Crime and Economic Growth: A Linear Dynamic Panel Data Model Approach

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Abstract

Recently, the impact of crime on economic growth has gained in importance in the academic literature. A large body of empirical studies affirms that crime has had a negative impact on economic growth. This research contributes to the debate by conducting an improved empirical study with the cross-country space framework. To do so, the author utilizes an updated longitudinal data of forty countries for the time span 1996-2016 first. Then, to deal with panel-level effects and potential biases, two-step GMM, fixed effects and random effects estimators are employed. The estimated results find no negative relationship between crime and economic growth of the sample countries during the observation time span. This finding is contrary to the dominant pronouncement of the previous empirical works but supports for the conclusion of a numbers of studies. After interpretating the research findings, some implications are provided.

Keywords: Crime, Economic growth, Fixed effects, Random effects, Two-step GMM estimators.

Introduction

Crime is one of today's most acute problems beside climate change, conflict, inequality, poverty, religious conflict, food and water security, lack of education, lack of economic opportunity and employment. Crime is an action or omission that constitutes an offense that may be prosecuted by the state and is punishable by law. The threat of crime is manifested in the form of violence, arson, false pretense/cheating, unlawful possession, robbery, assault, murder, theft, destruction, fraud and corruption.

The damage caused by crime has a significant negative impact on society welfare, which can lead to serious impediments for the creation and maintenance of a developed and well-functioning economy. It imposes large costs to private and public sectors, which have a negative impact on personal state-of-being of an individual, as well as on the welfare of the society as a whole (Ojog, 2014, p.1). The government expenditures on legal and judicial activities, police protection and corrections around the world reached billions of USD per year. All come directly and indirectly out of the pocket of taxpayers. These economic losses present an opportunity cost, because the money spent could yield some tangible and intangible returns if invested with care, therefore it seems reasonable to think that crime has a negative impact on the economic growth of a country (Gaibulloev and Sandler, 2008).

The impact of crime on economic growth has gained in importance in the academic literature and many tried to estimate what are the direct and indirect costs of crime on the society. However, the empirical results have been mixed. And, there exist debates and controversies on the issue. This research attempts to extend the literature by examining the effect of crime on economic growth of forty countries in the period from 1996 to 2016 by using two-step GMM estimators.

Apart from Introduction, this research is divided into five sections. Section 1 presents a brief review of related literature. Following section explicates the econometric models and data sources. The section 3 demonstrates the estimated results. Section 4 provides an analysis of the estimated results. The last section concludes the study and proposes some implications.

1. Review of related literature

Crime has generated both theoretical and empirical debate. Although the impact of economic variables on crime has been widely investigated (Berghoff and Spiekermann, 2018; Rosenfeld and Fornango, 2014; Greenberg, 2014; Lynch, 2013; Han, *et al.* 2013; Wu and Wu, 2012; Wang, 2011; Campana, 2011; Dull and Giacopassi, 2006; Lintner, 2004; Witt *et al.* 1998; Krohn, 1976). Accordingly, crimes are closely related to poverty, social exclusion, wage and income inequality, cultural and family background, level of education and other economic and social factors that may affect individual's propensity to commit crimes such as cultural characteristics, age and sex. There is not much concern about crime's effect on overall economic performance.

The impact of crime on economic performance has been discussed in the literature and partly effected the decision making of policy makers. However, the empirical results have been mixed, making the issue more controversial. Specifically, Sharkey and Torrats-Espinosa (2017), Arturo and Estrada (2014), Kumar (2013), Detotto and Otranto (2010), Mauro and Carmeci (2007), Ehrilch (1973), Becker (1968) find a negative and significant impact of crime on economic growth. Contrary

to this dominant pronouncement, Yu (2017), Goulas and Zervoyianni (2015), Ojog (2014) indicate no significant effect. Other studies designate an unclear effect of crime on economic performance such as Li *et al.* (2018), Burnham *et al.* (2004). This suggests that the previous empirical studies have not yet produced a definite conclusion about the magnitude of the impact of crime on the economic growth.

The diversity of empirical findings can be explained by the variety of applied methods (2SLS, ARDL, Bound test, Granger causality test, the Self-Organizing Map (SOM), the economics of crime monitoring model, *etc.*), country samples (single country: Australia, Colombia, France, Guatemala, India, Italy, Japan, Malaysia, Mexico, New Zealand, Nigeria, Oregon, the United Kingdom, the United States, *etc.*; a group of countries: EU-27, Latin America States, developing countries, developed countries, both developed and developing countries, *etc.*), variables employed (GDP per capita growth, GDP growth, Total Crime, Homicide, Violent Crime, Robbery, Domestic Burglary, Domestic investment, Government expenditure, Trade openness, Institutional quality, Tax, Human capital, Wage, Unemployment) and observation time. These mixed evidences of empirical works in the literature imply that the question of the crime-economic growth nexus is still an open one, hence is imperative for additional studies. This research aims to bridge this gap by presenting an improved empirical analysis of the macroeconomic consequences of criminal activity. The next section will explicate the econometric models and data sources.

2. Model specification and data sources

In a panel data model, the omitted variable bias resulting from the unobserved variable in the error term that is potentially correlated with one or more of the explanatory variables is also referred to as "unobserved heterogeneity". In cross-country investigations, heterogeneity across countries is present because of differences in economic conditions or social-cultural backgrounds. Dependence among countries is unavoidable due to cooperation or competition, particularly with the current prevalence towards globalization. Failing to account for these concerns jointly has constrained deeper analysis in extant studies. It is well known that each country sustains its own dynamics in the development process. This fact calls attention to the need to control for cross-country heterogeneity when initiating an empirical modeling strategy (Chou, 2013, p. 227). A dynamic panel model can account for the unobserved heterogeneity, in this case, due to the country-specific effects. The dynamic panel data model takes the following form:

$$y_{it} = \beta_0 + \gamma y_{it-1} + \beta' X_{it} + \mu' W_i + v_i + \varepsilon_{it} \quad (1)$$

For $i = \{1, \dots, N\};\ t = \{1, \dots, T\}$ using dataset with large *N* and fixed *T,*

y_{it} is dependent variable,

β_0 is constant,

y_{it-1} is lagged dependent variable,

the $\gamma_1, \dots, \gamma_p$ are p parameters to be estimated,

β' is a $k_1 \times 1$ vector of parameters to be estimated,

X_{it} is a $1 \times k_1$ vector of explanatory variables (time-varying explanatory variables),

μ' is a $k_2 \times 1$ vector of parameters to be estimated,

W_i is $1 \times k_2$ vector of time-invariant variables,

v_i are the panel-level effects (unobserved individual effects), which may be correlated with lagged dependent variable y_{it-1},

$_{it}$ is the random error, and ε_{it} are identically distributed (*i.i.d.*) with variance σ_ε^2.

Assumptions: we assume that the component error term: $\vartheta_i = v_i + \varepsilon_{it}$

E $(v_i) = 0$ and E$(\varepsilon_{it}) = 0$

E $(v_i v_j) = \sigma_v^2$, if j = i, 0 otherwise.

E $(\varepsilon_{it}\varepsilon_{js}) = \sigma_\varepsilon^2$ if j = i and t = s, 0 otherwise.

E $(v_i x_{it}) = 0$, E $(v_i w_i) = 0$

At this stage, this model assumes that the random error term ε_{it} is not serially correlated and the lagged dependent variable y_{it-1} is correlated with the panel-level effects (unobserved individual effects) v_i. If there is correlation between y_{it-1} and v_i the use of standard panel data estimator is not appropriate. Therefore, Arellano-Bond first-differenced estimator is utilized to eliminate the panel-level effects (unobserved individual effects) v_i. Taking first differences both sides of the equation (1) to eliminate panel-level effects v_i and W_i yields:

$$y_{it} - y_{it-1} = \beta_0 + \gamma(y_{it-1} - y_{it-2}) + \beta'(X_{it} - X_{it-1}) + \varepsilon_{it} - \varepsilon_{it-1} \quad (2)$$

In this equation, the panel-level effects (unobserved individual effects) v_i correlated with y_{it-1} and W_i are swept out from the model through first difference. However, after controlling for the panel-level effects (unobserved individual effects) by first difference, there still exist complications in the model: the correlation between the differenced lagged dependent variable and the disturbance term/process. [1]Because the y_{it-1} in Δy_{it-1} is a function of the ε_{it-1}, which is also in $\Delta\varepsilon_{it}$. So $\Delta y_{it-1}$is correlated with $\Delta\varepsilon_{it}$ by construction.

Arellano and Bond (1991) suggested that we could use the lagged levels, y_{it-2} and y_{it-3} and so on, as instruments. For generalized method of moments (GMM) style instruments, the limits on how many lags are to be included. If *T* is fairly large (more than 7-8) an unrestricted set of lags will introduce a huge number of instruments, with a possible loss of efficiency. By using the lag limits options, we may specify, for instance, that only lags 2-5 are to be used in constructing the GMM instruments. Then we could apply the standard instrumental techniques to estimate the model.

Building on the work of Anderson and Hsiao (1981, 1982) and Holtz-Eakin *et al.* (1988), Arellano and Bond (1991) derived one-step and two-step GMM estimators, using moment conditions in which lagged levels of the dependent and predetermined variables were instruments for the differenced equation. Blundell and Bond (1998) show that the lagged-level instruments in the Arellano-Bond estimator become weak as the autoregressive process becomes too persistent or the ratio of the variance of the panel-level effects v_i to the variance of the idiosyncratic error ε_{it} becomes too large. Building on the work of Arellano and Bover (1995), Blundell and Bond (1998) proposed a system estimator that uses moment conditions in which lagged differences are used as instruments for the level equation in addition to the moment conditions of lagged levels as instruments for the differenced equation. The additional moment conditions are valid only if the initial condition $E[v_i \Delta y_{i2}] = 0$ holds for all i (see Blundell and Bond 1998; Blundell *et al.* 2000)[2].

Notably, the order condition for model identification requires that the number of exogenous variables excluded from the model be at least as great as the number of endogenous regressors. When the number of excluded exogenous variables exceeds the number of endogenous regressors, the model is overidentified, and the validity of the instruments can then be checked via a test of

overidentifying restrictions. Performing the Sargan test after the one or two-step estimator is an alternative. Specifying *vce* (robust) produces an estimated VCE that is robust to heteroskedasticity. So, to deal with panel-level effects (unobserved individual effects) resulting from country-specific effects in panel datasets, overidentifying restrictions, heteroskedasticity and zero autocorrelation in first-differenced errors, in this research, the author will employ the two-step GMM estimators using *xtdpd* and *vce* (robust) for my linear dynamic panel data models. For further robust check of the estimated results, the author also runs a series of fixed effects and random effects models using the model specification (1).

In this research, the dependent variable is the real GDP Per capita annual growth (labeled GDPPCGR) denoting for economic growth of sample countries during 1996-2016 offered by the World Bank.

The Lagged GDP per capita (at constant 2010 USD) variable (LGDPPC labeled here) is the first control variable in the model to capture the "convergence rate", *ceteris paribus.*

The Crime (CRIME labeled here) is employed to examine the possible impact of crime on economic growth of forty countries when other variables are controlled for. In this research, the author employs the data of Intentional homicides (per 100,000 people)-a proxy of crime offered by the World Bank.

Foreign Direct Investment (*NETFDI* labeled here) is included next to examine the effect of FDI on economic growth of forty sample countries. The author uses the net FDI inflows (= FDI inflows – FDI outflows).

Government Expenditure (annual growth %) (*GOVEXP* labeled here) and Domestic Investment (as % of GDP) (INVEST labeled here) are embraced to examine the "crowding-out" or "crowding-in" effect of net FDI in forty economies.

Labor force participation rate (% of total population ages 15-64) (*LABOR* labeled here) entered the model to test the impact of the Human capital on economic growth of the group.

Finally, four additional control variables are added including Trade openness (*TRADEO* labeled here) measured by import and export as a share of GDP ([import + export]/GDP), Population growth (natural growth rate %) (*POPGRW* labeled here) and two dummies, Crisis 1997 (*CRISIS97* labeled here) and Crisis 2008 (*CRISIS08* labeled here), that capture the possible impact of the regional and global financial crisis on economic growth of these forty countries. These dummy variables take the value of "1" in crisis period, 1997-2000 and 2008-2011 respectively, and "0" otherwise.

Regarding data sources, this research employs a longitudinal data/panel dataset of forty countries in the period from 1996 to 2016 (see Appendix 4 for the list of sample countries). The data is collected from trustworthy sources of the World Bank (WB) and the International Monetary Fund (IMF) (see Appendix 1 for variables and data sources).

3. Estimated results

Table 1: Linear dynamic panel data models with Two-Step GMM estimators

Dependent Variable: Economic Growth (Real GDP per capita annual growth)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
GDPPCGR (L1)	-0.2400 (0.1544)	-0.2530 (0.1897)	-0.2988* (0.1478)	-0.3851* (0.1957)	-0.3847* (0.1601)	-0.3779*** (0.0860)	-0.3792* (0.1578)	-0.3898** (0.1266)	-0.4396*** (0.1231)
GDPPCGR (L2)	-0.2372* (0.1130)	-0.2470 (0.1469)	-0.2752* (0.1185)	-0.3026 (0.1634)	-0.3064* (0.1354)	-0.2817*** (0.0652)	-0.2677* (0.1199)	-0.2721** (0.0863)	-0.3552** (0.1221)
GDPPCGR (L3)	-0.1239 (0.0886)	-0.1373 (0.1148)	-0.1097 (0.1068)	-0.1329 (0.1218)	-0.1363 (0.1002)	-0.1217** (0.0462)	-0.1154 (0.0861)	-0.1237 (0.0662)	-0.1660 (0.0950)
LGDPPC	-0.0016*** (0.0003)	-0.0015** (0.0004)	-0.0013*** (0.0003)	-0.0013*** (0.0004)	-0.0013*** (0.0004)	-0.0013*** (0.0003)	-0.0012** (0.0004)	-0.0012*** (0.0003)	-0.0012*** (0.0003)
CRIME	-0.0643 (0.0472)	-0.0705 (0.0501)	-0.0492 (0.0380)	-0.0405 (0.0676)	-0.0323 (0.0407)	-0.0276 (0.0463)	-0.0366 (0.0516)	-0.0347 (0.0484)	0.0001 (0.0221)
NETFDI		0.0740* (0.0345)	0.0555* (0.0222)	0.0521* (0.0252)	0.0545 (0.0312)	0.0465 (0.0246)	0.0508* (0.0228)	0.0427 (0.0290)	0.0304 (0.0249)
GOVEXP			-1.6225*** (0.437)	-1.2697*** (0.3782)	-1.3081*** (0.3766)	-1.3813*** (0.3197)	-1.3629*** (0.3412)	-1.3644*** (0.3439)	-1.2900*** (0.2564)
INVEST				0.4352** (0.1586)	0.4500*** (0.1275)	0.3255*** (0.0842)	0.3403*** (0.1014)	0.3392*** (0.0860)	0.3037** (0.1094)
LABOR					-0.0642 (0.2552)	-0.0783 (0.2413)	-0.0921 (0.2424)	-0.0814 (0.2291)	-0.1196 (0.1587)
TRADEO						0.0679*** (0.0152)	0.0702*** (0.0180)	0.0716** (0.0238)	0.0789* (0.0308)
POPGRW							-0.7641 (0.5606)	-0.7932 (0.6482)	-0.6508 (0.4123)
CRISIS97								0.0986 (2.3348)	-1.0230 (2.4087)
CRISIS08									-1.5452* (0.7781)
_cons	0.5612 (0.2253)	0.5253* (0.2383)	0.6258** (0.2332)	0.5663** (0.2177)	0.5916* (0.2431)	0.5322* (0.2115)	0.5081* (0.2155)	0.4956 (0.3546)	0.9505** (0.3714)
N	720	720	720	720	720	720	720	720	720
Sargan Test (P value)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Arellano-Bond test (P value)	0.0043	0.0043	0.0006	0.0107	0.0029	0.0007	0.0032	0.0023	0.0036

Notes: WC-Robust standard errors in parentheses and * p<0.05, ** p<0.01, *** p<0.001.

Table 2: Fixed effects models

Dependent Variable: Economic Growth (Real GDP per capita annual growth)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
GDPPCGR (L1)	-0.3134 *** (0.0612)	-0.3310 *** (0.0588)	-0.3647 *** (0.0527)	-0.4319 *** (0.0590)	-0.4331 *** (0.0590)	-0.4416 *** (0.0552)	-0.4456 *** (0.0551)	-0.4396 *** (0.0550)	-0.4696 *** (0.0539)
GDPPCGR (L2)	-0.2991 *** (0.0279)	-0.3063 *** (0.0285)	-0.3251 *** (0.0261)	-0.3373 *** (0.0318)	-0.3374 *** (0.0318)	-0.3214 *** (0.0331)	-0.3138 *** (0.0346)	-0.3095 *** (0.0348)	-0.3675 *** (0.0274)
GDPPCGR (L3)	-0.1522 *** (0.0267)	-0.1596 *** (0.0269)	-0.1350 *** (0.0273)	-0.1556 *** (0.0275)	-0.1566 *** (0.0278)	-0.1421 *** (0.0266)	-0.1455 *** (0.0251)	-0.1424 *** (0.0255)	-0.1790 *** (0.0256)
LGDPPC	-0.0010 *** (0.0001)	-0.0009 *** (0.0002)	-0.0009 *** (0.0002)	-0.0010 *** (0.0001)	-0.0009 *** (0.0001)	-0.0009 *** (0.0001)	-0.0008 *** (0.0001)	-0.0009 *** (0.0001)	-0.0009 *** (0.0001)
CRIME	-0.0510 (0.0257)	-0.0514* (0.0250)	-0.0481 (0.0269)	-0.0338 (0.0244)	-0.0343 (0.0242)	-0.0320 (0.0239)	-0.0310 (0.0243)	-0.0267 (0.0245)	-0.0262 (0.0236)
NETFDI		0.0879** (0.0292)	0.0625** (0.0226)	0.0587* (0.0259)	0.0593* (0.0265)	0.0530* (0.0261)	0.0523 (0.0271)	0.0508 (0.0267)	0.0413 (0.0266)
GOVEXP			-1.4531 *** (0.3617)	-1.229 *** (0.3175)	-1.2314 *** (0.3178)	-1.2905 *** (0.2661)	-1.2807 *** (0.2672)	-1.2868 *** (0.2674)	-1.2148 *** (0.2463)
INVEST				0.4348 *** (0.0608)	0.4365 *** (0.0607)	0.3497 *** (0.0654)	0.3510 *** (0.0634)	0.3543 *** (0.0646)	0.3321 *** (0.0603)
LABOR					-0.0784 (0.1096)	-0.0970 (0.1118)	-0.0990 (0.1135)	-0.0871 (0.1128)	-0.1227 (0.1085)
TRADEO						0.0662 *** (0.0118)	0.0687 *** (0.0109)	0.0660 *** (0.0112)	0.0689 *** (0.0110)
POPGRW							-0.8395 ** (0.3038)	-0.8017 ** (0.3008)	-0.7994 ** (0.2670)
CRISIS97								0.5496* (0.2073)	0.1697 (0.2025)
CRISIS08									-1.4229 *** (0.2308)
_cons	0.3706 *** (0.0796)	0.3086 ** (0.1071)	0.3890 *** (0.0910)	0.4195 *** (0.0656)	0.4246 *** (0.0634)	0.3608 *** (0.0712)	0.3250 *** (0.0546)	0.2812 *** (0.0544)	0.647 5*** (0.0902)
N	720	720	720	720	720	720	720	720	720
R-sq	0.297	0.328	0.476	0.555	0.555	0.576	0.582	0.584	0.608
adj. R-sq	0.293	0.323	0.471	0.550	0.550	0.570	0.575	0.577	0.601

Notes: Robust standard errors in parentheses and * p<0.05, ** p<0.01, *** p<0.001.

Table 3: Random effects models

Dependent Variable: Economic Growth (Real GDP per capita annual growth)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
GDPPCGR (L1)	-0.341 *** (0.0551)	-0.354 *** (0.0531)	-0.385 *** (0.0473)	-0.454 *** (0.0515)	-0.455 *** (0.0513)	-0.462 *** (0.0488)	-0.463 *** (0.0494)	-0.459 *** (0.0492)	-0.490 *** (0.0480)
GDPPCGR (L2)	-0.319 *** (0.0293)	-0.323 *** (0.0289)	-0.340 *** (0.0265)	-0.354 *** (0.0316)	-0.354 *** (0.0316)	-0.336 *** (0.0333)	-0.325 *** (0.0336)	-0.322 *** (0.0337)	-0.380 *** (0.0263)
GDPPCGR (L3)	-0.162 *** (0.0252)	-0.168 *** (0.0253)	-0.143 *** (0.0259)	-0.166 *** (0.0261)	-0.167 *** (0.0265)	-0.151 *** (0.0254)	-0.154 *** (0.0242)	-0.151 *** (0.0246)	-0.188 *** (0.0250)
LGDPPC	-0.0008 *** (0.0001)	-0.0007 *** (0.0002)	-0.0007 *** (0.0001)	-0.0008 *** (0.0001)	-0.0008 *** (0.0001)	-0.0008 *** (0.0001)	-0.00073 *** (0.0001)	-0.00075 *** (0.0001)	-0.00078 *** (0.0001)
CRIME	-0.0489* (0.0242)	-0.0495* (0.0236)	-0.0449 (0.0244)	-0.0304 (0.0223)	-0.0308 (0.0222)	-0.0283 (0.0215)	-0.0272 (0.0221)	-0.0233 (0.0222)	-0.0228 (0.0215)
NETFDI		0.0912** (0.0308)	0.0655** (0.0239)	0.0623* (0.0274)	0.0629* (0.0279)	0.0560* (0.0275)	0.0547 (0.0284)	0.0535 (0.0281)	0.0443 (0.0281)
GOVEXP			-1.430 *** (0.352)	-1.212 *** (0.309)	-1.214 *** (0.310)	-1.272 *** (0.259)	-1.260 *** (0.260)	-1.266 *** (0.260)	-1.198 *** (0.241)
INVEST				0.428 *** (0.0628)	0.429 *** (0.0629)	0.346 *** (0.0677)	0.348 *** (0.0650)	0.351 *** (0.0661)	0.329 *** (0.0618)
LABOR					-0.0794 (0.107)	-0.108 (0.108)	-0.109 (0.109)	-0.0985 (0.108)	-0.132 (0.104)
TRADEO						0.0657 *** (0.0113)	0.0682 *** (0.0101)	0.0660 *** (0.0104)	0.0688*** (0.0104)
POPGRW							-0.954** (0.308)	-0.924** (0.305)	-0.929*** (0.268)
CRISIS97								0.506* (0.204)	0.127 (0.200)
CRISIS08									-1.411*** (0.229)
_cons	0.290 *** (0.0743)	0.240 ** (0.0840)	0.329 *** (0.0861)	0.353 *** (0.0877)	0.358 *** (0.0886)	0.304 *** (0.0864)	0.271 *** (0.0729)	0.228 *** (0.0682)	0.587 *** (0.0970)
N	720	720	720	720	720	720	720	720	720
R-sq:									
within	0.2960	0.3272	0.4751	0.5539	0.5542	0.5755	0.5809	0.5833	0.6073
between	0.0164	0.0130	0.0037	0.0048	0.0063	0.0019	0.0074	0.0079	0.0086
overall	0.2862	0.3196	0.4653	0.5429	0.5432	0.5652	0.5723	0.5744	0.5981

Notes: Robust standard errors in parentheses and * p<0.05, ** p<0.01, *** p<0.001.

4. Analysis of the estimated results

The estimated results are summarized in Table 1, Table 2 and Table 3 above with different sets of control variables. Since Crime (*CRIME* labeled here) is the key explanatory variable and primary focus; it is included in every model in my research to examine the possible impact of crime on economic growth of forty countries when other variables are controlled for. From Model 1 through Model 9 of the fixed effects, random effects, and two-step GMM estimated results, most of the variables are statistically significant at 1% or 5% level.

The coefficients of lagged GDP per capita (*LGDPPC* labeled here) are negative and significant in all models of fixed effects, random effects, and two-step GMM estimated results. The estimated convergence rate shows that country with a higher initial level of income would have a lower growth rate of GDP per capita. This supports for the conclusion of the Neo-classical growth theory.

The coefficients of foreign direct investment variable (*NETFDI* labeled here) are positive but unstably significant. After I control for human capital (*LABOR* labeled here) and economic shocks, the regional 1997 crisis and 2008 global financial crisis, they become insignificant. This suggests that the impact of FDI on economic growth of sample countries during 1996-2016 is not clear.

The coefficients of government expenditure variable (*GOVEXP* labeled here) are negative and stably significant at 1% level in all models of estimated results. This implies that local investment from government is less effective in terms of promoting economic growth of those sample countries during 1996-2016.

The coefficients of domestic investment variable (*INVEST* labeled here) are positive and stably significant at 1 or 5% level in all models of the estimated results. This explains that "crowding-in" effects occurred in these economies in the long run (1996-2016). According to the crowding-in effects, FDI is supposed to "crowding-in" domestic investment as incoming FDI would lead to new or higher amount of domestic investment where it would not be possible in the absence of FDI. Romer (1993) argues that the introduction of new goods to the economy has an important role on development. Thus, FDI is assumed to contribute to the capital formation of the host country through introducing new goods and technologies. Crowding-in of domestic investment as a result of receiving FDI generally occurs when foreign investment generates spillover effects to the domestic economy. As Borenzstein *et al.* (1998) argue that such spillovers occur because foreign investments lower the costs of adopting new technologies, which in turn enhances the rate of growth. FDI may also generate demand for specialized inputs, thus increasing the marginal productivity of investments in those inputs. Gallagher and Zarsky (2007) classify the channels for the crowding-in effect as follows. There may be backward linkages that are formed through the provision of inputs to foreign investors by local firms. Forward linkages can be formed as a result of the provision of goods and services by foreign firms in order to be used as efficiency-enhancing inputs by domestic industries. Crowding-in may occur due to knowledge spillovers from multinational firms to domestic firms that gain access to new technologies and tacit knowledge. Finally, multiplier effects can be observed when FDI enters the host country. An example of such effects could be that foreign investors raise the number of people employed in the

host country thereby increasing local spending on domestically produced goods and services, which is favorable for domestic investors.

The coefficients of human capital variable (*LABOR* labeled here) are negative but statistically insignificant. This means we do not have evidence to conclude that this factor has reduced economic growth of sample countries in observation time.

The trade openness variable (*TRADEO* labeled here) shows a significant and positive effect in all models of the estimated results. This means open to trade has promoted economic growth of these countries. Trade openness can boost economic growth in the following ways. First, international trade can allow countries to specialize in sectors where they have a relatively lower opportunity cost to exploit the comparative advantage over other countries. Over time, higher degree of openness helps economies to employ more of their human, physical and capital resources in areas where they have highest productivity and returns in open international markets. Second, trade openness can help the diffusion of advanced technology and new ideas to recipient countries to help them improve productivity and economic efficiency. Third, free trade will give consumers access to cheaper products and increase the purchasing power and living standard for both developed and developing countries. Fourth, it will also allow producers to attain cheaper inputs and hence reduce their cost and improve their competitiveness.

The coefficients of population growth variable (*POPGRW* labeled here) are negative and insignificant in dynamic panel models but they are negative and significant in fixed effects and random effects models. If I respect the estimated results of dynamic panel models implying that population growth had no effect on economic growth of these countries.

The estimated results in Model 9 of all three estimated techniques show that the 1997 Asian crisis had no harmful effect on economic growth of these forty economies. By contrast, the 2008 global financial crisis had a strong and negative impact on economic growth of these economies. The 2008 global financial crisis has been one of the most significant economic shocks in the post-war period. At its core, the crisis originated in credit markets in developed countries - centered particularly in the United States, the United Kingdom and Europe - but the fallout has had a significant effect on activity in every country and region. As the crisis intensified, there was a large swing in the appetite of world financial markets for risk, and in their capacity to accept risk. The result was a shift from the easy credit conditions that had prevailed for some years to a situation of tight credit and in some cases dysfunctional markets. This was accompanied by a loss of consumer and business confidence, with significant effects on global activity. Notably, with the deterioration in financial conditions following the Lehman Brothers' collapse, the level of activity in the major economies took a sharp turn for the worse. In the climate of extreme uncertainty, business and consumer confidence collapsed. Households responded by cutting discretionary spending especially demand for manufactured goods. The result was an exceptionally sharp fall in global industrial production towards the end of 2008, and significant contractions in GDP in most of the major economies. The downturn in the G7 economies intensified during the December quarter, especially in Japan, and spread to other parts of the world, including Asia, Latin America and Eastern Europe (Eday, 2009).

Now, we turn into discussion on the most important variable in this research, CRIME. Theoretically, various channels can be considered, through which crime can affect community and

society, especially growth potential of an economy. Criminal activities increase risks and effectively impose a tax of the returns to investment as some resources are diverted to protective activities from the productivity enhancing activities, and thereby negatively influence capital accumulation. That is, crime lowers both domestic and foreign private investment (Sandler and Enders, 2008). Moreover, they crowd out public expenditure from productive assets such as infrastructure and education to protective activities. They erode faith in the rule of law and public institutions and damage social relations and disrupt local learning interactions and knowledge spillovers between firms, which are essentials of good business environment. Thus, as high crime environment increases return to criminal activities relative to returns to legal productive activities, it discourages incentives for human capital accumulation (Kuma, 2013, p. 4). This has further led to stereotypes that inhibit societal progression between races and cultures. However, in this research, after the author controls for government expenditure, domestic investment, human capital, trade openness, population growth, and economic shocks (1997 and 2008 crises), the coefficients of this variable become statistically insignificant in all models of the estimated results. This illustrates that crime was not harmful for economic growth of these sample countries in the observation time. The author's research finding supports for the conclusion of Yu (2017), Goulas and Zervoyianni (2015), Ojog (2014), *etc.* that there is no significant effect of crime on economic growth. This finding is contrary to the dominant assertion of previous empirical works that crime has had a negative impact on economic growth such as in Sharkey and Torrats-Espinosa (2017), Arturo and Estrada (2014), Kumar (2013), Detotto and Otranto (2010), Mauro and Carmeci (2007), Ehrilch (1973), Becker (1968), *etc.*

The possible reasons for the contradiction are as follows. Firstly, as the estimated results suggest that, statistically, the accumulation of capital offsets the effect of crime on economic growth. By increasing the domestic investment - a determinant of economic growth of 40 sample countries in this research - this might discourage people to engage in criminal activities due to different reasons, but the most plausible one being financial stability. Secondly, the number of crimes committed is not high enough to exert a statistically significant effect on economic growth of those sample countries in the observation time.

5. Conclusion and implications

Estimating the economic consequences of crime is important for our society. Researchers have tried different approaches in assessing the effect of crime on economic performance. I employ an updated panel dataset of forty countries from 1996 to 2016 and two-step GMM estimators. Then, I rule out the panel-level effects (unobserved individual effects) resulting from country-specific effects, overidentifying restrictions, heteroskedasticity and zero autocorrelation in first-differenced errors. For further robust check of the estimated results, I also run a series of fixed effects and random effects models using differenced lagged dependent variable after first differencing. The estimated results suggest that crime was not harmful for economic growth of these sample countries in the observation time. This is contrary to dominant conclusion of the previous empirical studies.

What are implications for Vietnam from the findings of this research? In Vietnam, crime is present in various forms. From the first organized crime group to emerge in the country, the Binh Xuyen (Bình Xuyên) during the 1920s to a legitimate military organization later in the areas of protection rackets, opium, drug dens, prostitution houses, night clubs and casinos, crimes against

tourists, which includes pick-pocketing and snatch theft, and corruption and police misconduct. Crime is rated high in both Hanoi and Ho Chi Minh City. Typical of any large metropolitan area, crimes of opportunity involving foreigners are regularly reported recently. The number of hi-tech crimes has also increased in recent years. The Hi-tech crimes have become more popular and more sophisticated. For the case of Vietnam, some researches have examined the relationship between crime and economic growth. Accordingly, researchers mostly focus on the corruption crimes. The Government of Vietnam recognizes the threat that corruption poses to the legitimacy and long-term survival of the political system. The numerous studies have looked at the effect of corruption on economic growth and a common finding is that the former adversely affects the latter such as Nguyen *et al.* (2016). The Vietnamese government is making an effort to curb corruption in the country. A handful of corrupt individuals, ranging from law enforcers to politicians, have been arrested. Meanwhile, only few researches argue/mention or evaluate the impact of other types of crime on Vietnam's economic growth due to the lack of data/figure...

From this research, some implications can be drawn. Crime is a major part of every society. Its costs and effects touch just about everyone to some degree. The types of costs and effects are widely varied. Some costs are short-term while others last a lifetime. Of course, the ultimate cost is loss of life. Some costs of crime are less tangible. These kinds of costs can include pain and suffering, and a lower quality of life. There are also the traumatic impacts on friends and the disruption of family. So, every person should have his/her own way of coping with crime. You may find it helpful to structure your life as much as possible, defer major life decisions, maintain or increase your physical exercise, limit the use of alcohol and drugs, keep a journal, *etc*. Thus, various activities should also be jointly implemented by authorities and governments to reduce the rate of crime such as long-term investment in universal education and health care, good governance, strong rule of law, corruption control, extreme poverty and the inherent challenges reduction, and policies aimed at minimizing social segregation. This research finds no negative relationship between crime and economic growth of sample countries during observation time. This does not mean crime control is not important in these countries as well as in Vietnam.

In conclusion, my investigation can contribute to the existing literature on the impact of crime on economic growth in terms of testable implications from linear dynamic panel model. However, the estimated results were robust to changes in methods of estimation, economic models, observation periods, country samples, and variables employed. Hence, the results and analyses will be more reliable and persuasive if correctly specified models and consistent estimation techniques are rigorously employed.

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Appendix

Appendix 1: Variables and Data Sources

Variables	Data Resources
GDPPCGR	The World Bank, Retrieved on 5 July 2019 from website https://data.worldbank.org/indicator/NY.GDP.PCAP.KD.ZG
LGDPPC	The World Bank, Retrieved on 5 July 2019 from website https://data.worldbank.org/indicator/NY.GDP.PCAP.KD
CRIME	The World Bank, Retrieved on 5 July 2019 from website https://data.worldbank.org/indicator/VC.IHR.PSRC.P5?view=chart
NETFDI	The World Bank, Retrieved on 5 July 2019 from website https://data.worldbank.org/indicator/BX.KLT.DINV.WD.GD.ZS
GOVEXP	The World Bank, Retrieved on 5 July 2019 from website https://data.worldbank.org/indicator/NE.CON.GOVT.KD.ZG
INVEST	The IMF, Retrieved on 23 July 2019 from website https://www.imf.org/external/pubs/ft/weo/2019/01/weodata/index.aspx
LABOR	The World Bank, Retrieved on 5 July 2019 from website https://data.worldbank.org/indicator/SL.TLF.ACTI.ZS
TRADEO	The World Bank, Retrieved on 5 July 2019 from website https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS
POPGRW	The World Bank, Retrieved on 5 July 2019 from website https://data.worldbank.org/indicator/SP.POP.GROW?view=map

Appendix 2: Summary of the statistics

(Period: 1996-2016, Countries: 40, Observations: 840)

Variable	Mean	Std. Dev.	Min	Max
GDPPCGR	-0.0536734	3.493493	-21.38871	19.87826
LGDPPC	418.282	916.3417	-4297.944	13080.78
CRIME	-0.196654	3.806901	-31.2625	43.01746
NETFDI	0.1737722	6.440244	-66.02083	59.35096
GOVEXP	0.0553604	0.9390702	-11.7465	6.197966
INVEST	-0.0219524	2.426621	-14.204	13.271
LABOR	0.1278071	0.785187	-4.963997	5.028
TRADEO	0.9071592	8.078604	-79.1339	43.03824
POPGRW	-0.0026359	0.2997818	-2.598064	2.726449
CRISIS97	0.1904762	0.3929107	0	1
CRISIS08	0.1904762	0.3929107	0	1

Appendix 3: The Correlation Matrix

	LGDPPC	CRIME	NETFDI	GOVEXP	INVEST	LABOR	TRADEO	POPGRW	CRISIS97	CRISIS08
LGDPPC	1.0000									
CRIME	0.0225	1.0000								
NETFDI	-0.1134	-0.0073	1.0000							
GOVEXP	-0.0366	0.0048	-0.1224	1.0000						
INVEST	0.1633	-0.0515	0.0314	-0.1590	1.0000					

LABOR	0.1892	-0.0067	0.0576	-0.0593	0.1032	1.0000				
TRADEO	0.0210	-0.0283	0.0965	-0.0399	0.3070	0.0670	1.0000			
POPGRW	0.2553	0.0130	-0.0621	0.0151	0.0570	0.0464	0.0538	1.0000		
CRISIS97	0.0895	-0.0632	0.0640	0.0316	0.0029	0.0070	0.0812	-0.045	1.0000	
CRISIS08	-0.2002	0.0268	-0.1184	0.1296	-0.1282	-0.0731	-0.0026	-0.0520	-0.2353	1.0000

Appendix 4: Sample Countries

No.	Countries	No.	Countries
1	Albania	**21**	Jamaica
2	Armenia	**22**	Japan
3	Australia	**23**	Kyrgyz Republic
4	Austria	**24**	Mexico
5	Bulgaria	**25**	Netherlands
6	Canada	**26**	Nicaragua
7	Colombia	**27**	Norway
8	Costa Rica	**28**	Panama
9	Czech Republic	**29**	Poland
10	Denmark	**30**	Romania
11	El Salvador	**31**	Singapore
12	Finland	**32**	Slovak Republic
13	France	**33**	Slovenia
14	Germany	**34**	South Africa

15	Guatemala	**35**	Spain
16	Guyana	**36**	Sweden
17	Hungary	**37**	Switzerland
18	India	**38**	Thailand
19	Ireland	**39**	United Kingdom
20	Italy	**40**	United States

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Notes

[1]The disturbance term encompasses any shocks that occur to the dependent variable that cannot be explained by the conditional (or deterministic) portion of the model.

[2]*xtdpd* fits dynamic panel-data models by using the Arellano-Bond or the Arellano-Bover/Blundell-Bond system estimator; *xtdpd* can fit more complex models at the cost of a more complicated syntax.