

Determinants of the Weighted Crime Rate in Thailand

Arunee Punyasavatsut

Abstract—In order to incorporate both crime frequency and its seriousness, crime rates are weighted by their legal punishment, which is years in prison. Using panel data of all provinces in Thailand during 2007-2011, a fixed effect model of crime equation is estimated. The findings show that police clear-up crime rate, number of illegal immigrant workers, number of monks, number of tourists, and national educational-test scores are determinants of crime.

Index Terms—Panel data, Thailand, weighted crime rate.

I. INTRODUCTION

Economists have tried to answer why people committed crimes. Using an economic approach, Becker (1968) stated that individuals are rational and they decide whether to commit crime by comparing benefits and costs of engaging in crime [1]. Ehrlich (1973) incorporated in the concept of opportunities both punishment and reward, not only the cost of punishment [2]. According to these arguments, crime is like a job. During the period of recession, people are unemployed or get lower income from legal works, so they commit crime for more income. For the past forty years, both theoretical and empirical models of crime were developed extensively. Some economic factors were hypothesized to be determinants of crime, i.e., per capita income, income inequality, and unemployment rate. Other social and psychological factors are education, gender, age, family background, social interaction, and cost of punishment.

In order to investigate the determinants of crime, most empirical studies employed crime rate, which is number of police-reported crime cases per thousand persons, as a measure of crime. However, this measure does not reflect the severity of crime. For example, a murder and a bag snatching are equally counted as one case of crime. So, some researchers tried to develop a better measure of crime. For example, Black (1979) proposed that crime severity is not the objective number of crime cases but the subjective community's opinions about crime seriousness [3]. In this case, researchers should conduct a survey for information about crime severity. Wolfgang (1967) introduced three methods for calculating weighted crime rate. The frequencies of criminal events are weighted by world mean seriousness, relative number of population among countries, and seriousness scores of each country [4]. Nowadays, the weighted crime rate is widely applied. Since 2009, Statistics Canada (Canada's National Statistical Agency) unveiled the

crime severity index as a measure of crime in Canada [5].

In Thailand, Royal Thai Police reports number of crimes occurred in each province monthly. Only few studies about determinants of crime were found in Thailand [6]-[8]. Moreover, none of them employed weighted crime rate. So, this study is an attempt to propose a measure of crime that reveals both the number and the severity of crime in Thailand and to identify its determinants. The rest of this paper includes literature reviews, methods, overview of crime situation in Thailand, results of the study, discussions, and conclusions.

II. LITERATURE REVIEWS

The pioneer theoretical work in economics of crime is Becker's work in 1968 [1]. In his paper, he stated that "a person commits an offense if the expected utility to him exceeds the utility he could get by using his time and other resources at other activities. Some persons become criminal, therefore, not because their basic motivation differs from that of other persons, but because their benefits and costs differ (p. 176)." Ehrlich (1973) extended Becker's work by considering how income levels and distribution may affect criminal propensity and crime rate. His empirical study found that higher-income persons are likely to be victim of crime and income inequality is positive related to crime rate [2].

Their works motivated economists to verify and study the economic variables that determine criminal choices. For the past four decades, there are many empirical studies about determinants of crime. According to these empirical studies, the determinants of crime can be divided into four categories: economic factors, criminal's personal factor, social factor, and deterrent factors. Economic factors are income level, income inequality, unemployment, and inflation rate. Criminal's personal factors are age, sex, race, education, religion, and family background. Social factors are urbanization, population density, and social interaction. Finally, deterrent factors are law punishment and probability of being arrested. Determinants of crime are specified differently in each empirical study. It depends on type of data employed. For example, the studies which employed time-series data may include the determinant such as government policy that changes overtime. While the empirical studies that employed cross-sectional data or panel data can investigate the effects of geographical and social factors that are different among countries or cities.

Some recent empirical works employ panel data because it allows inclusion of both time-dimension and cross-sectional-dimension factors. For example, Omotor (2010) studies the demographic and socio-economic determinants of crimes in Nigeria [9]. He estimates a crime equation using a pooled dataset of Nigerian states from 2002 to 2005. The independent variables are population density,

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Arunee Punyasavatsut is with the Department of Economics, Kasetsart University, Bangkok, Thailand (e-mail: fecoand@ku.ac.th).

number of convicted cases, unemployment rate, income per capita, and education or literacy rate. Borraz and Gonzalez (2010) estimate a dynamic panel data model to identify the determinants of crime in Uruguay across the 19 Uruguayan departments in the period 1986-2006 [10]. The estimation includes department fixed effects which captures non-observable heterogeneity. Quijano (2010) estimates a model to determine the crime supply function using data from criminal reports and household surveys in Colombia from 1995 to 2003. The panel includes annual data of 13 metropolitan areas [11]. Hadden and Moghadam (2011) estimates the supply of offences regressions for violent crime including murder, assault and battery, and threat using the data over the period of 1997 to 2005 for all of the provinces of Iran [12]. Miyoshi (2011) examines the link between crime and labor market opportunities in Japan. He estimates the crime supply function using Japanese prefectural panel data from 1976 to 2005 [13]. Wu and Wu (2011) estimate a model of crime using panel data of UK regions over the years from 2002 to 2007 [14]. Finally, Punyasavatsut (2014) and Piemongsan (2010) estimate crime models using panel data of Thailand [7], [8]. However, they employ unweighted crime rate as a dependent variable.

III. DATA AND METHODOLOGY

The crime data collected by the Royal Thai Police are divided into 5 categories: (1) felony crime, i.e., murder, robbery, theft, kidnapping, and arson; (2) crime against person and sexual harassment, i.e., murder, voluntary manslaughter, involuntary manslaughter, aggravated assault/battery, assault/battery, and rape; (3) crime against property, i.e., theft, grab and run, extortion, robbery, receiving stolen property, and vandalism; (4) interesting crime, i.e., motorcycle larceny, car larceny, rape and kill, kidnapping, etc.; and (5) consensual crime (victimless crime), i.e., illegal-gun possession, gambling, drug, prostitute, and pornographic material. Each category has sub-categories. For example, the felony crime category composes of murder, theft, robbery, kidnapping, and arson sub-category. The punishments of these sub-categories, i.e., maximum years in prison, are used as weights. According to Thai Criminal Law, the punishments of murder, robbery, theft, kidnapping, and arson are death penalty, 15, 10, 20, and 20 years in prison respectively. We assumed that execution is equal to 30 years in prison. Then, the weights for murder, theft, robbery, kidnapping, and arson are 1, 15/30, 10/30, 20/30, and 20/30 respectively. Following this method, the weights of each sub-category were calculated.

The panel data of 76 provinces from 2007 to 2011 were used for estimation. There are totally 380 observations. Dependent variable is the weighted crime rate and independent variables are real gross provincial products per capita (GPP), unemployment rate (U), inflation rate (INF), minimum wage (WAGE), ratio of low-income population (POVERTY), population density (DENS), number of tourists (TOUR), number of industrial factories (FAC), number of illegal immigrant workers (IMM), ratio of male youth population (14-25 years-old men) (MEN), number of monks

(MONK), police clear-up crime rate (ARR), and O-NET scores (ONET). O-NET stands for Ordinary National Educational Test. It is a nation-wide test for all M.6 students, which are final-year of secondary-school students, in the country. The test composes of five subjects: mathematics, science, social science, English language and Thai language. So, O-NET scores represent level of education in each province.

The data of low-income population are collected from National Statistical Office. It is defined as the proportion of population for whom consumption is less than the poverty line.

Since the panel data is used this study, we employed Hausman test to identify whether fixed or random effect model is more preferable. However, the time-dimension of the data is only 5 years, so we did not implement a panel unit root test.

IV. OVERVIEW OF CRIME IN THAILAND

The number of overall-country crime cases increases over year. Its average monthly growth rate is about 1.3% during January 1997-December 2011. During the period of ex-prime minister Thaksin Shinawatra's drug-conquer policy during February-April 2003, the drug crimes substantially dropped about 64.6% (see Fig. 1). However, murders and other crimes against person are higher because many drug sellers were killed to break the police investigation. So, the total crime cases decreased only 12.6%.

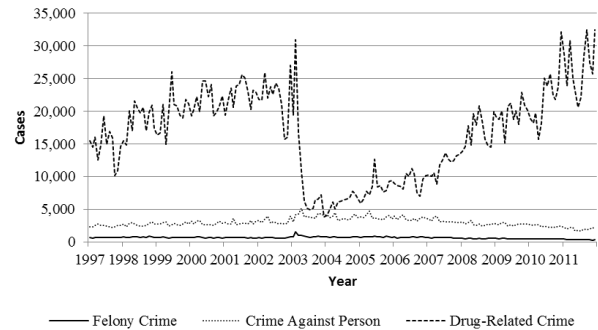


Fig. 1. Some categories of crime during 1997-2011.
Source: Royal Thai Police (2013).

Crime rates are high in large cities, capital cities, and tourist cities. Chonburi province, where the famous tourist-attraction Pattaya located, got highest crime rate in 2011 (see Table I). Its crime rate is 23.27 cases per thousand persons. Phuket, a well-known island, got the second rank with 22.96 cases per thousand persons. Bangkok, the capital city, had 17.19 cases per thousand persons. Even though the numbers of illegal events are large in these cities, but most of them are not serious crimes. They are mostly theft and gambling.

When we consider the weighted crime rate, the situation has changed. The top three provinces with the highest weighted crime rates are Surat Thani, Krabi, and Chumpon. Because many crimes against person and illegal-gun possession were found in these provinces. Bangkok becomes the 36th rank when the weighted crime rate is considered. One

of the interesting findings is that the three south-border provinces, which are Pattani, Yala, and Narathiwat, got the higher rank when the weighted crime rate is considered. Yala, Narathiwat, and Pattani are ranked no. 8th, 13th, 15th respectively. Because many terrorisms frequently occur in these provinces.

TABLE I: THE PROVINCIAL RANKING OF UNWEIGHTED AND WEIGHTED CRIME RATES

Rank	Province	Unweighted Crime Rate (Case per Thousand Population)	Province	Weighted Crime Rate
1	Chon Buri	23.27	Surat Thani	1.18
2	Phuket Samut	22.96	Krabi	0.99
3	Sakhon	18.93	Chumphon	0.92
4	Bangkok	17.19	Phuket	0.87
5	Ranong	14.61	Satun	0.87
6	Ratchaburi Nakhon	12.60	Ranong	0.86
7	Pathom	12.39	Chon Buri	0.77
8	Surat Thani	12.17	Yala Samut	0.77
9	Rayong	12.12	Sakhon Nakhon Si	0.77
10	Chumphon	11.81	Thammarat	0.73

V. EMPIRICAL RESULTS

The results of Hausman test indicated that fixed effect model is more appropriate than random effect model. So, the fixed effect model was estimated (see Table II). The findings are as follows: police clear-up crime rate, number of tourists, and monks are highly statistically significant and their effects on the weighted crime rate are as hypothesized. Higher police clear-up crime rate deters crime and more monks lead to the declining crime rate. On the other hand, tourist cities tend to have more crime rate. Higher illegal immigrant workers also have positive effects on the weighted crime rate. Mostly, they participate in crime against person and victimless crime. Moreover, the result shows that higher O-NET scores have negative effects on crime because of the civilization effect. Education has an indirect effect on the preference of individuals. It makes criminal more costly in psychological terms.

However, some independent variables do not relate to the weighted crime rate. These variables are GPP, unemployment rate, inflation rate, number of industrial factories, and ratio of male youth population.

Some independent variables are statistically significant but their effects on crime are opposite to what we were expected. For example, it is found that the higher population density, the lower the weighted crime rate. Other two variables that their coefficients show the unexpected signs are ratio of low-income population and minimum wage. Becker’s model implies that increases in individual returns make illegal activities decline. But the facts are that favorable economic environment, which are high wage and low poverty rate, and

high population density lead to more chances for criminal activities. So, the crime rate increases when people, who are likely to be victims of crime, are well-being.

When compare our findings to those of Punyasavatsut (2014) [7] which employed unweighted crime rate as the dependent variable, it is found that both studies’ findings are quite similar, except the effect of male-youth variable on crime. In the unweighted crime model, the ratio of male youth population do affects the total crime rate and the rate of crime against person. But when the weighted crime rate is employed, the coefficient of male-youth variable is not statistically significant. So, an increase in male youth makes some sorts of crime like teenage fight and gang violence increase. But it does not increase the seriousness of crime significantly.

TABLE II: THE ESTIMATION RESULTS

Dependent Variable: the Weighted Crime Rate			
Independent Variables	Units	Coefficient	t-statistics
ARR	percentages	-0.0039	-7.2617***
DENS	persons per km ²	-0.0002	-7.8795***
FAC	places	-0.0003	-1.3841
GPP	thousand baht	0.0001	0.9772
IMM	persons	2.34E-06	5.1048***
INF	percentages	-0.0082	-1.7146*
MEN	percentages	-0.0004	-0.4564
MONK	persons	-2.31E-05	-8.0411***
ONET	marks	-0.0035	-3.4954***
POVERTY	percentages	-0.004	-5.6861***
TOUR	thousand persons	4.98E-05	7.1871***
U	percentages	-0.0283	-2.3343**
WAGE	Baht per day	0.0059	6.3198***
Constant		0.5859	2.9066***
R-squared		0.6578	
Adjusted R-squared		0.6417	
Durbin-Watson statistics		0.6309	
F-statistics		40.9364	

Note: *, **, *** represent 90, 95, and 99 percent of statistically significant respectively.

VI. DISCUSSIONS

The average police clear-up crime rate is 86.78% in Thailand during 2007-2011. It is increasing overtime after a sharply drop in 2003 when the drug-conquer policy was imposed (see Fig. 2). According to the findings that the clear-up rate has negative effects on the weighted crime rate, then, the upward trend in clear-up rates may reduce the crime rate in the future.

However, the problem of terrorism in south-border provinces still maintains. The data show that Pattani, Narathiwat, and Yala provinces’ clear-up rate are only 18.89%, 19.17%, and 25.63% respectively and they are the top-three minimum rates in the country.

An important factor that has strong effects on crime rate is

tourists. It is found that tourist provinces, e.g., Phuket, Krabi, and Chon Buri, have high crime rates. Types of crime that are often found in tourist cities are drugs, theft, gambling, and prostitute. In 2011, there are 18,947,000 and 8,642,000 both domestic and foreign tourists visited Bangkok and Chon Buri respectively. The Tourist Police Division was established in 1976 in order to facilitate conveniences and provide safety for tourists.



Fig. 2. Police clear-up crime rate during 1997-2011.
Source: Royal Thai Police (2013).

Illegal immigrant worker is one of determinants of crime. Our finding supports a police's research [15] that illegal immigrant workers cause various types of crime. There were 1,948,980 illegal immigrant workers all over the country in 2011. About ¼ of them stayed in the capital city, Bangkok. Most of illegal immigrant workers came from neighbor country, Myanmar.

Our finding also supports Lochner's arguments [16] that improvement in education can indirectly lower crime. In this study, we employed national educational test score, which is an educational outcome, as a proxy of education level. However, other proxies of education level, such as education quality and educational attainment, are also preferred if their data are available.

An interesting finding is that the number of monks, which is a proxy of religion, affects the crime rate. Most of Thais are Buddhism and the five precepts of Buddhists are against killing living beings, taking what is not given (or stealing), sexual misconduct, false speech, and use of intoxicating drink or drugs. So, religion or belief can lower crime.

Unfortunately, the potential negative effects of economic circumstance on crime are not existed in our study because the GPP coefficient is not statistically significant.

VII. CONCLUSIONS

In order to make a crime rate to represent both its amount and severity, we weighted frequency of crime by its legal punishment. The study also attempts to identify the determinants of the weighted crime rate. The determinants of crime are divided into three categories which are: (1) macroeconomic variables which represent economic activities i.e., real per capita gross provincial products (GPP), unemployment rate, ratio of low-income population, official minimum wage rate, and inflation rate; (2) sociological variables i.e., educational variable, which is Ordinary

National Educational Test (O-NET), number of illegal immigrant workers, number of male youth population ages 14-25, number of tourists, number of monks, population density, and number of industrial factories; and (3) deterrent variable which is police clear-up crime rates. The dataset comprises of annual data of 76 provinces in Thailand over the period of 2007–2011.

The results of Hausman tests show that fixed effect model is more appropriate than random effect model. So, this study uses the fixed effect estimates. It is found that some determinants do explain crime rates significantly. These determinants are police clear-up crime rate, number of illegal immigrant workers, number of monks, number of tourists, and O-NET scores. Their impacts on crime are as expected. The strong positive effects of the number of tourists on crime are found. However, the impacts of some variables on crime are not found. The results show that GPP, number of industrial factories, inflation rate, ratio of male youth population, and unemployment rate are not statistically significant. The findings also show that minimum wage rate, ratio of low-income population, and population density have impacts on crime but their impacts are opposite to what hypothesized.

According to the results of our study, the policy authorities may pay attention to control crime in tourist cities and the provinces that many illegal immigrants are lived.

Most limitations of our study came from lack of data. The provincial data of many variables cannot be collected. For example, the data of urbanization and police officers are not available.

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Arunee Punyasavatsut was born in Bangkok, Thailand. She received her B.Sc. in economics at Kasetsart University, Thailand in 1989; the M.A. in economics at Thammasat University, Thailand in 1992; and the Ph.D. in economics at the same university in 1999.

She is currently an assistant professor in economics at the Department of Economics, Faculty of Economics, Kasetsart University. Her major fields are economic growth and macroeconomics. Her research interest is about the role of economic circumstances on social problems, such as crime, suicide, and traffic-accidental fatality.