



**ADB Working Paper Series**

**WHICH DIMENSION OF INCOME  
DISTRIBUTION DRIVES CRIME?  
EVIDENCE FROM THE PEOPLE'S  
REPUBLIC OF CHINA**

---

Chen Wang, Guanghua Wan,  
and Xueliang Zhang

No. 704  
March 2017

**Asian Development Bank Institute**

Chen Wang is lecturer at the School of Urban and Regional Science, Shanghai University of Finance and Economics. Guanhua Wan is director of research at the Asian Development Bank Institute. Xueliang Zhang is professor at the School of Urban and Regional Science, Shanghai University of Finance and Economics.

The views expressed in this paper are the views of the author and do not necessarily reflect the views or policies of ADBI, ADB, its Board of Directors, or the governments they represent. ADBI does not guarantee the accuracy of the data included in this paper and accepts no responsibility for any consequences of their use. Terminology used may not necessarily be consistent with ADB official terms.

Working papers are subject to formal revision and correction before they are finalized and considered published.

The Working Paper series is a continuation of the formerly named Discussion Paper series; the numbering of the papers continued without interruption or change. ADBI's working papers reflect initial ideas on a topic and are posted online for discussion. ADBI encourages readers to post their comments on the main page for each working paper (given in the citation below). Some working papers may develop into other forms of publication.

ADB recognizes "China" as the People's Republic of China.

Suggested citation:

Wang, C., G. Wan, and X. Zhang. 2017. Which Dimension of Income Distribution Drives Crime? Evidence from the People's Republic of China. ADBI Working Paper 704. Tokyo: Asian Development Bank Institute. Available: <https://www.adb.org/publications/which-dimension-income-distribution-drives-crime-prc>

Please contact the authors for information about this paper.

Email: [c.wang@law.leidenuniv.nl](mailto:c.wang@law.leidenuniv.nl), [gwan@adbi.org](mailto:gwan@adbi.org), [zhang.xueliang@mail.shufe.edu.cn](mailto:zhang.xueliang@mail.shufe.edu.cn)

This paper has benefited from the comments of Professor Yuan Zhang and participants of the Asian Development Bank Institute (ADBI) Workshop on Structural Transformation and Inclusive Growth (Tokyo, 20–21 September 2016). The authors gratefully acknowledge financial support from the PRC's National Social Science Funds (14ZDB138), the National Natural Science Funds (71133004, 71473160), the China Postdoctoral Science Foundation (2016M591645), the Bairen Program of Yunnan Province, and the Innovation Research Team from Shanghai University of Finance and Economics.

Asian Development Bank Institute  
Kasumigaseki Building, 8th Floor  
3-2-5 Kasumigaseki, Chiyoda-ku  
Tokyo 100-6008, Japan

Tel: +81-3-3593-5500  
Fax: +81-3-3593-5571  
URL: [www.adbi.org](http://www.adbi.org)  
E-mail: [info@adbi.org](mailto:info@adbi.org)

© 2017 Asian Development Bank Institute

**Abstract**

Income distribution is perceived to affect crime (Becker 1968; Thurow 1971; Merlo 2003). Consequently, economists have been modeling crime-employing inequality indicators as one of the explanatory variables, yielding mixed results. This paper argues that income polarization rather than inequality should be taken into account in the context of crime analysis. Technically, in addition to income gaps as captured by inequality indicators, the recently developed polarization index of Duclos, Esteban, and Ray (2004) also measures social segregation, which implies immobility and alienation, both of which are closely related to social tensions and conflicts. Thus, this polarization index is expected to be a better variable in explaining crime. To substantiate our arguments, provincial panel data from the People's Republic of China (PRC) are used to model the crime–income distribution relationship. Income polarization is found to be positively and significantly associated with crime. When both income polarization and inequality indicators are included in the models, the former remains a positive and significant determinant while the latter becomes insignificant.

**JEL Classification:** D31, K4

## Contents

1.	INTRODUCTION .....	1
2.	CRIME, INCOME INEQUALITY, AND INCOME POLARIZATION: LITERATURE REVIEW .....	2
3.	MODEL SPECIFICATION AND DATA.....	3
3.1	Model.....	3
3.2	Data.....	4
4.	EMPIRICAL RESULTS.....	5
4.1	Descriptive Statistics.....	5
4.2	The Positive Relationship between Income Polarization and Crime .....	7
4.3	Income Inequality, Income Polarization, and Crime.....	11
4.4	Income Polarization, Economic Growth and Crime .....	11
5.	SUMMARY .....	15
	REFERENCES .....	16

## 1. INTRODUCTION

As argued by Loayza et al. (2000), among others, criminal activities act like a tax on the entire economy, discouraging domestic and foreign direct investment, reducing firms' competitiveness, diverting resources to nonproductive use, and creating uncertainty and inefficiency. Also, individuals who have contacts with the criminal justice system face less chance of employment, which increases the cost of job matching and unemployment (Borland and Hunter 1999). More generally, crimes impair quality of life anywhere and everywhere, adversely affecting happiness and health (Robinson and Keithley 2000; Davies and Hinks 2010). Some directly cause fear, pain, and suffering (Detotto and Otranto 2010).

To contain or fight crimes, it is vital to identify and analyze the determinants. One of them is income distribution (Backer 1968; Merlo 2003). As pointed out by Thurow (1971), preventing crime and creating social or political stability may depend on preserving a narrow distribution of income. In modeling the relationship between income distribution and crime, the conventional practice is to use inequality indicators such as the Gini coefficient (Enamorado et al. 2016). However, inequality indicators only measure income differences. They do not capture clustering of individuals, which has implications on social segregation or alienation. As criminologists point out, those who are alienated in a community or society are more likely to commit crimes (Patterson 1991). Further, in a segregated society or when a population group is alienated, upward income mobility would be low for the disadvantaged. According to Friedman (1962), two societies with the same income inequality, the one with greater income mobility would be more equal in the long run.

Thus, it appears preferable to use measures of income distribution that can capture segregation and alienation of individuals when exploring the income distribution–crime relationship. Interestingly, the recently developed polarization indices can capture both the income differences and social segregation (Foster and Wolfson 1992, 2010). By definition, polarization describes the extent of population clustering with homogeneous individuals within each cluster but heterogeneous individuals across clusters (Esteban and Ray 1994). In a polarizing society, population clusters become more and more sharply distinguished from one another in wealth and power, resulting in immobility and low social integration (Deutsch 1971). In particular, income polarization is found to be closely related to social unrest (Esteban and Ray 1994).

This paper contributes to the literature by introducing polarization into crime modeling and by exploring the determinants of crime in the People's Republic of China (PRC), using the index of Duclos, Esteban, and Ray (2004) or DER index hereafter.<sup>1</sup> We focus on the post-reform period in the PRC when income distribution worsened and crime rates rose significantly.<sup>2</sup> It is found that income polarization is positively and significantly associated with crimes while the coefficients of inequality indicators are less significant or insignificant. When the DER index and an inequality indicator are both included in the same model, the coefficient of the former remains positive and significant while that of the latter becomes insignificant with unexpected signs.

---

<sup>1</sup> Pioneer studies on this subject are, for example, Foster and Wolfson (1992, 2010), Esteban and Ray (1994), Wang and Tsui (2000), Zhang and Kanbur (2001), and Duclos, Esteban, and Ray (2004).

<sup>2</sup> Official statistics show that criminals arrested by the People's Procuratorate increased from 598,101 in 1998 to 896,403 in 2013, nearly 1.5 times within 15 years (National Bureau of Statistics 1998, 2013).

This paper is structured as follows. Section 2 provides a literature review, followed by model specification and data description in section 3. Section 4 presents empirical results and sensitivity analyses. Section 5 concludes, with policy implications.

## **2. CRIME, INCOME INEQUALITY, AND INCOME POLARIZATION: LITERATURE REVIEW**

The economic literature on crime can be traced back to Becker (1968), who establishes that a rational decision of criminal acts is based on cost–benefit analysis. The expected net benefit is the difference between the loot and the opportunity cost of crime such as penalties imposed on apprehended criminals. According to Ehrlich (1973), inequality induces crimes because of large differences between the expected gains from successful crime and returns from legitimate work for the poor. This link between inequality and crime was further examined in a general equilibrium model by İmrohoroğlu, Merlo, and Rupert (2000), where the crime rate, the levels of expenditures for police protection, and income redistribution are simultaneously determined. They show that increases in the variance of wage lead to higher crime rates. Using a dynamic equilibrium model, İmrohoroğlu et al. (2004) find that when income inequality increases in the United States (US), more people engage in criminal activities.

To empirically model the relationship between income distribution and crime, almost all studies employ inequality indicators as proxies of income distribution. And research findings are mixed. For instance, Chiu and Madden (1988) examine the effects of income inequality on the level of burglary. They argue that individuals with low earnings potentially have a greater incentive to take risks and engage in burglary. The rich become potential burglary victims. Their empirical results show that the number of burglaries increases as inequality increases. Fowles and Merva (1996) find that wage inequality is positively linked to violent crimes. Ehrlich (1973) and Hsieh and Pugh (1993) argue that rising income inequality breeds crime, as confirmed by Blau and Blau (1982) and Kelly (2000) using data on violent crime from the US. Fajnzylber et al. (2002) find a two-way causality between crime and income inequality. Using an instrument variable approach, Enamorado et al. (2016) find that between 2006 and 2010, a one percentage point rise in the Gini coefficient translates into an increase of more than 10 drug-related homicides per 100,000 inhabitants. Using data from the PRC, crime rate is also found to be positively correlated with intra-provincial inequality (Cheong and Wu 2015).

Contrary to the above findings, other studies demonstrate that income inequality is negatively correlated or uncorrelated with crimes. Using county-level data from the US, Brush (2007) finds a negative relationship between income inequality and crime rates in the time-series setting although the relationship is positive in the cross-sectional setting. The negative correlation is also found by Baharom and Habibullah (2009), who use 1973–2003 data from Malaysia. Chintrakarn and Herzer (2012) employ state-level panel data for the period 1965–2005 in the US and find that inequality exerts a robust crime-reducing effect. Finally, Zhang et al. (2011) conclude that there is no robust evidence supporting the positive relationship between income inequality and crime in the PRC.

These mixed findings could be attributable to the incompleteness of income inequality as a proxy of income distribution. As argued earlier, inequality indicators only measure income gaps and do not capture income immobility and social segregation, which are perceived to drive crime. On the other hand, income polarization reflects a “divided society” (Zhang and Kanbur 2001) where people cannot easily change their social

identity from one income group to another. Thus, unlike inequality the concept of polarization is closely related to social segregation and income mobility.

Turning to measurement of polarization, Foster and Wolfson (1992, 2010) propose a polarization index, capturing “increased spread,” the classical example of which is the rich becoming richer and the poor becoming poorer. Esteban and Ray (1994) and Duclos et al. (2004) conceptualize income polarization into an “identification–alienation” framework. The “alienation” component represents the extent of income difference between individuals. The “identification” component captures the phenomenon of “clustering around extreme income poles,” reflecting income group densities. Within each group, individuals share common social identity and have similar interests. It is well known that a person’s behavior is strongly influenced by the group the person interacts with (Glaeser et al. 1996, Bayer et al. 2007) and people in lower income groups have lower cost of crime.

Despite the relevance of polarization to crimes, no previous attempt has been made to model the relationship between crimes and polarization, using the DER index. The bi-polarization index of Foster and Wolfson (1992, 2010) is not considered in this paper because it assumes existence of only two poles of income distribution.<sup>3</sup> Also, when computing the bi-polarization indicators, it is necessary to split the data sample and the point of split is arbitrarily set at the median income (Esteban and Ray 2005). On the contrary, the DER index of Duclos et al. (2004) lets data determine the number of poles and the point(s) of splits.

### 3. MODEL SPECIFICATION AND DATA

#### 3.1 Model

Our baseline mode is specified as follows:

$$Crime_{it} = \alpha + \beta' IncDist_{it} + \theta' X_{it} + \eta_t + T + \mu_i + \varepsilon_{it}, \quad (1)$$

where  $i$  indexes province and  $t$  indexes year,  $Crime$  represents crime rate, and  $IncDist$  stands for a vector of proxies of income polarization, namely income polarization and income inequality.  $X$  contains control variables.  $\eta$  is a set of dummy variables to take into account changes in criminal statistics in 1989 and 1992, and the special years of 1996 and 2001 when intensive crackdown on crime occurred.  $T$  is time trend,  $\mu_i$  is province fixed effect, and  $\varepsilon$  is the usual disturbance term.

Regarding control variables, GDP per capita is included to account for the level of material well-being. Some studies found that better living standard reduces violence due to better social control and self-regulation (Patterson 1991; Fowles and Merva 1996). However, others found a positive association between economic development and crime as more affluence means larger potential loot from crimes (Fanjzylber et al. 1998). Net migration is included in our model. Immigrants usually experience higher than average levels of unemployment and lower incomes and often suffer from discrimination and barriers to housing, education, career opportunities, and political participation (Wortley 2003). These produce both absolute and relative deprivation, which can cause criminal behaviors. Some immigrant groups may be more involved in

---

<sup>3</sup> According to Foster and Wolfson (1992, 2010), the bi-polarization indicator can be expressed as  $FW = (G^B - G^W) \frac{\mu}{m}$ , where  $G^B$ ,  $G^W$ ,  $\mu$ , and  $m$  denote the between group inequality, within group inequality, the sample mean, and median income of the income distribution, respectively.

criminality than others. For example, Rattner (2007) found that Russian Federation immigrants in Israel commit a higher crime rate than native Israelis. They are responsible for most of the organized crimes in the Netherlands (Siegel and Bovenkerk 2007). Finally, we also control police expenditure, although Edlund et al. (2008) find its correlation with crime insignificant.

Other control variables include population density (number of population/square kilometer) which affects the probability of acquiring the information necessary to perform a crime (Sjoquist 1973), urbanization rate measured as the ratio of urban residents to the total population is also employed, since urban areas provide better job opportunities and stronger police force.

### 3.2 Data

Unless indicated otherwise, all data are sourced from China Statistical Yearbooks, published by the National Bureau of Statistics (NBS). Two crime indicators from the Procuratorial Yearbooks of China will be used as the dependent variable: criminal arrests and criminal prosecutions per 10,000 population.<sup>4</sup> They are likely to underestimate the true level of crimes.<sup>5</sup> This, however, does not represent a problem as long as they are consistent over time and across locations. We mainly focus on prosecution rates since there are non-criminals who were arrested but not prosecuted.

To construct the income polarization and income inequality measures at the provincial level, grouped data are ungrouped using the method of Shorrocks and Wan (2009).<sup>6</sup> The conventional inequality indices of Gini and Theil and the DER index of Duclos, Estaban, and Ray (2004) are then computed. The latter is estimated applying the commonly used parameter  $\alpha = 0.5$ .<sup>7</sup> A DER index of  $\alpha = 0$  indicates absence of polarization, whereas an index of  $\alpha = 1$  indicates complete polarization.

The data sample covers the period of 1985–2008, due to the availability of grouping income data. The descriptive analyses for crime and income polarization apply the full sample while our empirical estimations are based on the sample from 1988 to 2006, due to the data availability for all variables. Table 1 presents the summary statistics for the empirical analyses.

---

<sup>4</sup> Criminal activities include homicide, intentional injury causing serious injury or death, rape, robbery, drug trafficking, arson, explosion, and poisoning.

<sup>5</sup> According to Brush (2007), this bias may also be related to income disparity. For example, in impoverished areas people are less likely to report crimes; police in underfunded department do not record all crimes conscientiously.

<sup>6</sup> This technique is capable of reproducing individual data from grouped statistics with a high degree of accuracy. It ensures that the characteristics of the synthetic income distribution exactly match the reported values.

<sup>7</sup> The formula for calculating income polarization is as follows (Duclos et al., 2004, p. 1744):  $DER(f, \alpha) = \int \int f(x)^{1+\alpha} f(y) |x - y| dx dy$ , where  $\alpha \in [0.25, 1]$ ,  $x$  and  $y$  are income of two different individuals, and  $f(x)$  and  $f(y)$  are the density functions. When  $\alpha = 0$ , the DER index reduces to the Gini coefficient:  $G = \int \int f(x) f(y) |x - y| dx dy$ .



**Table 1: Summary Statistics**

Variable	Obs	Mean	Std. Dev.	Min	Max
Prosecution rate	384	6.066	2.950	1.110	21.2
Arrest rate	384	5.951	2.440	1.060	18.2
DER index	384	23.5	3.5	15.5	35.7
The Gini coefficient	384	0.371	0.071	0.193	0.587
Theil index	384	0.246	0.119	0.061	1.477
GDP per capita	384	7.117	7.000	0.744	58.2
Police expenditure	384	6.926	1.858	1.593	13.4
Net migration	384	5.7	23.5	-113.4	106.1
Population density	384	351.2	352.9	1.7	2,084.3
Urbanization	384	41.7	20.7	13.1	86.2

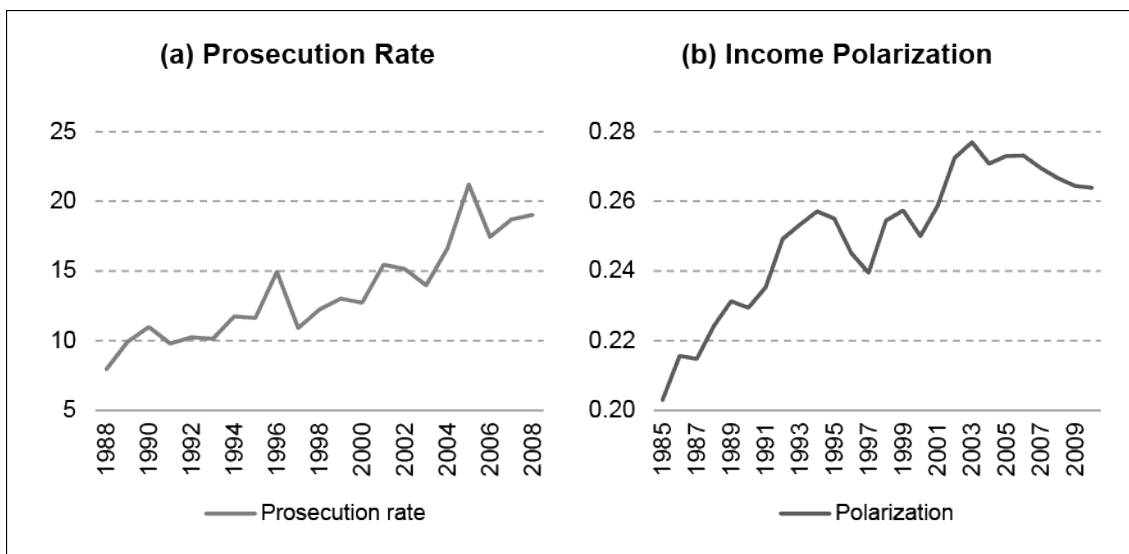
Source: Procuratorial Yearbook of China and NBS; own calculations.

## 4. EMPIRICAL RESULTS

### 4.1 Descriptive Statistics

Figure 1 shows the increasing trends of crime rates and income polarization for the PRC as a whole. During the period under study, the crime rate increased remarkably with three peaks in 1996, 2001, and 2006 (see the left panel of Figure 1), implying growing social tensions and social conflicts. Income polarization exhibits an inverted U pattern (see the right panel). It increased significantly from 1986 to 1994, reaching the peak in 2003. Although decreased after 2003, the level of polarization remains high compared to early years. This trend broadly corresponds to that of the prosecution rate.

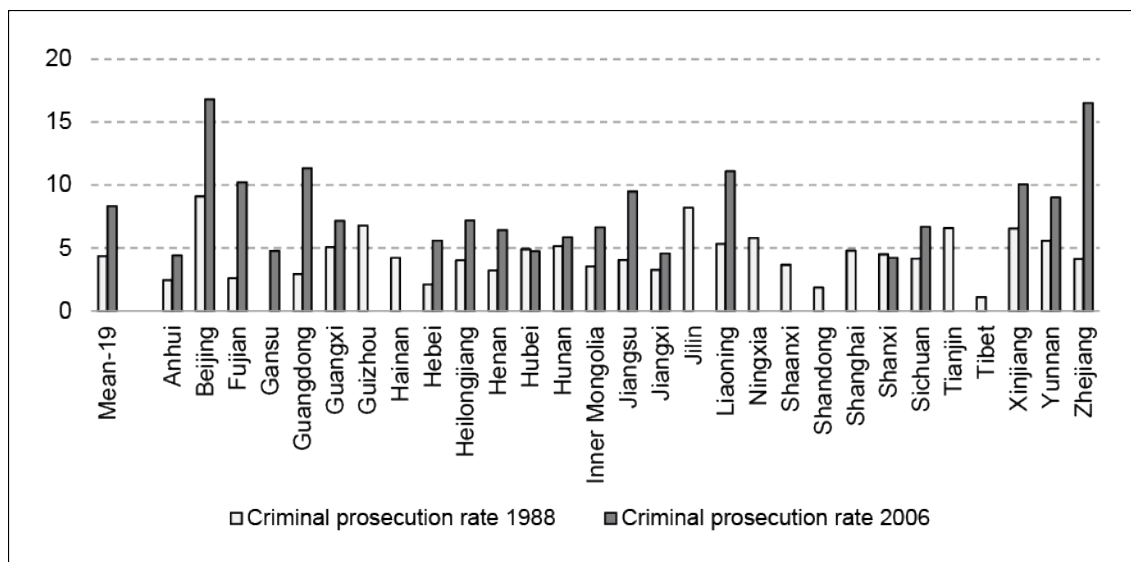
**Figure 1: Trends of Crime Rates and Income Polarization, 1985–2008**



Source: Procuratorial Yearbook of China and NBS; own calculations.

Province-level crimes share similar trends with the national counterpart although there are substantial variations across provinces. Figures 2 plots the data for 1988 and 2006. Observed crimes in 1988 were most severe in Beijing, Jilin, and Guizhou while least severe in Tibet, Shandong, and Hebei. The situation changed in 2006 when Beijing, Zhejiang, and Guangdong had the most severe crimes and provinces with the least crimes were Anhui and Shanxi. Regarding changes in crimes, the largest increase was found in Zhejiang, followed by Guangdong, Beijing, and Fujian. Only two provinces had an attenuating trend throughout the entire period: Hubei and Shanxi.

**Figure 2: Provincial Crime Rates in 1988 and 2006**



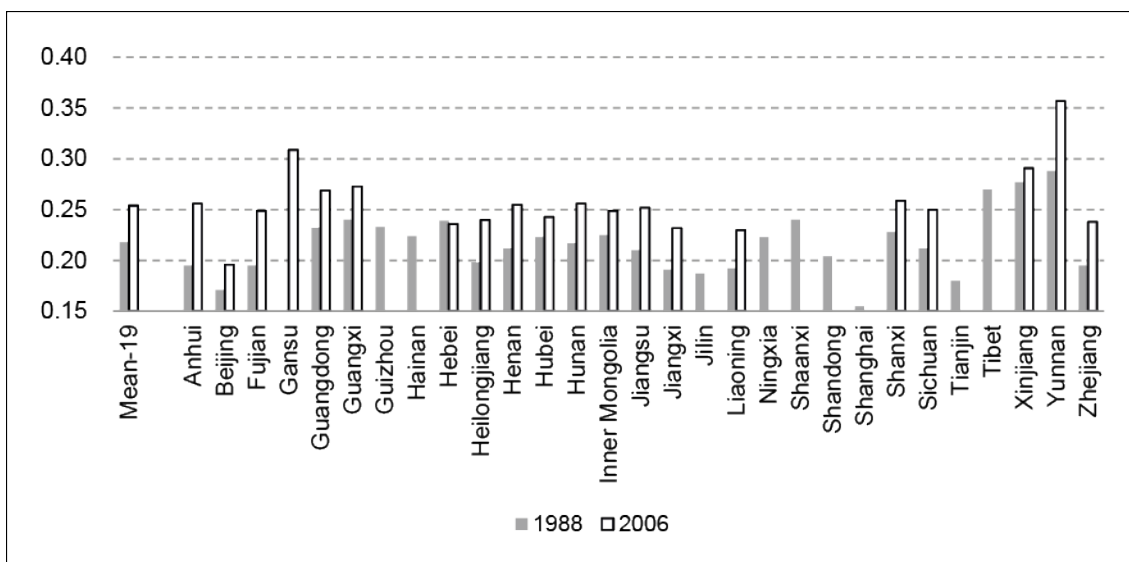
Note: Since there are many observations not available in 2008, we present the year 2006 as the latest year instead of 2008. Mean 19 provinces excludes Gansu, Guizhou, Hainan, Jilin, Ningxia, Shaanxi, Shandong, Shanghai, Tianjin, and Tibet. For some provinces, data year are around 1988 (Beijing, Guangxi, Guizhou, Hunan, Ningxia, Shanxi, Tianjin, Xinjiang, Yunnan, and Zhejiang, 1989; Jiangsu and Jilin, 1990; Hubei, 1991; Inner Mongolia, 1993) and around 2006 (Shanxi and Sichuan, 2005).

Source: Procuratorial Yearbook of China.

Figure 3 plots 1988 and 2006 estimates of income polarization at the provincial level. In 1988, Yunnan, Xinjiang, and Tibet were most polarized while the least polarized regions were Shanghai, Beijing, and Tianjin. In 2006, Yunnan and Xinjiang remained the most polarized while Gansu replaced Tibet as one of the most polarized regions. At the same time, Beijing, Liaoning, and Jiangxi were least polarized. In the majority of provinces, income polarization grew, with the largest growth in Yunnan, followed by Anhui, Henan, and Zhejiang. However, Hebei experienced a slight decrease from 0.239 in 1988 to 0.236 in 2006.

Interestingly, high income polarizations did not occur in rich provinces but in the west or southwest—Yunnan, Xinjiang, and Gansu. This may be attributed to the fact that the west possesses a relatively larger agriculture sector and the urban–rural gap is larger, too. The descriptive statistics also indicate that in most provinces where the income polarization increased, the crime rates also increased.

**Figure 3: Provincial Income Polarization in 1988 and 2006**



Note: Since there are many observations not available in 2008, we present the year 2006 as the latest year instead of 2008. Mean 19 provinces excludes Gansu, Guizhou, Hainan, Jilin, Ningxia, Shaanxi, Shandong, Shanghai, Tianjin, and Tibet. For some provinces, data year are around 1988 (Beijing, Guangxi, Guizhou, Hunan, Ningxia, Shanxi, Tianjin, Xinjiang, Yunnan, and Zhejiang, 1989; Jiangsu and Jilin, 1990; Hubei, 1991; Inner Mongolia, 1993) and around 2006 (Shanxi and Sichuan, 2005).

Source: NBS; own calculations.

## 4.2 The Positive Relationship between Income Polarization and Crime

Table 2 presents the estimation results of the relationship between income polarization and crime. All regressions in Table 2 include year and province fixed effects except for M2.5 and M2.6 which use province dummies, criminal records adjustment, and intensive crackdowns dummies. It is clear that the coefficient of income polarization is positive and significant under every model except for M2.1, which is most likely to suffer from the problem of omitted variables.

M2.2 controls the level of economic development, expenditure on police as percentage of GDP, and net migration. In M2.3 and M2.4, additional variables are controlled. When criminal records adjustment and intensive crackdowns dummies are considered instead of year fixed effects (see M2.5 and M2.6), the estimates for the coefficients of income polarization become even larger.

We explore the robustness of our findings by using criminal arrest rates as the dependent variable (Table 3). The result shows that the crime-enhancing effect of income polarization remains unchanged.

**Table 2: Panel Data Regressions of Crime Rate and Income Polarization**

<b>Crime</b>	<b>M2.1</b>	<b>M2.2</b>	<b>M2.3</b>	<b>M2.4</b>	<b>M2.5</b>	<b>M2.6</b>
Income polarization	0.019 [0.46]	0.087** [2.59]	0.080** [2.46]	0.080** [2.46]	0.112*** [3.01]	0.113*** [3.04]
GDP per capita		0.272*** [8.35]	0.302*** [8.31]	0.302*** [8.31]	0.275*** [8.86]	0.268*** [8.22]
Police expenditure		0.157*** [2.93]	0.164*** [3.11]	0.164*** [3.11]	0.164*** [2.93]	0.160*** [2.85]
Migration		0.007 [1.00]	0.006 [0.85]	0.006 [0.85]	0.007 [0.88]	0.007 [0.99]
Population density			-0.004 [-1.05]	-0.004 [-1.05]	-0.001 [-0.19]	-0.000 [-0.06]
Urbanization			-0.021*** [-3.31]	-0.021*** [-3.31]	-0.023*** [-3.50]	-0.022*** [-3.34]
Trend				-0.007 [-0.22]	-0.040 [-1.44]	-0.023 [-0.70]
Intensive crackdown in 1996					-0.131 [-0.59]	-0.073 [-0.32]
Intensive crackdown in 2001					0.978*** [3.69]	0.958*** [3.62]
Record adjustment in 1989						-0.031 [-0.11]
Record adjustment in 1992						0.240 [0.99]
Constant	3.300*** [3.11]	0.189 [0.20]	2.559* [1.66]	2.566* [1.66]	1.869 [1.23]	1.492 [0.94]
Provincial FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	N	N
No. of observations	384	384	384	384	384	384
Adj R-sq	0.789	0.882	0.886	0.886	0.854	0.854

Note: t values in brackets; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

**Table 3: Panel Data Regressions of Crime Rate (Arrest Rate) and Income Polarization**

Crime	M3.1	M3.2	M3.3	M3.4	M3.5	M3.6
Income polarization	0.008 [0.19]	0.069** [2.07]	0.064** [2.01]	0.064** [2.01]	0.083** [2.48]	0.082** [2.45]
GDP per capita		0.219*** [8.11]	0.234*** [7.91]	0.234*** [7.91]	0.198*** [7.47]	0.193*** [7.01]
Police expenditure		0.142*** [3.03]	0.150*** [3.30]	0.150*** [3.30]	0.133*** [2.78]	0.133*** [2.79]
Migration		0.011** [2.00]	0.010* [1.80]	0.010* [1.80]	0.012* [1.85]	0.013* [1.90]
Population density			-0.000 [-0.07]	-0.000 [-0.07]	0.004 [1.02]	0.004 [1.13]
Urbanization			-0.028*** [-4.18]	-0.028*** [-4.18]	-0.028*** [-4.08]	-0.028*** [-3.96]
Trend				-0.021 [-0.69]	-0.037 [-1.52]	-0.027 [-0.94]
Intensive crackdown in 1996					0.026 [0.15]	0.057 [0.31]
Intensive crackdown in 2001					1.137*** [5.43]	1.124*** [5.35]
Record adjustment in 1989						0.198 [0.76]
Record adjustment in 1992						0.064 [0.29]
Constant	3.664*** [3.51]	0.920 [0.99]	2.251 [1.56]	2.272 [1.57]	1.790 [1.30]	1.550 [1.09]
Provincial FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	N	N
No. of observations	384	384	384	384	384	384
Adj R-sq	0.759	0.857	0.867	0.867	0.839	0.838

Note: t values in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

We further carry out robustness check using two-stage least square (2SLS) estimation because crime rates may also affect income polarization or inequality. As stressed by Enamorado et al. (2016), higher crime rates can diminish the stock of physical capital and development of human capital, raise segregation and erode social capital, affect the capacity of local government and economic activity, and increase the incentives to migrate to safer areas. In this paper, lagged income polarization is used as the instrumental variable. Once again, the results are found to be robust and the effect becomes even greater with 2SLS estimation.

**Table 4: Panel Data Regressions (2SLS) of Crime Rate and Income Polarization**

Crime	M4.1	M4.2	M4.3	M4.4	M4.5	M4.6
Income polarization	-0.022 [-0.25]	0.138* [1.88]	0.114* [1.67]	0.114* [1.67]	0.235*** [3.22]	0.234*** [3.21]
GDP per capita		0.015*** [2.98]	0.015*** [3.04]	0.015*** [3.04]	0.016*** [3.23]	0.017*** [3.32]
Police expenditure		0.259*** [7.70]	0.294*** [7.94]	0.294*** [7.94]	0.279*** [8.62]	0.271*** [8.21]
Migration		0.188*** [3.48]	0.183*** [3.62]	0.183*** [3.62]	0.202*** [3.73]	0.195*** [3.56]
Population density			-0.005 [-1.17]	-0.005 [-1.17]	-0.002 [-0.49]	-0.001 [-0.37]
Urbanization			-0.030*** [-3.75]	-0.030*** [-3.75]	-0.030*** [-3.35]	-0.029*** [-3.22]
Trend				-0.185 [-0.49]	-0.072** [-2.05]	-0.051 [-1.31]
Intensive crackdown in 1996					-0.254 [-1.09]	-0.179 [-0.75]
Intensive crackdown in 2001					1.255*** [5.18]	1.235*** [5.13]
Record adjustment in 1989						-0.066 [-0.20]
Record adjustment in 1992						0.337 [1.36]
Provincial FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	N	N
No. of observations	332	332	332	332	332	332
Adj R-sq	0.457	0.700	0.718	0.718	0.644	0.645
Idp	0.000	0.000	0.000	0.000	0.000	0.000
Cdf	76.722	70.694	69.894	69.894	83.115	82.546
Widstat	34.436	30.966	30.617	30.617	46.672	45.213

Note: t values in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

It is useful to look at the impacts of the control variables. GDP per capita is found to exert a strong crime-enhancing effect. Fast growth in post-reform PRC certainly has led to improvements in people's well-being and significant poverty reduction. However, it also increases the marginal benefit and incentives to crime. Moreover, gains from growth have been unequally or even unfairly distributed among individuals and population subgroups. It is not surprising that this kind of growth is positively correlated with rising crimes.

Police expenditure, surprisingly, exerts a positive and significant effect on crimes in all models.<sup>8</sup> One possible explanation is that increase in the policy expenditure helps investigating more hidden criminal activities. Another possibility is that a reverse causality exists here, which can be investigated in future research.

Turning to urbanization, the results show that higher level of urbanization is negatively and significantly associated with both crime rates. This suggests that the crime-inducing effects of urbanization are more than offset by its crime-reducing effects. In particular, urbanization provides job opportunities for poor and rural migrants. Thus, when the migration flow is controlled in the model, urbanization turns out to be associated with less criminal activities.

### 4.3 Income Inequality, Income Polarization, and Crime

What would happen if income inequality instead of polarization is used as the proxy of income distribution? Table 5 indicates that the Gini index is insignificant in model M5.1. When using the Theil index, income inequality becomes insignificant for all models (M5.4, 5.5, and 5.6). More interestingly, when both income polarization and income inequality indicators are included, the coefficient of income polarization is still positive and significant while those of the Gini coefficient and Theil index become insignificant or even negative.

All these support and confirm the superiority of the polarization index over conventional inequality measures as indicators of income distribution in modeling crimes.

### 4.4 Income Polarization, Economic Growth and Crime

As mentioned earlier, growth in GDP per capita may be associated with more criminal activities. It is thus interesting to explore whether the detrimental impacts of income polarization vary as income level changes. Toward this purpose, we introduce the interaction of income polarization and GDP per capita, as well as its square term to the baseline model:

$$Crime_{it} = \alpha + \beta Pol_{it} + \beta_1 Pol_{it} * GDP_{it} + \beta_2 Pol_{it} * (GDP_{it})^2 + \theta' X_{it} + \eta_t + T + \mu_i + \varepsilon_{it}. \quad (2)$$

According to model (2), the effect of income polarization on crime is:

$$\frac{\partial Crime_{it}}{\partial Pol_{it}} = \beta + \beta_1 * GDP_{it} + \beta_2 * (GDP_{it})^2. \quad (3)$$

The estimation results of model (2) are reported in Table 7, which shows that the coefficient of the interaction term is significantly positive and the coefficient of the square term is significantly negative, indicating that the detrimental effect of income polarization on crime is larger in richer areas or as the economy grows. However, the effect is expected to decrease when per capita GDP reaches a threshold level, estimated to be 63163.37 yuan.<sup>9</sup>

<sup>8</sup> Considering the reverse causality, we also use 2SLS estimation with lagged police expenditure as the instrumental variable of the police expenditure. The relationship between crime and police expenditure does not alter.

<sup>9</sup> Based on M7.5 in Table 7, the peak for the effect of the interaction term between income polarization and GDP per capita is  $-0.0182789/(-0.0001447)^2=63.16337$  (1,000 yuan), which is 63,163.37 yuan.

**Table 5: Panel Data Regressions of Crime Rate and Income Inequality (Gini and Theil)**

Crime	M5.1	M5.2	M5.3	M5.4	M5.5	M5.6
The Gini coefficient	2.295 [1.39]	3.701* [1.68]	3.760* [1.69]			
Theil index				0.568 [0.86]	0.600 [0.48]	0.605 [0.48]
GDP per capita	0.300*** [8.29]	0.272*** [8.83]	0.265*** [8.18]	0.302*** [8.29]	0.274*** [8.81]	0.267*** [8.17]
Police expenditure	0.162*** [3.06]	0.165*** [2.92]	0.160*** [2.84]	0.161*** [3.06]	0.169*** [3.01]	0.165*** [2.94]
Migration	0.006 [0.84]	0.007 [0.88]	0.007 [1.00]	0.005 [0.79]	0.006 [0.82]	0.007 [0.93]
Population density	-0.004 [-1.06]	-0.001 [-0.17]	-0.000 [-0.04]	-0.005 [-1.10]	-0.001 [-0.24]	-0.000 [-0.11]
Urbanization	-0.021*** [-3.37]	-0.024*** [-3.58]	-0.023*** [-3.43]	-0.021*** [-3.39]	-0.024*** [-3.64]	-0.023*** [-3.49]
Trend	0.001 [0.03]	-0.031 [-1.11]	-0.014 [-0.43]	0.009 [0.27]	-0.014 [-0.49]	0.003 [0.08]
Intensive crackdown in 1996		-0.107 [-0.48]	-0.049 [-0.21]		-0.062 [-0.28]	-0.006 [-0.02]
Intensive crackdown in 2001		0.976*** [3.65]	0.956*** [3.58]		0.982*** [3.66]	0.963*** [3.59]
Record adjustment in 1989			-0.026 [-0.09]			0.001 [0.01]
Record adjustment in 1992			0.238 [0.98]			0.223 [0.91]
Constant	3.580** [2.43]	3.071** [2.06]	2.694* [1.74]	4.289*** [3.02]	4.208*** [3.03]	3.852*** [2.66]
Provincial FE	Y	Y	Y	Y	Y	Y
Year FE	Y	N	N	Y	N	N
No. of observations	384	384	384	384	384	384
Adj R-sq	0.886	0.853	0.853	0.885	0.852	0.851

Note: t values in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.



**Table 6: Panel Data Regressions of Crime Rate, Income Polarization, and Income Inequality (Gini and Theil)**

Crime	M6.1	M6.2	M6.3	M6.4	M6.5	M6.6
Income polarization	0.117** [2.04]	0.146* [1.87]	0.145* [1.85]	0.081** [2.33]	0.121*** [2.97]	0.122*** [3.00]
The Gini coefficient	-2.034 [-0.70]	-1.846 [-0.44]	-1.774 [-0.41]			
Theil index				-0.041 [-0.08]	-0.347 [-0.39]	-0.348 [-0.39]
GDP per capita	0.304*** [8.27]	0.276*** [8.75]	0.269*** [8.13]	0.302*** [8.29]	0.275*** [8.85]	0.268*** [8.21]
Police expenditure	0.165*** [3.14]	0.165*** [2.93]	0.160*** [2.85]	0.164*** [3.11]	0.164*** [2.92]	0.160*** [2.85]
Migration	0.006 [0.83]	0.006 [0.86]	0.007 [0.98]	0.006 [0.85]	0.007 [0.88]	0.007 [0.99]
Population density	-0.005 [-1.09]	-0.001 [-0.22]	-0.000 [-0.08]	-0.004 [-1.05]	-0.001 [-0.20]	-0.000 [-0.07]
Urbanization	-0.021*** [-3.27]	-0.023*** [-3.46]	-0.022*** [-3.31]	-0.021*** [-3.31]	-0.023*** [-3.47]	-0.022*** [-3.31]
Trend	-0.006 [-0.17]	-0.038 [-1.35]	-0.021 [-0.64]	-0.007 [-0.22]	-0.039 [-1.40]	-0.022 [-0.67]
Intensive crackdown in 1996		-0.129 [-0.57]	-0.071 [-0.31]		-0.134 [-0.60]	-0.076 [-0.33]
Intensive crackdown in 2001		0.978*** [3.68]	0.958*** [3.61]		0.973*** [3.66]	0.953*** [3.59]
Record adjustment in 1989			-0.027 [-0.10]			-0.031 [-0.11]
Record adjustment in 1992			0.237 [0.97]			0.240 [0.98]
Constant	2.469 [1.59]	1.759 [1.14]	1.389 [0.87]	2.550* [1.65]	1.752 [1.14]	1.374 [0.86]
Provincial FE	Y	Y	Y	Y	Y	Y
Year FE	Y	N	N	Y	N	N
No. of observations	384	384	384	384	384	384
Adj R-sq	0.886	0.854	0.854	0.886	0.854	0.854

Note: t values in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

**Table 7: Crime, Income Polarization, and Economic Growth**

<b>Crime</b>	<b>M7.1</b>	<b>M7.2</b>	<b>M7.3</b>	<b>M7.4</b>	<b>M7.5</b>
Income polarization	-0.027 [-0.69]	-0.023 [-0.58]	-0.023 [-0.58]	0.025 [0.55]	0.027 [0.56]
Income polarization* GDP per capita	0.024*** [5.85]	0.023*** [5.22]	0.023*** [5.22]	0.018*** [3.76]	0.018*** [3.66]
Income polarization* GDP per capita <sup>2</sup>	-0.000*** [-2.64]	-0.000*** [-2.82]	-0.000*** [-2.82]	-0.000** [-2.50]	-0.000** [-2.52]
GDP per capita	-0.075 [-0.66]	-0.041 [-0.33]	-0.041 [-0.33]	0.029 [0.20]	0.032 [0.22]
Police expenditure	0.147*** [3.10]	0.154*** [3.26]	0.154*** [3.26]	0.153*** [2.97]	0.151*** [2.93]
Migration	0.006 [0.92]	0.006 [0.84]	0.006 [0.84]	0.008 [1.08]	0.008 [1.07]
Population density		0.001 [0.43]	0.001 [0.43]	0.006 [1.58]	0.006 [1.55]
Urbanization		-0.017*** [-3.01]	-0.017*** [-3.01]	-0.018*** [-3.07]	-0.019*** [-3.07]
Trend			-0.152*** [-3.90]	-0.162*** [-4.19]	-0.164*** [-3.71]
Intensive crackdown in 1996				-0.150 [-0.67]	-0.152 [-0.65]
Intensive crackdown in 2001				1.085*** [4.47]	1.087*** [4.46]
Record adjustment in 1989					-0.124 [-0.49]
Record adjustment in 1992					0.033 [0.15]
Constant	2.476** [2.50]	2.569** [2.04]	2.721** [2.15]	1.653 [1.24]	1.672 [1.19]
Provincial FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	N	N
No. of observation	384	384	384	384	384
Adj R-sq	0.900	0.902	0.902	0.867	0.866

Note: t values in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

## 5. SUMMARY

When exploring the relationship between crime and income distribution, income inequality is commonly used as the proxy of the latter (Enamorado et al. 2016). However, as this paper demonstrates, rather than income inequality, income polarization captures much better the effects of social tension and conflict that a worsening income distribution generates. Therefore, this study contributes to the crime literature by modeling the effect of income polarization on criminal prosecution rates in the PRC for the period 1985–2008.

The descriptive analyses show that the highest level of crime rate was found in rich provinces, such as Beijing and Zhejiang. Regarding income polarization, the highest level was found in the western PRC. During the period under study, both the levels of crime rate and income polarization increased on average.

Our modeling results suggest that, in general, income polarization is positively and significantly related to the criminal prosecution rate. This result is confirmed by several sensitivity analyses. Regarding income inequality, we do not find it has a significant relationship with crime. When incorporating income inequality and income polarization in one model, the former still does not show any significance while the latter does. These findings support our argument that income polarization is more closely linked to crime than income inequality. In addition, we find that the positive effect of income polarization on crime is larger in richer area, and then this effect decreased with further economic development. It reminds us to put more attention and effort on income polarization during the process of economic development.

To tackle the rising trend of crime, several policy suggestions could be taken into account. First, the government should enhance pro-poor economic development, to mitigate income polarization. The PRC has already pulled tons of people out of poverty since decades ago. However, there are still around 50 million rural people living under the poverty line (below 2300 yuan per year or \$1 per day), as reported by *Statistical Communiqué of the People's Republic of China on the 2015 National Economic and Social Development* published by NBS. Pro-poor growth combines economic growth and poverty reduction together, absorbing labor in lower income groups. Second, urbanization should be enhanced and accelerated. More specifically, social-integration-related policies should be enhanced to eliminate discrimination in the labor market and increase both educational and employment opportunities for migrants.

Finally, this study does not distinguish the types of crime. Future work will examine the impact of income polarization on different criminal activities. Moreover, this study does not examine whether the effect of income polarization on crime is larger in urban areas than in rural areas. Since crime activity is more intensive in urban areas, studies examining the impact of income polarization on urban crime could provide more targeted policy implications.

## REFERENCES

- Baharom, A. and M. Habibullah. 2014. Crime and income inequality: The case of Malaysia. *Journal of Politics and Law* 2(1): 55.
- Bayer, P., R. Hjalmarsson, and D. Pozen. 2007. Building criminal capital behind bars: Peer effects in juvenile corrections. NBER Working Paper No. 12932. Cambridge, MA: National Bureau of Economic Research.
- Becker, G. 1968. An economic approach to crime and punishment. *Journal of Political Economy* 76(2): 169–217.
- Blau, J., and P. Blau. 1982. The cost of inequality: Metropolitan structure and violent crime. *American Sociological Review* 47(1): 114–129.
- Borland, J., and B. Hunter. 2000. Does crime affect employment status? The case of Indigenous Australians. *Economica* 67(265): 123–144.
- Brush, J. 2007. Does income inequality lead to more crime? A comparison of cross-sectional and time series analyses of United States countries. *Economic Letters* 96(2): 264–268.
- Cheong, T., and Y. Wu. 2015. Crime rates and inequality: A study of crime in contemporary China. *Journal of the Asia Pacific Economy* 20(2): 202–223.
- Chintrakarn, P., and D. Herzer. 2012. More inequality, more crime? A panel cointegration analysis for the United States. *Economics Letters* 116(3): 389–391.
- Chiu, W., and P. Madden. 1998. Burglary and income inequality. *Journal of Public Economics* 69(1): 123–141.
- Davies, S., and T. Hinks. 2010. Crime and happiness amongst heads of households in Malawi. *Journal of Happiness Studies* 11(4): 457–476.
- Detotto, C., and E. Otranto. 2010. Does crime affect economic growth? *Kyklos* 63(3): 330–345.
- Deutsch, M. 1971. Conflict and its resolution. In *Conflict Resolution: Contributions of the Behavioral Sciences*, edited by C. G. Smith. Notre Dame: University of Notre Dame Press.
- Duclos, J., J. Esteban, and D. Ray. 2004. Polarization: concepts, measurement, estimation. *Econometrica* 72(6): 1737–1772.
- Edlund, L., H. Li, J. Yi, and J. Zhang, 2008. More men, more crime: Evidence from China's one-child policy. Available at SSRN 1136376.
- Ehrlich, I. 1973. Participation in illegitimate activities: A theoretical and empirical investigation. *The Journal of Political Economy* 81(3): 521–565.
- Enamorado, T., L. López-Calva, C. Rodríguez-Castelán, and H. Winkler. 2016. Income inequality and violent crime: evidence from Mexico's drug war. *Journal of Development Economics* 120: 128–143.
- Esteban, J., and D. Ray. 1994. On the measurement of polarization. *Econometrica* 62(4): 819–851.
- Esteban, J., and D. Ray. 2005. A Comparison of Polarization Measures. Institut d'Anàlisi Econòmica (CSIC). Barcelona. Unpublished manuscript.
- Fajnzylber, P., D. Lederman, and N. Loayza. 2002. What causes violent crime? *European Economic Review* 46(7): 1323–1357.

- Foster, J., and M. Wolfson. 1992. Polarization and the decline of the middle class: Canada and the U.S. Vanderbilt University. Mimeo.
- . 2010. Polarization and the decline of the middle class: Canada and the U.S. *The Journal of Economic Inequality* 8(2): 247–273.
- Fowles, R., and M. Merva. 1996. Wage inequality and criminal activity: An extreme bounds analysis for the United States, 1975–90. *Criminology* 34(2): 163–182.
- Friedman, M. 1962. *Capitalism and Freedom*. Chicago: University of Chicago Press.
- Glaeser, E., B. Sacerdote, and J. Scheinkman. 1996. Crime and social interactions. *Quarterly Journal of Economics* 111(2): 507–548.
- Hsieh, C., and M. Pugh. 1993. Poverty, income inequality, and violent crime: a meta-analysis of recent aggregate data studies. *Criminal Justice Review*, 18(2), 182–202.
- İmrohoroğlu, A., A. Merlo, and P. Rupert. 2004. What accounts for the decline in crime? *International Economic Review* 45(3): 707–729.
- İmrohoroğlu, A., Merlo, and P. Rupert. 2000. On the political economy of income redistribution and crime. *International Economic Review* 41(1): 1–26.
- Kelly, M. 2000. Inequality and crime. *The Review of Economics and Statistics*. 82(4): 530–539.
- Loayza, N., P. Fajnzylber, and D. Lederman. 2000. Crime and victimization: An economic perspective. *Economia, Journal of LACEA* 1(1): 219–302.
- Merlo, A. 2003. Income distribution, police expenditures, and crime: A political economy perspective. *Journal of the European Economic Association* 1(2–3): 450–458.
- Patterson, E. 1991. Poverty, income inequality, and community crime rates. *Criminology* 29(4): 755–776.
- Rattner, A. 2007. Crime and Russian immigration: Socialization or importation? The Israeli case. In *Crime and Immigration*, edited by J. Freilich and G. Newman. Burlington: Ashgate.
- Robinson, F., and J. Keithley. 2000. The impacts of crime on health and health services: A literature review. *Health, Risk & Society* 2(3): 253–266.
- Shorrocks, A., and G. Wan. 2009. Ungrouping income distributions: Synthesising samples for inequality and poverty analysis. In *Arguments for a Better World: Essays in Honor of Amartya Sen, Vol. II*, edited by K. Basu and R. Kanbur. Oxford: Oxford University Press.
- Siegel, D., and F. Bovenkerk. 2007. Crime and manipulation of identity among Russian-speaking immigrants in the Netherlands. In *Crime and Immigration*, edited by J. Freilich and G. Newman. Burlington: Ashgate.
- Sjoquist, D. 1973. Property crime and economic behavior: Some empirical results. *The American Economic Review* 63(3): 439–446.
- Thurow, L. 1971. The income distribution as a pure public good. *The Quarterly Journal of Economics* 85(2): 327–336.
- Wang, Y., and K. Tsui. 2000. Polarization orderings and new classes of polarization indices. *Journal of Public Economic Theory* 2(3): 349–363.

- Wortley, S. 2003. Hidden intersections: Research on race, crime, and criminal justice in Canada. *Canadian Ethnic Studies* 35(3).
- Zhang, X., and R. Kanbur. 2001. What difference do polarisation measures make? An application to China. *Journal of Development Studies* 37(3): 85–98.
- Zhang, Y., S. Liu, and L. Liu. 2011. Can we attribute increasing criminal rate to enlarging urban–rural inequality in China? *Economic Research Journal* 2: 59–71. [In Chinese]