	Country	Crime Index	Safety Index
1	Bangladesh	68.52	31.48
2	Syria	67.74	32.26
3	Malaysia	63.05	36.95
4	Mongolia	62.56	37.44
5	Cambodia	54.38	45.62
6	Vietnam	52.22	47.78
7	Maldives	51.70	48.30
8	Pakistan	51.23	48.77
9	Iran	49.40	50.60
10	Lebanon	49.16	50.84

Source: Numbeo (2018b).

Table 3: Selected South-Eastern Asia Crime Index, 2018

Rank	Country	Crime Index	Safety Index
1	Malaysia	63.05	36.95
2	Cambodia	54.38	45.62
3	Vietnam	52.22	47.78
4	Thailand	47.25	52.75
5	Indonesia	44.72	55.28
6	Philippines	40.13	59.87
7	Singapore	16.23	83.77

Source: Numbeo (2018c).

This concern is supported by the crime statistics report by Numbeo (2018a; 2018b; 2018c) where Malaysia was classified as having one of the world's highest crime indexes in 2018. It was ranked 15th with an index value of 63.05 and was among the world's lowest security indexes of 36.95 (Table 1). While at the Asian level, Malaysia was ranked as the third highest crime and least secure index (Table 2) compared to neighbouring countries such as Vietnam and Cambodia which were relatively safer with lower crime indexes. Additionally, at the Southeast Asian level, Malaysia was ranked first in the list of the highest crime index in the region and is classified as the least secure in the Southeast Asian region compared to other ASEAN countries (Table 3).

From previous discussions, it is evident that the drastic increase in crime index up to 2008 is extremely alarming despite the decline in subsequent years. In addition to criminal law enforcement, and socio-economic, psychological and demographic factors, other factors could also contribute to the rise in crime index in Malaysia such as macroeconomic factors. These have not been discussed sufficiently in previous studies, especially in the context of crime in Malaysia. These weaknesses and disadvantages motivate us to study economic-related factors that could play a significant role in contributing to the rise of criminal cases in Malaysia. Such a study would help guide policymakers and related laws in an effort to reduce crime while maintaining economic stability and security in Malaysia. This study examines the relationship between criminal activities (crime index) and multi-macroeconomic factors such as economic growth, unemployment, poverty, population, and inflation in Malaysia from 1980 to 2013.

The remainder of the paper is organised as follows. The next section reviews the relevant literature. This is followed by the discussion of the research methodology, empirical results, and findings before drawing to a conclusion.

II. Literature Review

The economics of crime was first introduced by Becker in 1968 in his paper entitled "Crime and Punishment". Becker's (1968) ideas are based on the assumption that a person will commit or engage with an offence or crime if the expected utility exceeds the utility that can be obtained from doing other activities (e.g. in terms of time and resources). According to Haddad and Moghadam (2011), the tendency to engage in risky criminal work occurs when the expected net returns exceed the returns earned from other (legal) jobs.

From a theoretical viewpoint of the economics of crime, a set of theories predicts that property crimes should increase during economic difficulty. This is also called motivational theory. Another theory predicts that property crimes may decline during the economic recession. This is also called an opportunity theory (Luiz, 2001). While the theory of motivation directly explains the positive relationship between property crime and economic crisis, opportunity theory explains this relationship negatively whereby limited property can be stolen during a crisis or economic recession as many of the unemployed stay which can increase control and security of residential premises.

The study and understanding of criminal activity driven by problematic behaviour are important and has been examined from different viewpoints such as sociology, psychology, political science, economics and anthropology with the aim to overcome or mitigate these increasingly tangible crimes (Meera & Jayakumar, 1995; Masih & Masih, 1996).

Most criminal activities are aimed at generating income (Manzoni, Brochu, Fischer & Rehm, 2006). Even the theory of economics of crime models by Becker (1968) and Ehrlich (1973) portrays crime as being aimed at generating income and takes time to happen (Haddad & Moghadam, 2011). However, criminal activity (e.g. illegal drug use) is the largest contributor to social costs (Manzoni, Brochu, Fischer & Rehm, 2006). For example, a study in Germany shows that criminal activity costs the community in the form of "fear" and "anxiety" (Brück &Müller, 2010). According to Brück and Müller (2010), unlike terrorism, criminal activity (though not all) may also affect the behaviour, mental health, welfare and priorities of the public who are driven by fear, especially if the criminal activity is frequent. Furthermore, compared to property crime, violent crime is less sensitive to economic conditions (Gould, Weinberg & Mustard, 2002).

Several studies examined the factors determining the occurrence of criminal activity. For example, studies on economic factors as determinants of crime include Bonomo and Sullivan (1968), Becker (1968), Ehrlich (1973), Ehrlich (1996), Luiz (2001) and Khan, Ahmed, Nawaz and Zaman (2015). Other studies focus on politics, social, demography, psychology and law or justice (Bechdolt JR, 1975; Tatalovich, 1976; Howsen & Jarrell, 1987; Meera & Jayakumar, 1995; Masih & Masih, 1996; Manzoni et al., 2006; Rickman & Witt, 2007; Buonanno & Montolio, 2008; Loureiro, Mendonca, Moreira & Sachsida, 2009; Aaltonen, Kivivuori & Martikainen, 2011; Haddad & Moghadam, 2011; Khan et al., 2015; Eriksson, Hjalmarsson, Lindquist & Standberg, 2016; Tarling & Dennis, 2016). Others focus on factors causing fear of crime and violence (Vitèlli & Endler, 1993; Bennett & Flavin, 1994; Miceli, Roccato & Rosato, 2004; Brück & Müller, 2010; Khruakham & Lee, 2014; Crowl & Battin, 2016). However, Masih and Masih (1996) theoretically classified factors that can influence rates or criminal activity into demographic-socio-economic, economic and barrier factors.

Of the numerous factors that might influence criminal activity, Raphael and Winter-Ebmer (2001) showed that unemployment is a major contributor to criminal activity, especially property crime (see also Howsen & Jarrell, 1987; Carmichael & Ward, 2001; Phillips & Land, 2012; Andresen, 2012). In addition, unemployment can influence criminal activities via criminal motivation and criminal opportunity based on the Cantor-Land model(refer to Phillips & Land, 2012 for a detailed explanation of the model).

The relationship between unemployment and crime is positive and significant (Chiricos, 1987; Ralston, 1999). According to Haddad and Moghadam (2011), the unemployed especially the youth have a higher probability of engaging in criminal activity. This probability is supported by a study that found the unemployment rate among youths has a positive and significant relationship with the property crime rate (Meera & Jayakumar, 1995; Buonanno & Montolio, 2008). Evidence of this positive and significant relationship was also found in Altindag (2012). For example, an increase in unemployment increases criminal activities in Malaysia (Meera & Jayakumar, 1995) and in Pakistan (Khan et al., 2015). However, in separate studies, no relationship between crime and unemployment was found for the case of England and Wales (Hale & Sabbagh, 1991).

Besides unemployment and employment, other factors such as poverty also have a significant impact on crime, especially property crime (Howsen & Jarrell, 1987; Kelly, 2000) where there is a positive relationship between crime and poverty (Khan et al., 2015). However, according to Aaltonen et al. (2011) in his findings in Finland, poverty and socio-economic factors are generally no longer seen as significant factors for crime. However, the findings might not be appropriate for other contexts, especially developing or less developed countries where poverty and socio-economic factors are still very relevant.

Other factors such as economic growth (income) were also found to have a significant positive impact on crime (Meera & Jayakumar, 1995; Haddad & Moghadam, 2011; Mulok, Kogid, Lily & Asid, 2016). For example, studies in Malaysia suggest that an increase in income or economic growth increases criminal rate (Meera & Jayakumar, 1995; Mulok et al., 2016). In addition, inflation also has a significant impact on criminal activity. Inflation is an important predictor variable to changes in property crime (Devine, Sheley & Smith, 1988; Ralston, 1999) where the relationship between inflation (CPI) and crime is positive (Yearwood & Koinis, 2011). Other factors such as tourism also affect criminal activity (Howsen & Jarrell, 1987) where the relationship is positive (Montolio & Planells-Struse, 2016).

III.Methodology

The basic crime function used in the current study can be written as:

$$C = f(X) \tag{1}$$

or

$$C_t = \alpha + \beta X_t + u_t \tag{2}$$

where C_t is the crime rate or activities at time t; X_t is macroeconomic factors (i.e., economic growth, unemployment, poverty, population, and inflation) at time t; α and β are unknown parameters to be estimated, and u_t is random disturbance at time t.

For empirical analysis, this study employed the ARDL bound test approach in analysing the long-run relationship between variables. The main advantage of this method is that it can be applied regardless of whether the regressors are *I*(0) or *I*(1). In addition, this approach is suitable for time series data that might be affected by the structural change and highly capable of analysing small sample sizes and limited data (Pesaran, Shin and Smith, 2001).

Prior to cointegration analysis, unit root testing needs to be conducted to ensure no variable has a level of integration greater than one. The stationarity test in this study is conducted using the Augmented Dickey-Fuller unit root test (Dickey & Fuller, 1981). For cointegration analysis, the general ARDL model (Pesaran et al., 2001) can be written as follows:

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 x_{t-1} + \sum_{i=1}^{m} \beta_i \Delta y_{t-i} + \sum_{j=0}^{m} \gamma_j \Delta x_{t-j} + u_t \tag{3}$$

where α_0 is constant and u_t is white noise disturbance error. Two separate statistics can be used to test the existence of long-run relationship: the *F*-test for H_0: $\alpha_1 = \alpha_2 = 0$ and *t*-test for H_0: $\alpha_1 = 0$ in equation (3). However, the cointegration analysis in this study will adopt the F-test approach. Two borders asymptotic criticalvalues given for cointegration test when independent variables are *I*(*d*) (where $0 \leq d \leq 1$): lower critical value when the regressor is assumed to be *I*(0) and upper critical value when the regressor is assumed to be exactly *I*(1).If the test statistic is greater than the upper critical value, it can be concluded that a cointegration relationship exists between the variables. If the test statistic is less than the lower critical value, then the null hypothesis of nocointegration cannot be rejected. The existence of cointegration test results cannot be determined (or inconclusive)if the test statistic is between the lower and upper critical values. In addition, the long-run ARDL regression equation in general form can be written as

$$y_t = \alpha + \sum_{i=1}^{p} \beta_i y_{t-i} + \sum_{i=0}^{q} \gamma_i x_{t-i} + \varepsilon_t \tag{4}$$

Further analysis on the causal relations was tested using the Toda-Yamamoto approach (Toda & Yamamoto, 1995). The approach is considered to be more competent and has greater ability for features of the cointegration process and it overcome problems relating to invalid asymptotic critical values when causality tests are conducted on a non-stationary variable series. This approach involves an estimate of VAR (*k*+*dmax*) model where *k* is the optimal lag length in the original VAR system and *dmax* is the maximum integration level for variables in the system. The approach uses a modified Wald (MWald) test for zero constraints on parameters in the VAR (*k*) model, not including the *dmax*. The Toda-Yamamoto augmented VAR causality approach in the bivariate system can be written as follows:

$$y_t = \alpha_1 + \sum_{i=1}^{k+d_{max}} \beta_{1i} y_{t-i} + \sum_{i=1}^{k+d_{max}} \gamma_{1i} x_{t-i} + u_t \tag{5}$$

$$x_t = \alpha_2 + \sum_{i=1}^{k+d_{max}} \beta_{2i} y_{t-i} + \sum_{i=1}^{k+d_{max}} \gamma_{2i} x_{t-i} + v_t \tag{6}$$

where, α is constant, β and γ are unknown parameters, *k* is the optimal lag length and *d* is the maximum integration level of variable series in the system. Meanwhile, the *u* and *v* are white noise error terms. The lag length *k* is initially selected based on the lowest value of Schwarz Information Criterion (SIC). Later, more lags are added depending on the highest order of integration (*d*) for the variable series *yt* and *xt*. The significance test is carried out on the parameters in the VAR system only up to (*k*) lag(s), not including the additional (*d*) lag in determining the causal relationship between *yt* and *xt* in the VAR system. The x_t causes y_t if joint test of all the γ_{1j} in equation (5) is significant regardless of β_{2i} in equation (6). On the other hand, y_t causes x_t if joint test of all the β_{2i} in equation (6) is significant regardless of γ_{1j} in equation (5). Bidirectional causality exists between y_t and x_t if joint test for both γ_{1j} and β_{2i} are significant.

The analysis involves the use of annual data from 1980 to 2013 which consists of 34 observations based on data availability (limited data available for poverty and crime). Data for total crime (index) as a proxy for crime activities (CR), real GDP (RGDP), total population (POP), poverty rate (POV), inflation rate (IN) and unemployment rate (UN) were obtained from multiple sources, the Royal Malaysia Police (PDRM), the Department of Statistics, Malaysia and Thomson Datastream. All variables are then transformed into logarithmic form (L). It is also worth noting that some of the observations for particular years are not available or missing especially the criminal activities and poverty rate. As an alternative solution to the missing data, we employed the well-established and robust mathematic and statistical technique to fill up the missing data using linear interpolation.

IV. Empirical Results

Comparing the trend movements of criminal variables with macroeconomic factors as shown in Fig. 1, there are three possible outcomes. First, the trend movements of the real output (LRGDP) and the population (LPOP) are seen to be parallel to the trend of crime activities (LCR) movement which shows an increasing trend. Second, the trend movements of the poverty rate (LPOV), unemployment rate (LUN) and inflation rate (LIN) are contrary to the LCR movement where the LCR trend shows an increase, whereas the trend for LPOV, LIN and LUN show a decline. However, the trend movements of LUN and LIN are quite volatile showing a significant fluctuation over the period. Third, there are significant structural changes or fall (increase) of trends in certain years. However, these changes are seen to be more temporary. This study assumes that such changes have no significant (though there is only marginal) effect on the relationship between LCR and macroeconomic factors. Hence, the role and influence of the structural changes are not to be emphasised in this study.

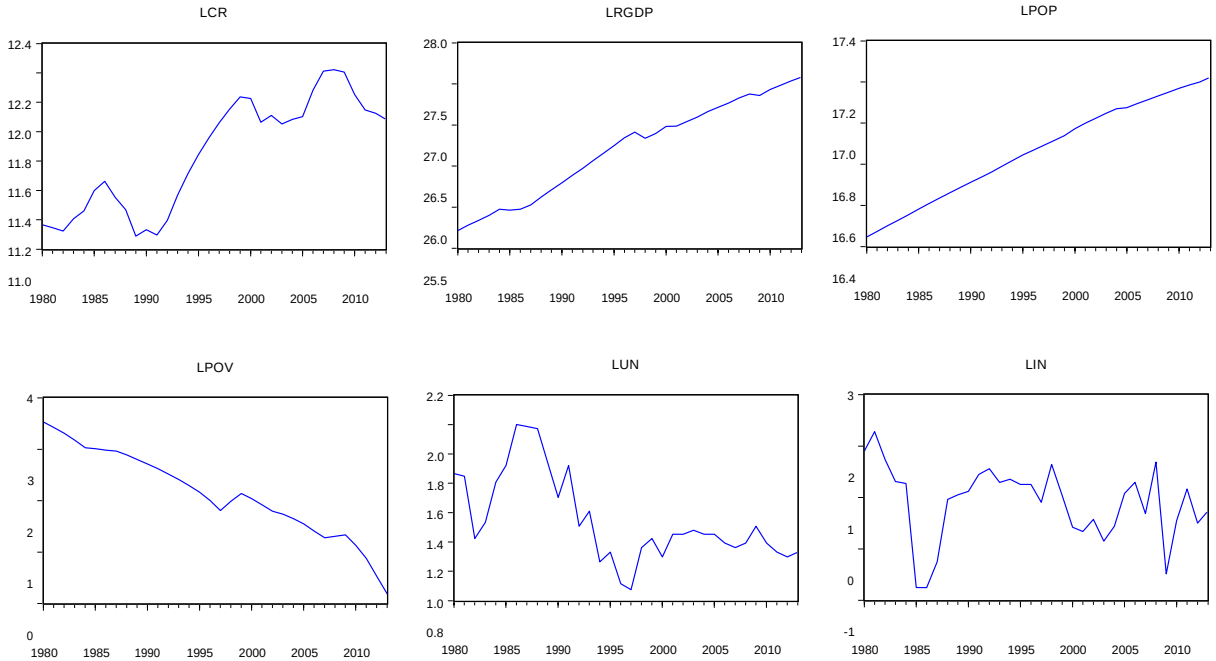

Figure 1: Crime and Macroeconomic Factors

The mean distribution of each variable is shown in Table 4. The LRGDP variable has the highest mean value followed by the LCR which are 26.71 and 11.65 respectively. Meanwhile, LIN and LUN have the lowest means which are 0.90 and 1.35 respectively. However, this statistic only shows the mean distribution of the individual variable and not a comparison of means between the variables. In addition, all variables have a small standard deviation between 0.24 to 0.84. Skewness values are also low and almost all negative (except LUN) between -0.68 to -0.13. The kurtosis value for each variable was relatively small and less than 3.0 except LIN where the kurtosis value was slightly larger than 3.0. Meanwhile, the assumption of normality for all variables is fulfilled and reflects that all variables are normally distributed. Unit root tests indicate that LIN and LPOP are stationary at level or have an order of integration of *I*(0). While other variables are stationary at the first difference or have an order of integration equal to *I*(1). Therefore, there is a difference in the order of integration between variables. This implies the importance of using a suitable model or method of analysis such as the ARDL model in analysing the relationships between variables that have a different order of integration.

Table 4: Summary Descriptive Statistics

	LCR	LIN	LPOP	LPOV	LRGDP	LUN
Mean	11.648	0.904	16.865	2.133	26.707	1.354
Standard Deviation	0.384	0.724	0.239	0.844	0.588	0.298
Skewness	-0.132	-0.684	-0.172	-0.292	-0.205	0.794
Kurtosis	1.508	3.123	1.753	2.407	1.690	2.725
Jarque-Bera Statistic	3.251	2.670	2.370	0.980	2.668	3.676
ADF	*I*(1)	*I*(0)	*I*(0)	*I*(1)	*I*(1)	*I*(1)

Out of 2,048 models that have been estimated using an automated selection procedure based on the Schwarz Information Criterion (SIC) value, the best model chosen based on the minimum value of SIC is ARDL (1, 2, 0, 2, 2, 0). A total of 20 best ARDL models based on the lowest SIC values are shown in Fig. 2. The result of the cointegration test based on ARDL bound test as in Table 5 shows that there exists a cointegration or long-run equilibrium relationship between criminal activities and other economic factors. This is shown by the F-statistic value greater than the upper bound critical value at 1% significance level which is 6.36 > 4.15. This illustrates that criminal variables and macroeconomic factors tend to co-move towards long-run equilibrium. Meanwhile, the associated long-run coefficients are shown in Table 6.

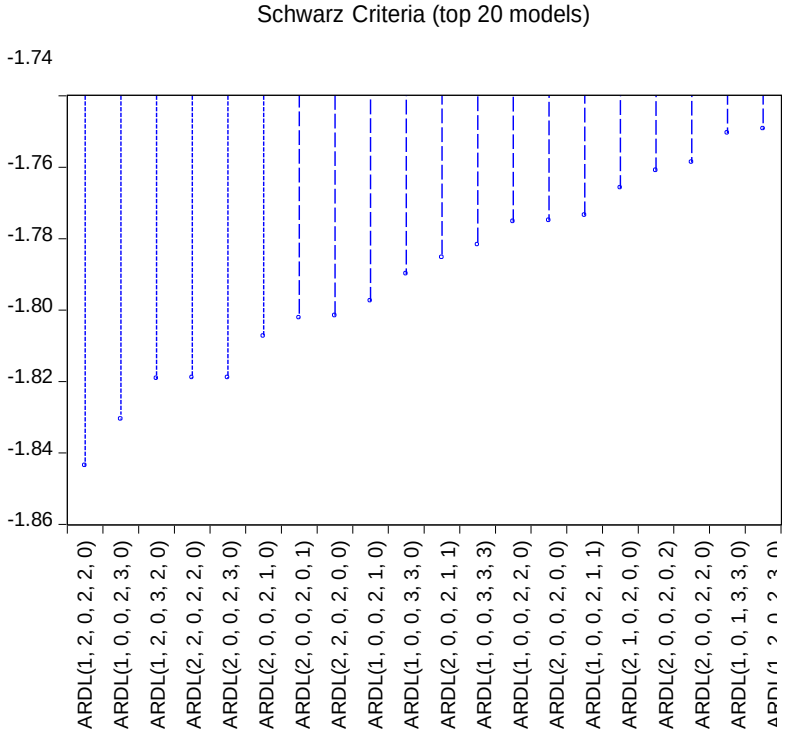

Figure 2: Top 20 Models Selected By SIC

Table 5: ARDL Bound Test

***F*-Statistic**	***I*(0)**		**Critical Value Bounds**	***I*(1)**		
6.360***	**10%**	**5%**	**1%**	**10%**	**5%**	**1%**
	2.08	2.39	3.06	3.00	3.38	4.15
Diagnostic Test	Jarque-Bera Statistic		χ^2_{SC}		χ^2_{ARCH}	
	1.489		2.103		1.598	

Notes: *** denote rejection at 1% significance level. JB indicate Jarque-Bera statistic for normality test, SC indicate Breusch-Godfrey Serial Correlation test, and ARCH indicate heteroscedasticity test using Engle's ARCH test.

From Table 6, almost all variables except unemployment (LUN) have a significant relationship and significant impact on the criminal variable (LCR) in the long-run. The real output (LRGDP) and poverty rate (LPOV) have a positive impact on the criminal activities but have negative effects on the inflation rate (LIN) and population (LPOP). The estimated results also indicate that LPOP and LRGDP variables have a greater impact on the LCR of -12.04 and 6.86 respectively. In other words, a 1% increase in population will reduce crime activities by 12.04% and 1% increase in total real output will increase the criminal activities by 6.86%. While a 1% increase in poverty and inflation rates increased and reduced crime activities by 1.23% and 0.30% respectively. The relationship between the unemployment rate and criminal activities was negative but not significant.

Table 6: ARDL Long-Run Regression

Dependent Variable: LCR		
Variable	**Coefficient**	**Standard Error**
Constant	29.978	26.436
LRGDP	6.864**	2.816
LIN	-0.304**	0.136
LPOP	-12.040**	5.483
LPOV	1.226*	0.640
LUN	-0.015	0.432

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

The Granger non-causality test results based on the Toda-Yamamoto Augmented VAR approach suggest that only population (LPOP) has a significant impact on criminal activities in the short-run. Population does Granger cause criminal activities as shown by a significant Wald-statistic, χ^2 at the 5% level. While the diagnostic test shows the model is free from the autocorrelation and heteroscedasticity problems and is normally distributed as shown in Table 7.

Table 7: Toda-Yamamoto Augmented VAR (k = 2, d_{max} = 1)

Dependent Variable: LCR			
Null Hypothesis		**χ^2-Statistic**	
$LRGDP \nRightarrow LCR$		3.809	
$LPOV \nRightarrow LCR$		0.838	
$LPOP \nRightarrow LCR$		8.570**	
$LIN \nRightarrow LCR$		0.017	
$LUN \nRightarrow LCR$		0.096	
Diagnostic Test	Jarque-Bera Statistic	χ^2_{SC}	χ^2_{ARCH}
	0.233	1.678	2.314

Notes: ** denote rejection at 5% significance level. $\nRightarrow$denotes 'does not Granger cause'.

V. Findings and Discussion

As the focus of this research paper is to discuss the relationship between criminal activities and some macroeconomic factors that contribute to the incidence of criminal activities in Malaysia, it is preferable if the relationship and the effect of these macroeconomic factors on criminal activities are discussed further. Some macroeconomic variables may have relatively 'unique' relationships with criminal activities that can challenge one's understanding of the issue. This study examines the relationship between macroeconomic variables and criminal activities, especially those that are deviated from theory or diverged from 'normal' relationships.

The empirical findings from the estimation of the criminal model show that the criminal activities have a significant relationship with the real output (LRGDP), the poverty rate (LPOV), inflation rate (POP) and population (LPOP). While the rate of poverty has a positive relationship with the criminal activities as expected, other variables have a 'unique' and unexpected relationship with criminal activities.

The positive relationship between criminal activities and poverty rate is in line with the findings from previous studies such as Khan et al. (2015). The higher the poverty rate, the higher the possibility of criminal activities. This situation can be explained easily. This is because those who are plagued by poverty usually live underprivileged and are trying to survive. They are likely to be involved in criminal activities such as stealing, robbing, snatching and possibly killing.

For relationship between criminal activities and real output growth, the empirical finding shows that an increase in economic growth is likely to result in an increase in criminal activities. This can be explained easily if these interpretations take into account the views of economists who tend to argue that better economic times increase crimes. Economic prosperity means more people can afford to buy valuable things which offer opportunities for crime such as stealing, robbing and house-breaking. There is also a higher demand for drugs and alcohol, and the violence that often accompanies their consumption (Mulok et al. 2016). The significant positive impact of economic growth on criminal activities in the current study supports the findings of Haddad and Moghadam (2011) and Mulok et al. (2016).

The empirical finding also shows that an increase in population size reduces the criminal activities. The current result contradicts the findings of Nolan III (2004) and Chamlin and Cochran (2004). The negative relationships may be explained through situations where an increase in population size may be dominated by an increase in the number of elderly people who were previously actively involved in criminal activities being less active and less likely to engage in criminal activities. Also, there is an increase in the number of young people or children with low self-esteem and are afraid to engage in criminal activities. The significant impact of population on crime was also supported by a Granger causality test showing that the population does Granger cause crime.

Meanwhile, the negative relationship between criminal activities and the inflation rate implying that an increase in inflation rate tends to reduce criminal activities. However, this result is contradicted with the findings from a number of empirical studies showing a positive relationship between inflation and crime such as Tang and Lean (2007), Tang (2009), Yearwood and Koinis (2011) and Tang (2011). The current study suggests that an increase in inflation rate tends to reduce criminal activities. This phenomenon may be explained by the indirect effects of an inflation rate on crime activities through economic growth. This is because the inflation rate is an 'evil' macroeconomic variable that can affect the economic growth of a country (Kogid, Asid, Mulok, Lily & Loganathan 2012) which, in turn, has an indirect effect on criminal activities.

In addition, the relationship between economic growth and criminal activities is positive (Mulok et al., 2016). Thus, the effect of an increasing inflation rate on criminal activities is indirect. This means that rising inflation rates tend to cause a fall in economic growth (output) and the downturn in economic growth tends to lead to a reduction in criminal activities due to the positive relationship between criminal activities and economic growth. This can also be explained as due to the rising cost of living; less people can afford to buy valuable things to steal. Another possibility is that the different unit of measurement of crime and inflation used in the studies by Tang (2009; 2011) and Yearwood and Koinis (2011) may lead to different effects of inflation on crime. For example, using consumer prices index (CPI) as a proxy to the inflation rate (instead of using change in CPI) may depict a different impact of inflation on crime. This is because the CPI is increasing over time if compared to change or rate in CPI (inflation rate). The same applies to crime either in the total number of crimes or rate (crime rate).

Other than the aforementioned significant variables, although the unemployment rate is regarded as a major contributor and significant factor to criminal activities (Raphael & Winter-Ebmer, 2001), the unemployment rate in the current study does not have a significant impact on crime in Malaysia. However, a number of empirical studies have showed a significant positive relationship between unemployment rate and crime including Ralston

(1999), Meera and Jayakumar (1995), Tang and Lean (2007), Buonanno and Montolio (2008), Tang (2009; 2011), Altindag (2012) and Khan et al. (2015).

VI. Conclusion

Effective policymaking that considers factors that reduce incentives for crime should be implemented as suggested by Haddad and Moghadam (2011). In addition, Gebo and Bond (2016) suggested that social problem solving such as criminal activity through collaborative efforts from all parties may be effective even though the cooperation from all parties is not easy to achieve.

This current study examines the relationship between criminal activities (crime index) and multi-macroeconomic factors such as economic growth, unemployment, poverty, population, and inflation in Malaysia. The empirical results suggest that in the long-run, economic growth, inflation, poverty and population are significant factors affecting the criminal activities in Malaysia with economic growth and poverty recorded positive effects, whereas negative effects for inflation and population. Further investigation revealed that only population Granger causes the criminal activities in the short-run. The results provide useful information for policymakers to strengthen the existing crime-related policies in order to improve safety and security while maintaining economic stability in Malaysia through the monitoring of movement of those significant variables.

In addition, government efforts to increase technical skills among the less educated population (i.e. via conventional education) especially the youth could also help increase the chances of getting a job requiring technical skills. This could reduce the unemployment rate in Malaysia further and eventually could help reduce the crime rates. Moreover, technically skilled workers can meet the demands of technology-based industries. Furthermore, one of the efforts towards becoming a high-income developed country is through the implementation of industry revolution 4.0 at the university level that can enhance the quality and technical skills of the labour force.

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