The Role of Social Factors in Explaining Crime

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Abstract

Utilizing Malaysia data from 1973 to 2008, the study reveals that crime can be influenced by population, fertility, unemployment, and GDP in either the long-run or short-run period. This study also further analysed beyond sample estimations of the variables involved and found that although violent crime can be explained in the short-run only from the VECM analysis, it is found to be explained by other explanatory variables in the long-run of beyond sample for at least 50 years ahead. It is important for policy makers to focus in both social structure and economic conditions to help prevent crime in the long-run.

Keywords: fertility; violent; property, unemployment, VECM; causality

1. INTRODUCTION

In 2004, Levitt published an interesting article in which he argued that crime activities hefty decline in the United States in 1990s was not caused by any factors postulated to explaining the decline all this while. His analysis found that the strong economy of the 1990s, changing demographics, better policing strategies, gun control laws, concealed weapons laws and increased use of the death penalty never contributed to the decrease in crime at that time but little. Contrariwise, Levitt (2004) found ample evidence that shows increasing prison populations, rise in the size of police force, crack epidemic decline, and the legalization of abortion were the real cause in the substantial decrease of crime rates at that time. The idea behind the relationship between legalized abortion and crime was built upon two hypotheses namely, unwanted children are at a greater risk for crime and legalized abortion leads to a reduction in the number of unwanted births. This hypothesis is parallel to that of conventional criminology theories which suggest that problematic children with stressful childhood are likely to become criminals in their adulthood (evidence can be found from studies by Farrington, 1996 for explanations on how problem families produce problem children). Interestingly, while predicting growth in crime rates in the eighties, Levitt (2004) found that the motivation factors differ from the demotivation factors in nineties.

All this while, economists' intervention in criminology studies were bounded to the facts that crime is an act that will sow the wind and reap the whirlwind of economics in a country. It is a well-known fact that crime will influence the transmission of economic growth through hindrance of foreign direct investment, constraints for investment in human capital, decline in competitiveness, reducing productive capacity, and increase in expenditure of unprofitable sector (crime fighting) to name a few. The role of fertility and demographic transition are also hypothesized to influence transition in economic growth from the unified

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growth theory perspective. However, these diverted causes of growth transmission were given less importance in the development of economics of crime model. At least, not until the provocative article by Levitt (2004). It is inevitable that there are various factors to account before one can analyse the crime decision of particular person. Akerlof (1997) in his paper on social distance argued that social decisions cannot be based on individuals values alone but must also take into consideration the social interaction of particular individuals in their decision making process. Becker's earliest framework (Becker, 1964; 1968; 1971; 1973; 1974) of social decisions was primarily explained on individual considerations alone on the ground that social interactions are not important since the externalities from them could be captured within the group.

Disagreeing, Akerlof (1997) articulated an improved rational choice analysis by incorporating social factors into the model. In his social interaction theory, Akerlof explains that social decisions such as the demand for education, the practice of discrimination, the decision to marry and bear children or the decision to engage in criminal activities are not as simple as intermediate microeconomics decision-making theory which was built upon various assumptions for simplification purposes. The improved rational-choice theory, although is an extension of Becker's earlier work, will be favouring the arguments by sociologists rather than economists since social decisions have social consequences which are interrelated with a particular individual and all the people and environment surrounding them - a consequence not borne by economists. Hence, growing researches (Dilulio, 1996; Levitt and Donohue, 2001 among the earliest) have turned their interest to certain sociological aspects such as income inequality, poverty, race, gender, and fertility to explain the incidence of crime. Criminology and socio-demographic issues has intersects and interacts with each other directly or indirectly while explaining their respective explananda, epistemological and scientific characteristics (South & Messner, 2000).

Enthused with the facts that social factors may explain the presence and/or absence of crime activities in a country, this study is initiated to empirically estimate the dynamic relationship between crime, unemployment, economic growth (GDP), population, and fertility rate in Malaysia. As a developing economy, Malaysia is in her struggle to increase economic growth for future development. However, social factors such as fertility and population size can bestow considerable impact towards her economic growth. Theoretically, low fertility rates will cause a decrease in the number of population in a country which in the long-run causes their labour force size to decline thus dampen its economic growth. On the contrary, high fertility rates can cause unanticipated increase in population size which in the long-run can cause various social problems such as crime, unemployment, and political turbulences in case where population increase higher than increase in national income thus widen the inequality gap. Several crime literatures can be found discussing on effects of population, neighbourhood and fertility as the cause of crime along with unemployment and equality. Studies on neighbourhood characteristics found that particular neighbourhood characteristics play an important role in determining crime notwithstanding family and individual characteristics (Billy & Moore, 1992; Brewster *et. al.,* 1993; Brewster, 1994; South & Crowder, 1999).

Generally, engaging in sexual activities take place earlier (Billy *et. al.,* 1994) and the risk of non-marital (teenage) expectant is greater (Brooks-Gunn, *et. al.,* 1993; Crane, 1991; Hogan & Kitagawa, 1985; Ku *et. al.,* 1993) in economically disadvantaged communities compared to privileged communities. Crime can also influence family-related demographic events indirectly when diminishing men's economic status and employment stability due to

criminal activities influence women's marriage and fertility patterns (Fossett & Kiecolt, 1993; Sampson, 1995; South & Lloyd, 1992a, 1992b). Unemployment and GDP on the other hand can be the indirect causes that trigger socio-demographic instability and inequality that explain crime in a country. There are bulk of research explaining crime-unemployment and crime-income in many countries using different types of data and methodology but results are still mixed and consensus on the types of relationship exists never been achieved to date (Becker, 1968; Ehrlich, 1973; Reilly and Witt, 1996; Papps and Winkelmann, 2000; Raphael and Ebmer, 2001; Edmark, 2005; Cantor and Land, 1985; Britt, 1994; Melick, 2004 among others). Masih & Masih (1996) initiated the use of cointegration and Granger causality test to examine the causal relationship between various socioeconomic variables and disaggregated crime data in Australia for the period of 1963 to 1990. They also go further to explain the dynamic linkages between crime and socioeconomic variables beyond the sample for policy implication purposes. However, the cointegration model is still less favoured in the field of economics of crime (Masih & Masih, 1996; Narayan & Smith, 2004; Narayan & Smith, 2006; Tang and Lean, 2007; Baharom and Habibullah, 2008; Baharom and Habibullah, 2009; Habibullah and Baharom, 2009 are among the few) despite the huge arguments and abundance research available in the particular field. As such, the structured of the paper follows. A brief background of Malaysia demographic issues is discussed in Section 2. Section 3 provides the intuitive account of the econometrics methodology employed before discussing results in more detail in Section 4. Some policy implications and conclusions of the study are made available in Section 5.

2. MALAYSIAN DEMOGRAPHIC ISSUES

Malaysia is a newly industrialized country with a record of strong economic performance and poverty reduction and a goal of transforming itself into a high-income and developed nation by the year 2020. The government are steadfast in improving the quality of life of the people and enlarging people's choice ranging from political, social and economic freedom. The economy expanded at a robust 5.8% annual rate in the 5 years to 2008, contributing to a reduction in overall poverty 5.7% in 2004 to 3.6% in 2007. In 2012, her gross domestic product increased further to 5.4 per cent against 4.9 per cent in the preceding quarter led by continued expansion in the Services and Manufacturing sectors.

At the same time, government responded proactively to mitigate the adverse effects of the global financial crisis by implementing two fiscal stimulus packages (one announced in November 2008 and the other in March 2009), easing monetary policy, and relaxing foreign investment restrictions on certain services and local equity requirements for newly listed companies. These policies envisage national unity as the goal of development and the two-pronged strategy to achieve it (1) the eradication of poverty and (2) the restructuring of society conducted within the context of rapid and continuous economic growth. It is evident that formulation of core development philosophy, policies and plans suited to particular circumstances and needs as executed by Malaysian government was the reason behind the 30 years of Malaysia's poverty reduction, growth and racial harmony success (Economic Planning Unit, 2004).

Table 1: Area Indices and the Malaysian Quality of Life Index (MQLI)

Index	2007	2008	% change (1990-2008)
Income & Distribution	121.5	124.3	*24.3*
Working Life	132.4	132.2	*32.2*
Transport & Communication	121.4	122.9	*22.9*
Health	129.8	129.1	*29.1*
Education	125.5	130.6	*30.6*
Housing	131.8	133.9	*33.9*
Environment	101.7	94.1	*-5.9*
Family Life	101.7	105.5	*5.5*
Social Participation	110.7	111.9	*11.9*
Public Safety	79.8	82.8	*-17.2*
Culture & Leisure	109.0	108.1	*8.1*
MQLI	115.0	115.9	*15.9*

Note: 1990 is used as the base year
Source: Economic Planning Unit (EPU)

The human development index (HDI) of Malaysia has improved in the year 1980 to 2010 with 1.1% rise annually. The HDI index for 2010 was 0.744 compared to 0.541 in 1980 placing the nation in ranking 57 out of 169 countries with comparable data. Concomitant with socio-economic development, numbers of social issues emerged that can paralyzed the economic progress in Malaysia such as increase mobility, city congestion, squatter settlements and crime rate. Although the overall Malaysian quality of life improved in the year 1990 to 2010, its public safety index, as reported by the Malaysia Quality Life Index (2008) shows a downward trend[1]. The 2008 MQLI report are supported with crime data from Royal Malaysia Police Department (RMPD) that keep increasing from 1983 to 2008.

Along with the macroeconomic instability, demographic variables have also been accused as the strongest determinant of crime rates in Malaysia (Sidhu, 2005). Further urbanization and population density also affect crime rates as shown by the crime rates between the states of Kuala Lumpur and Pulau Pinang with the comparatively more populous states of Sabah, Sarawak, Perak and Kedah. The former group displayed a higher index crime per 100,000 than the latter states (Sidhu, 2005). This encourages us to include population rate and fertility rate in our study to better explain Sidhu's (2005) findings with relevant data and quantitative modelling. To add to this, Malaysian current crime situation is worrying (Tang, 2009; Baharom and Habibullah, 2009; Habibullah and Baharom, 2009) and became a constant source of discussion and debate along the corridors of the managerial ranks within the police leadership (Sidhu, 2005).

This signifies the importance of the contribution to be made from empirical analysis in this paper since crime is not only a major statistical element in the Criminal Justice System but more importantly so, it effects the economy, social and international trade of the country indirectly. Hitherto, several studies has been conducted in the case of Malaysia to determine the exact relationship between crime rates and macroeconomic variables (Tang, 2009; Baharom and Habibullah, 2009; Habibullah and Baharom, 2009; Hamzah and Lau, 2011) but none of them included population and fertility rate in their economics of crime model. In fact, Baharom and Habibullah, (2009) fails to identify any relationship between crime and macroeconomic variables even though a rough looks at the figure prove that they move together. This result most probably is caused by the exclusion of some important variables that are left behind. This paper are anticipated to provides extra information on the relationship between crime and socio-demographic variables especially for the policy makers

and police department in both combating crime and improving economic and demographic instability.

3. METHODOLOGY

Data Description[2]

Time series data spanning from 1973 to 2008 are utilized in this study. All the crime data were obtained directly from the Royal Malaysia Police Department[3]. Macroeconomic variables (unemployment and GDP) are provided by the Department of Statistics while demographic variables (population and fertility rate) were downloaded from the World Bank websites. Following the research recommendations of Cherry (1999), variables utilized in this study were transformed into log-linear form to certify that the estimated coefficients are elastic except for population, fertility, and unemployment rate.

Crime Function Model

Following Becker (1968) and its extension in Ehrlich (1973), this study estimates following models of economics of crime which will be analysed differently for different categories of crime used in the study namely, total crime, property crime and violent crime for Malaysia;

Model 1: (total crime model);

$$ttl_t = \alpha + \beta_1 fert_t + \beta_2 gdp_t + \beta_3 ue_t + \beta_4 pop_t + \varepsilon_t$$

Model 2: (property crime model);

$$prop_t = \alpha + \beta_1 fert_t + \beta_2 gdp_t + \beta_3 ue_t + \beta_4 pop_t + \varepsilon_t$$

Model 3: (violent crime model);

$$vio_t = \alpha + \beta_1 fert_t + \beta_2 gdp_t + \beta_3 ue_t + \beta_4 pop_t + \varepsilon_t$$

where ttl is the total crime, prop refers to property crime while vio represent the violent crime model. α is the constant and β refers to the estimation parameters. $fert_t$, gdp_t, pop_t, and ue_t fertility rate, Gross Domestic Product growth rate, population growth rate and unemployment rate respectively.

The reason for dividing the crime categories into property, violent and total crime models is due to the fact that violent crime are unique case of crime activities which can be influenced by variety if motives and it may not operate in a predicted direction in the long-run as that which occurs to some extent with property crimes. Field (1990) argued that violent crime might be influenced by short-term influences which may be different from its long-term determinants. Hence, to identify any differences among the different categories of crime it is important to test the model separately.

Corman et. al., (1997) highlights two problems in empirical testing of crime models, mutual causality between crime and the deterrence variables in a dynamic way which is not easily modelled using ordinary regression methods being the first and relative contributions of independent deterrence variables are not clear if multicollinearity exists among them as the second problem which can be overcome using a vector autoregressive (VAR) model. Also, Corman et. al., (1997) pointed out that VAR is "*a useful alternative to the standard models in*

analysing what causes crime". The rest of the section will elaborate each steps required to complete the estimations in a VAR technique.

Univariate Unit Root Test

As a prerequisite for a time series analysis we adopt battery of univariate unit root test. The ADF (Dickey & Fuller, 1979), PP (Phillips & Perron, 1988) and KPSS (Kwiatkowski *et. al.*, 1992) test are employed to act as supplement of validity evident. It can be verification for the consistency of the results obtained. The three testing procedures are special on their own way. All the testing procedures share the same null proposition of a unit root except for the KPSS which test the null of stationarity.

Cointegration Test

When two or more variables in a system are found to be cointegrated, it is said to have a long-run equilibrium relationships. Granger (2004) pointed out that a pair of integrated series must have the property that a linear combination of them is stationary – they are cointegrated. The cointegration series developed by Johansen and Juselius (1988, 1990) provide a new insight in determining the long-run relationships between variables in a series before proceeding to the Granger causality test. Their test utilizes two likelihood ratios (LR) test statistics for the number of cointegrating vectors: namely the trace test and the maximum eigenvalue test. The Johansen procedure is well known in the time series literature and the detail explanation are not presented here.

Granger Causality Test

Engle and Granger (1987) exhibited that once variables are proven to be cointegrated, there will also be the existence of a corresponding ECM representation. This ECM implies that changes in the dependent variable are a function of the level of disequilibrium in the cointegrating relationship which captured by the error-correction term as well as changes in other explanatory variables. For cointegrated model, we will test for the Granger causality in Vector Error Correction Model (VECM) by testing the significance of the error-correction term.

Consider the equation below[4]:

$$\Delta ttl = \alpha_1 + \lambda_{t-1} + \sum_{i=1}^{n} \phi_{11} \Delta fert_{t-1} + \sum_{i=1}^{n} \varsigma_{12} gdp_{t-1} + \sum_{i=1}^{N} \omega_{13} \Delta ue_{y-1} + \sum_{i=1}^{N} \gamma_{14} pop_{t-1} + \varepsilon_1$$

$$\Delta fert = \alpha_2 + \lambda_{t-1} + \sum_{i=1}^{n} \phi_{21} \Delta ttl_{t-1} + \sum_{i=1}^{n} \varsigma_{22} gdp_{t-1} + \sum_{i=1}^{N} \omega_{23} \Delta ue_{y-1} + \sum_{i=1}^{N} \gamma_{24} pop_{t-1} + \varepsilon_2$$

$$gdp = \alpha_3 + \lambda_{t-1} + \sum_{i=1}^{n} \phi_{31} \Delta fert_{t-1} + \sum_{i=1}^{n} \varsigma_{32} \Delta ttl_{t-1} + \sum_{i=1}^{N} \omega_{33} \Delta ue_{t-1} + \sum_{i=1}^{N} \gamma_{34} pop_{t-1} + \varepsilon_3$$

$$\Delta ue = \alpha_4 + \lambda_{t-1} + \sum_{i=1}^{n} \phi_{41} \Delta fert_{t-1} + \sum_{i=1}^{n} \varsigma_{42} gdp_{t-1} + \sum_{i=1}^{N} \omega_{43} \Delta ttl_{t-1} + \sum_{i=1}^{N} \gamma_{44} pop_{t-1} + \varepsilon_4$$

$$\Delta pop = \alpha_5 + \lambda_{t-1} + \sum_{i=1}^{n} \phi_{51} \Delta fert_{t-1} + \sum_{i=1}^{n} \varsigma_{52} gdp_{t-1} + \sum_{i=1}^{N} \omega_{53} \Delta ue_{t-1} + \sum_{i=1}^{N} \gamma_{54} ttl_{t-1} + \varepsilon_5$$

Equation above consists of α as the constants, λ as the cointegration vector which is the Error Correction Term (ECT) and ϕ, ς, ω and γ refers to the estimation parameters. If the variables are found to be not cointegrated, then the following Granger causality test will be conducted based on standard VAR procedures. Although the cointegration test provides insight on the relationship shared among the variables in a system, it does not indicate the direction of causality of the variables included. Granger causality test helps us to determine the direction of causation of all the variables in the system (Engle and Granger, 1987) and come to the conclusion of which variable have influence on the other.

4. RESULTS AND DISCUSSION

Univariate Unit Root Test

All the three tests involved reveals that the tests statistics are smaller than the conventional significance level in their level form for each of the variables except GDP. Only GDP are stationary in the level form [i.e.: integrated of order 1 - $I(0)$] for all the tests carried out. Strong evidence was found for stationarity in all the tests' first difference form since the tests statistics are larger than the conventional significance level for all the variables[5].

Cointegration Test

After determining the stationarity properties of the variables, we proceed to determine the long-run equilibrium of the system under our investigation. We utilized the Johansen and Juselius (1988, 1990) in our study although our univariate unit root tests provide mixture of order of integration among the variables. This is supported by the argument in Johansen (1995) that states that having stationary variables in a system theoretically not an issue. The null hypothesis of no cointegrating vector (r=0) in favour of at least one cointegrating vector is rejected at 5 percent significance level for the first two model (see Table 2). In the case of total crime model and property crime model, it is noted that both the trace and the maximum eigenvalue tests led to the same conclusion—the presence of one cointegrating vector.

Rejecting the null hypothesis of no cointegration implies that the two variables do not drift apart and share at least a common stochastic trend in the long run. On the other hand, both the tests failed to reject the null hypothesis of non-cointegration in the case of violent crime even at the 10 per cent level. As predicted earlier, violent crime might portray different results that property crime due to the differences in the nature of the crime itself. Violent crime are non-pecuniary related by nature thus the cause of violent crime might be significantly different than that of property crime which primary focus is pecuniary gain. There are several arguments related to failure in identifying any significant relationship in a violent crime model. Underreporting problem acknowledged earlier should be among one of the possible explanations since violent crime such as rape, murder, assault, and voluntarily causing hurt victims usually know the doers hence discouraging police report. Another important explanation will be the hierarchical nature of uniform crime reporting problems (Levitt and Miles, 2004). For example, in a situation where a woman was raped and brutally murdered, only the murder case will be reported since it is more serious causing a loss of life.

Table 2: Cointegration Analysis

Panel A: Total Crime Model					
		$k = 1$ $r = 1$			
Null	**Alternative**	**λmax**		**Trace**	
		Unadjusted	**95% C.V.**	**Unadjusted**	**95% C.V.**
$r = 0$	$r = 1$	36.32 (0.03)*	33.88	81.35 (0.00)*	69.82
$r \leq 1$	$r = 2$	26.69 (0.65)	27.58	45.02 (0.09)	47.86
$r \leq 2$	$r = 3$	11.06 (0.64)	21.13	18.33 (0.54)	29.80
$r \leq 3$	$r = 4$	7.16 (0.47)	14.26	7.27 (0.55)	15.49
$r \leq 4$	$r = 5$	0.11 (0.74)	3.84	0.11 (0.74)	3.84
Panel B: Property Crime Model					
		$k = 1$ $r = 1$			
Null	**Alternative**	**λmax**		**Trace**	
		Unadjusted	**95% C.V.**	**Unadjusted**	**95% C.V.**
$r = 0$	$r = 1$	37.74 (0.01)*	33.88	83.22 (0.00)*	69.82
$r \leq 1$	$r = 2$	26.73 (0.06)	27.58	45.47 (0.08)	47.86
$r \leq 2$	$r = 3$	11.19 (0.63)	21.13	18.75 (0.51)	29.80
$r \leq 3$	$r = 4$	7.42 (0.44)	14.26	7.55 (0.51)	15.49
$r \leq 4$	$r = 5$	0.13 (0.72)	3.84	0.13 (0.72)	3.84
Panel C: Violent Crime Model					
		$k = 1$ $r = 0$			
Null	**Alternative**	**λmax**		**Trace**	
		Unadjusted	**95% C.V.**	**Unadjusted**	**95% C.V.**
$r = 0$	$r = 1$	27.30 (0.23)	33.88	68.24 (0.07)	69.82
$r \leq 1$	$r = 2$	22.97 (0.17)	27.58	40.94 (0.19)	47.86
$r \leq 2$	$r = 3$	12.99 (0.45)	21.13	17.97 (0.57)	29.80
$r \leq 3$	$r = 4$	4.98 (0.74)	14.26	4.98 (0.81)	15.49
$r \leq 4$	$r = 5$	0.00 (0.99)	3.84	0.00 (0.99)	3.84

Notes: Asterisks (*) denote statistically significant at 5% level. k is the lag length and r is the number of cointegrating vectors(s). The unadjusted statistics are the standard Johansen. Figures in the parenthesis are the probabilities of rejection for Johansen tests.

VECM Granger Causality Test

Prior to the cointegration properties of the system, we proceed to examine the causal linkages among the variables. Population is found to be endogenous in both the total crime model and property crime model. This is shown in population equation where the ECT is statistically significant suggesting that population solely bears the brunt of short run adjustment to bring about the long run equilibrium in both total crime and property crime model (refer to Table 3). The *t*-statistics on the lagged residual are also statistically significant and negative in both models supporting the Johansen results reported earlier. The

speed of adjustment for total crime model is -0.254 while property crime model reports -0.153 speed of adjustment.

Table 3: VECM Granger Causality Results

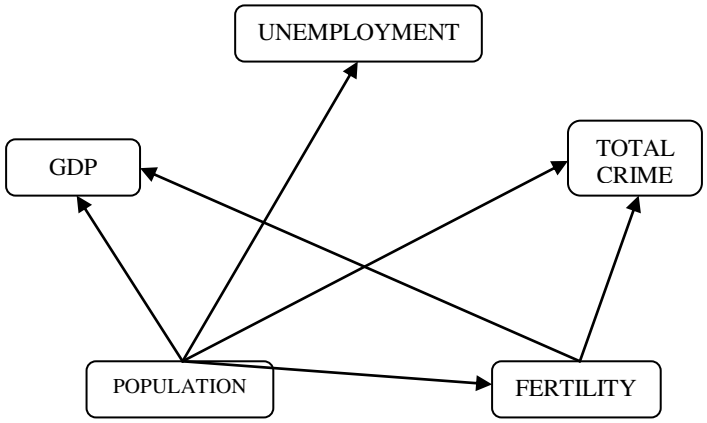
Dependent Variables	**Δfert**	**gdp**	**Δpop**	**Δue**	**Δttl**	**ECT**	
			χ^2**- statistics (p-value)**			**Coefficient**	**t-ratio**
Panel A: Total Crime Model							
Δfert	-	5.079 (0.08)**	2.018 (0.36)	0.322 (0.85)	4.720 (0.09)**	-0.107	-1.793
gdp	0.471 (0.79)	-	1.331 (0.51)	1.399 (0.50)	3.934 (0.14)	0.013	0.005
Δpop	4.908 (0.09)**	23.979 (0.00)*	-	5.680 (0.06)**	20.289 (0.00)*	-0.254*	-4.938*
Δue	1.755 (0.42)	2.373 (0.31)	1.673 (0.43)	-	3.976 (0.14)	-0.285	-0.802
Δttl	0.030 (0.99)	0.902 (0.64)	0.344 (0.84)	0.105 (0.95)	-	0.093	-1.334
Panel B: Property Crime Model							
Dependent Variables	**Δfert**	**gdp**	**Δpop**	**Δue**	**Δprop**	**ECT**	
			χ^2**- statistics (p-value)**			**Coefficient**	**t-ratio**
Δfert	-	4.405 (0.11)	2.228 (0.14)	0.317 (0.85)	3.959 (0.14)	-0.059	-1.633
gdp	0.697 (0.71)	-	1.539 (0.46)	1.302 (0.52)	3.899 (0.14)	-0.156	-0.106
Δpop	4.140 (0.13)	24.245 (0.00)*	-	6.240 (0.04)*	18.189 (0.00)*	-0.153*	-4.945*
Δue	1.846 (0.40)	2.384 (0.30)	1.668 (0.43)	-	4.091 (0.13)	-0.177	-0.83
Δprop	0.059 (0.97)	0.775 (0.68)	0.215 (0.90)	0.027 (0.99)	-	-0.049	-1.52
Panel C: Violent Crime Model							
Dependent Variables	**Δfert**	**gdp**	**Δpop**	**Δue**	**Δvio**	**ECT**	
			χ^2**- statistics (p-value)**			**Coefficient**	**t-ratio**
Δfert	-	1.393 (0.27)	5.122 (0.01)*	1.035 (0.37)	4.831 (0.02)*	-	-
gdp	0.951 (0.48)	-	0.738 (0.49)	0.546 (0.59)	1.209 (0.32)	-	-
Δpop	2.341 (0.12)	0.247 (0.78)	-	0.064 (0.94)	1.557 (0.23)	-	-
Δue	1.470 (0.25)	3.110 (0.06)*	0.615 (0.55)	-	2.094 (0.14)	-	-
Δvio	2.178 (0.13)	3.977 (0.03)*	8.294 (0.00)	1.704 (0.20)	-	-	-

Notes: The χ^2- statistic tests the joint significance of the lagged values of the independent variables, and the significance of the error correction term(s). The Vector Error Correction Model (VECM) formulation established only in 2 models (Total Crime Model and Property Crime Model) with one error correction term for each model. For the Violent Crime Model we use the standard VAR model since no significant cointegration vector was found from Johansen Cointegration Test (Table 2). Δ indicates variables that are stationary after first difference. Figures in the parentheses are the *p*-values. Asterisk (*) and (**) indicates statistically significant at 5% and 10% level.

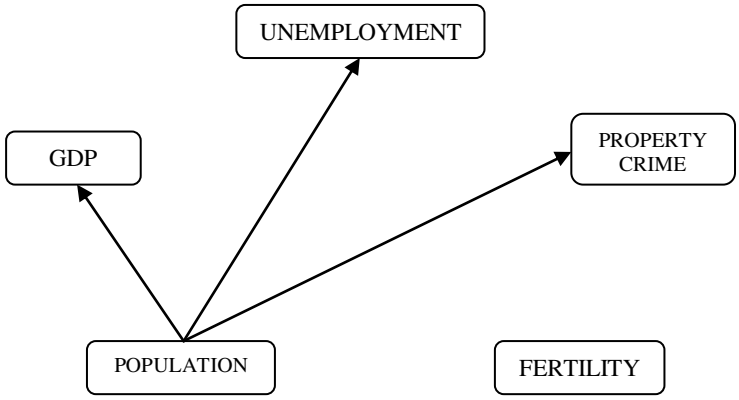
The magnitude of these coefficients indicates that the speed of adjustment towards the long-run path varies between the two models. Particularly, it will take around 4 years for total crime model and 8.5 years for property crime model to adjust to the long run equilibrium due to the short run adjustments. The error correction coefficients are fairly small for property

crime models which suggest that once shocked, convergence to the long-run equilibrium is slow for property crime compared to the total crime model.

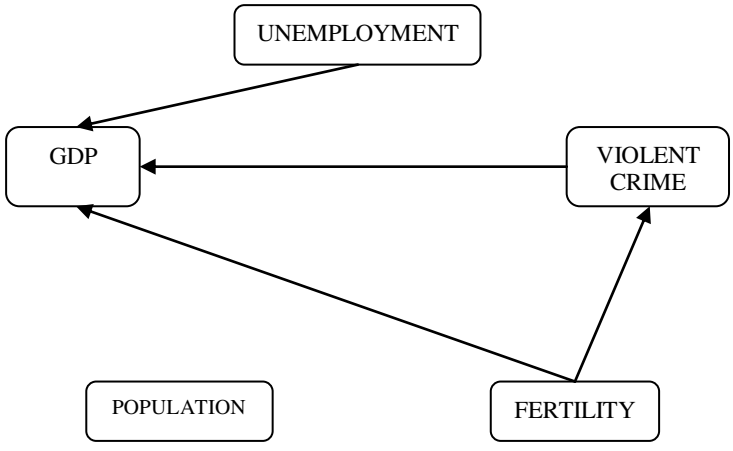
Figure 1: Summary of Short-Run Causal Linkages



Total Crime Model



Property Crime Model



Violent Crime Model

For the short-run Granger causality analysis, it is proven that there exist causal linkages among the variables for all the three models under investigation either at 5 percent or 10 percent significance level. Fertility are the cause for GDP and total crime in Malaysia while population can cause all the variables (fertility, GDP, unemployment and total crime)

involved in the first model. For property crime model, only population can Granger cause GDP, unemployment and property crime at 5 percent significance level. Lastly, violent crime is the cause for GDP and fertility can cause population and violent crime in Malaysia. At the same time, unemployment is proven to Granger cause GDP in the last model. Kendall and Tamura (2008) found negative relationship between violent crime and fertility rate among unmarried women using a panel of time-series analysis in 20 countries. Summary of the causal linkages for all the models are provided in Figure 1.

Further Analysis

Having established all the relationship from the results, this paper advances to ascertain the relationships found earlier for beyond sample estimation. In order to gauge the relative strength of the variables and the transmission mechanism responses beyond the sample observed, we shocked the system and partitioned the forecast error variance decomposition for each of the variables in the system (Masih & Masih, 1995; 1996). The innovation of the VDCs will be represented in percentage form and strength of five variables to their own shocks and each other are measured by the value up to 100 per cent. A variable that is optimally forecast from its own lagged values will have all its forecast error variance accounted for by its own disturbances (Sims, 1982). The VDCs are executed using time horizons of 1 to 50 years.

Table 4: Variance Decompositions (VDCs)

Years	Due to Innovations in:				
	fert	gdp	pop	ue	crime
			Total Crime		
1	2.86	31.37	0.00	0.00	**65.77**
15	0.26	36.90	1.73	0.22	**60.88**
30	0.16	36.70	1.72	0.17	**61.24**
40	0.13	36.66	1.72	0.16	**61.33**
50	0.12	36.63	1.72	0.15	**61.39**
			Property Crime		
1	2.88	34.65	0.01	19.70	**42.76**
15	0.23	36.12	0.99	27.77	**34.90**
30	0.13	35.84	0.94	27.92	**35.18**
40	0.10	35.77	0.93	27.96	**35.25**
50	0.09	35.72	0.92	27.98	**35.29**
			Violent Crime		
1	10.97	5.21	4.45	1.71	**77.66**
15	43.89	10.39	10.70	4.97	**30.06**
30	59.53	7.11	10.82	3.07	**19.48**
40	64.62	6.04	10.88	2.44	**16.01**
50	67.98	5.34	10.92	2.03	**13.72**

Notes: Figures in the first column refer to number of years. All other figures are estimates rounded to two decimal places - rounding errors may prevent perfect percentage decomposition in some cases. Column in bold represents their own shocks.

Table 4 provides the decomposition of the forecast error variance of all the variables in the system for the three models employed in this study. For the total crime model, it is obvious that even after 50 years' time horizon; most of the variance in total crime are explained by its own shocks (61%) rather than the other variables in the system. Although VECM results indicates that the causality runs from fertility and population to total crime, the causal linkages may last for a short term only with insignificant value (0.2% to 1.7%). In the case of property crime, although population is found to be endogenous and can cause property crime in the short run from the VECM results, it is evident that GDP and

unemployment can explain the variance in the property crime after 50 years ahead. Almost 36% of GDP and 28% in unemployment will explain the property crime rates for Malaysia in the long run. It must be noted that although the short-run relationship are rather weak, it is lighten in the long run that any adjustment made to GDP and unemployment will affect property crime rate in the long run (say, 50 years ahead). Model 3 shows that all other variables can explain violent crime up to 86% of its forecast error variance in the long run (50 years' time horizon). Although only fertility is found to cause violent crime in the short-run from the VECM analysis, it is obvious that all other variables can affect violent crime in the long-term.

Results are comparable to the one estimated by Gaviria *et. al.,* (2011) using the neighborhoods data for Bogotá in analyzing the causal relation between adolescent fertility and homicide rates. They explain the relationship in a longer time span indicating that places with high adolescent fertility rates at the moment the kids of adolescent mother become teenagers are more likely to have higher homicide rates when these teenagers reach their peak crime ages between 18 to 26 years old. The results are independent of access to education among the children. This partly explains our findings on long-run relationship between violent crime and fertility, unemployment, GDP and population rate in Malaysian case.

5. CONCLUSION AND POLICY IMPLICATIONS

This paper is initiated at providing better understanding on the relationship between different crime categories and various socio-demographic variables in Malaysia. It is important to note that this study proves the existence of either a short-run or long-run relationship among the variables involved in the system. From the VECM analysis, we found that population are the endogenous variables which is caused by crime while GDP and fertility are the variables that leads (exogenous) the property crime and total crime in Malaysia. This results is further strengthen by the VDCs analysis for the beyond sample period that also shows GDP as the most exogenous variables in the system. From policy perspective, this study is pinpointed to provide better understanding of the dynamics of different categories of crime in Malaysia prior to any implementation or formulation of policies to combat crime.

Since GDP and fertility are found to be the leading variables in the system, it is suggested that government focus on correcting both of them to give long term effect to the crime rates rather than spending on law and enforcement for short term insignificant effect. Malaysia is not unique in facing the risk of increasing world crime rate each year. The stylize fact of alarming crime increase and deteriorating public perceptions towards police drives the implementation of National Key Results Areas (NKRAs) in 2009 as part of the seven key areas concerning the people of Malaysia. NKRA represents a combination of short-term priorities to address urgent public demands and long-term issues affecting the people that required the government's attention immediately. Among those seven key areas, reducing crime was highlighted on the first issues to be addressed under the Minister of Home Affairs.

The policy implications derived from the results suggest that government consider policies which affect the economic and social structural factors which determine the crime rate in the long run rather than focusing on increase expenditure on law enforcement alone. It is important that both economic and social characteristics are corrected and law enforcement strategies tighten in order to ensure decrease in crime rates can be retained in the long run. While existing crime fighting policies and expenditure are adequate for decreasing crime in

Malaysia, it is also important to ensure that expected return from crimes are decreasing for potential criminals. There are several economic and social variables such as equality, unemployment, and population or fertility control to be focused on to ensure the expected returns to illegal market are less favourable. Policymakers should also focus on the population density and fertility rate that can affect crime since too many people and congested neighbourhood without fair distribution of income will increase crime in the long run.

Notes

[1] The public safety index is measured by two sub-indices namely, crime per thousand population and road accidents per thousand vehicles. Table 1 provides detailed explanation on Area Indices and the MQLI differences in 2007 and 2008.

[2] Vast empirical studies included control variables in their estimation models to control for any other variables that may influence crime but not included in the model. We found it unnecessary under two circumstances, 1) from the inconsistency in the results obtained in earlier studies it is well-acknowledged that criminal actions are argued to be determined by numerous factors, some not observed in the model studied while others are immeasurable in a quantitative analysis leading to inconclusive number of variables to be controlled, and 2) following the argument by Clarke (2012) who concluded that including a control variables could cause larger problems to the model tested such as increase bias on estimated coefficient, introduce measurement error, introduce endogeneity into specification and/or numerous problems can occur which affect the standard errors. Interested readers can refer to Clarke (2005, 2009, and 2012) for detailed explanations on nuisance of control variables.

[3] It is important to acknowledge one serious shortcoming from the crime official statistics utilized for an empirical investigation. Official crime statistics portrays only the crime that are reported to and recorded in the police department. Since many crimes are either ignored or considered inconsequential, it goes unreported and underrated. However, less serious crime has the high propensity of going unreported while more serious crimes do get reported in common situation. Although there are a lot of unreported cases of crime, available statistics can at least portray a general crime pattern in a country.

[4] Vector Error Correction Model (VECM) is illustrated for Model 1 only for brevity.

[5] The variables GDP are not tested for the 1st difference form because it is already stationary in its level form. Results are not provided in this paper for brevity but available upon request.

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