

# **An Empirical Investigation of the Parole Policy in Taiwan\***

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## **ABSTRACT**

In this paper, we provide evidence on the deterrence effects of severity of punishment on crime rates based on the experience of Taiwan. Specifically, we investigate whether a tougher parole policy, which was implemented in Taiwan during 1997, is associated with a decline in crime rates. Our results indicate that the overall crime rate in Taiwan declined significantly after the implementation of the new parole policy. This is reflected in both misdemeanor and felony crimes. We also find that both the overall recidivism rate and the parolee recidivism rate declined significantly after the implementation of the new policy. These results hold after controlling for other variables that are likely to be associated with crime rates such as unemployment rate, educational level, crime conviction rate, and police outlays. We also find that the number of new prisoners admitted to correctional institutions declined significantly after the passage of the new parole policy. Overall, our results suggest that the tougher parole policy has a deterrent effect on criminal behavior, which is consistent with the deterrence hypothesis. Finally, we find that

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correctional institution costs increased after the 1997 parole policy change.

**Key Words:** parole policy, crime rate, deterrence effect, correctional Institution costs

## I. Introduction

The deterrence effects of legal sanctions and law enforcement are of continuing interest to policy makers and researchers. Over the past forty years, numerous studies have been conducted to examine the deterrence effects of certainty and severity of punishment on criminal behavior. Much of the earlier work was undertaken by sociologists and criminologists, linking criminal behavior to the offender's unique personal characteristics and social conditions. Becker (1968), however, was the first to examine this issue by employing an economic analysis approach. In his classic model, criminal behavior is analyzed using the expected utility framework. Criminals are viewed as rational decision makers, and their decision to engage in crime depends on the benefits and costs associated with crime and with alternative lawful activities. The theory, which has been further modified and extended by Ehrlich (1973), basically predicts that an individual will commit fewer crimes if the benefits from crime decrease, the costs of crime increase, the benefits from lawful activities increase, or the costs of lawful activities decrease.

The Becker-Ehrlich theoretical framework leads to the deterrence hypothesis, which contends that an increase in the expected costs of crime due to punishment will reduce criminal behavior, and in particular, that an increase in the probability or the severity of punishment for some crime will cause a reduction in the incidence of the crime (see e.g., Schmidt and Witte, 1984; Miller et al., 2008). A large body of empirical literature has examined the deterrence hypothesis but the results are somewhat mixed. For example, regarding the relationship between police and crime, Levine (1975) reports a positive association between the size of police force and the murder and robbery rates using the data from twenty six U.S. cities in 1971. Pogue (1975) finds little support for the hypothesis that criminal activity is better controlled by increasing police spending and employment. Using a panel data approach and a sample of 252 U.S. suburbs and 269 U.S. cities for the years 1960 and 1970, Greenberg and Kessler (1983) also find no evidence that

police employment reduces violent or property crime. On the other hand, Deutsch et al. (1990) find that police expenditures have a negative and significant effect on property crime by using the U.S. data of 48 states over the years 1970 to 1980. Recognizing the potential simultaneity problem in previous police-crime studies, Marvell and Moody (1996) use a Granger-causality approach and confirm that the presence of additional police reduces crime. Levitt (1997) uses the timing of mayoral and gubernatorial elections as an instrumental variable to identify a causal effect of police on crime, and his results indicate that an increase in police substantially reduces violent crime but has a smaller impact on property crime.

Some recent studies also examine the link between prison releases and crime. Using state panel data in the United States for the period 1975 to 1999, Kovandzic et al. (2004) find no evidence of a significant positive relationship between prison releases and homicide rates after controlling for prison population levels. Vieraitis, Kovandzic, and Marvell (2007), however, show that increases in the number of prison releases appear to be significantly related to increases in crime by using a state panel data for 46 states in the U. S. from 1974 to 2002. Raphael and Stoll (2004) use state panel data from 1977 to 1999 to assess the propensity of recently released inmates to commit crime upon release. They find that the net positive impact of prison releases on crime varies over time and is influenced by the sentencing systems used by different states. Larger impacts are observed for the late 1970s and early 1980s. Also, the statistically significant impacts only occur in states with weakened or no parole board. For states with strong parole boards, the net prison releases have little or no effect on crime.

Some other studies specifically address the relationship between parole or early releases, and crime. For example, Kuziemko (2007) evaluates the social welfare effects of the U.S. parole reform that moved from discretionary parole policies in favor of mandatory supervised release over the past 30 years. She develops a framework that considers the following three effects: (1) do longer prison terms decrease future criminal activity? (2) how well do parole boards perform their jobs? and (3) does the hope of parole make prisoners reform? Using a 1998 policy reform in Georgia that effectively eliminated the possibility of parole for inmates convicted of certain crimes, she finds that (1) longer prison terms reduce recidivism, (2) parole boards appear to be highly accurate in forecasting inmates' future recidivism risk in the process of deciding their release dates, and (3) inmates respond to the incentives generated by parole boards through participating more in their

rehabilitation while in prison and having lower recidivism rates upon release. Overall, the paper concludes that the benefits of parole regimes outweigh their costs.

Using a sample of Queensland prisoners released between January 1992 and December 1994, Worthington, Higgs, and Edwards (2000) provide Australian evidence regarding how various custodial and socioeconomic variables affect the likelihood of recidivism resulting from a parole violation or re-offense over the length of the parole period. Their results indicate that recidivism is related to ethnic background, marital and family status, the number of prisons in which the most recent custodial episode was served (a measure of the stability of the inmate's reform environment), and the number of violations committed in the most recent episode of custody.

The purpose of this study is to examine the deterrence effects of legal sanctions on crime rates based on the experience of Taiwan. Specifically, we investigate whether a tougher parole policy, which was implemented in Taiwan during 1997, is associated with a decline in crime rates. This new parole policy heightens the threshold level before an inmate will be considered for early release and therefore it leads to, on average, a longer term of imprisonment for criminals. Rational choice theory suggests that when criminals are given the choice of illegal versus legal avenues of economic gain, they more often choose the latter when the costs of crime increase. Thus, a tougher parole policy is likely to deter crime in this manner by making criminals perceive that the costs of committing crimes will increase through an increase in the severity of punishment.

Using an event study approach, our results indicate that the overall crime rate in Taiwan declined significantly after the implementation of the new parole policy that was introduced in 1997. This is reflected in both misdemeanor (crimes with a sentence of less than three years, including burglary, injury, and chemical abuse) and felony (crimes with a sentence of more than three years, including murder, serious harm, robbery, rape, and aggravated assault) rates. We also find that both the overall recidivism rate and the parolee recidivism rate declined significantly after the implementation of the new policy. These results hold after controlling for other variables that are likely to be associated with crime rates such as unemployment rate, educational level, crime conviction rate, and police outlays. We also find that the number of new prisoners admitted to correctional institutions declined significantly after the passage of the new parole policy. Overall, our results suggest that the tougher parole policy has a deterrent effect

on criminal behavior, which is consistent with the deterrence hypothesis.

We also examine whether the correctional institution costs in Taiwan change after the 1997 parole policy change. If the tougher parole policy has deterrence effects, then crime rates will decline and therefore the total prisoner population may fall, which in turn, may lead to lower costs for correctional institutions in Taiwan. On the other hand, the costs may rise because inmates will stay in prison for a longer term with the higher parole threshold. Our findings show that, after the budget growth rate is taken into consideration, the total correctional institution costs in Taiwan increased after the implementation of the new policy.

The remainder of this paper is organized as follows. Section 2 reviews the theoretical framework underlying the economic analysis of criminal behavior, provides an overview of the parole system in Taiwan, and develops the research hypotheses. Section 3 discusses the sample and data. Empirical models and results for the aggregate-level analysis are presented in section 4, followed by the discussion on the individual-level analysis in section 5. The final section provides concluding remarks.

## II. Background and Hypothesis Development

### A. Theoretical Framework

Becker (1968) introduces the initial economic model of criminal behavior which emphasizes the relation between crime and punishment. Individuals are characterized as rational economic agents who respond to incentives and opportunities. Each individual engages in lawful or unlawful activities according to the expected costs and benefits from each activity. The benefits from crime include pecuniary returns and non-pecuniary returns. The theory also identifies several possible costs associated with criminal behavior.<sup>1</sup> One such cost is the expected loss due to punishment for the crime. This cost considers both the probability of apprehension and conviction and the prospective penalty if convicted. This cost is directly related to the deterrence hypothesis we examine here.

Following Becker's framework, Mui and Ali (1997: 261) specify the following form for the crime supply function:

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1 These costs include the money spent on obtaining resources needed to commit the crime and the opportunity costs of committing the crime.

$$C = f(p, s, X)$$

Where  $C$  is the number of crimes committed;  $p$  is the (perceived) probability of detection/conviction,  $s$  is a measure of (perceived) severity of punishment and  $X$  is a vector of socioeconomic variables.

As indicated in Mui and Ali (1997),  $p$  is often measured by the current and/or lagged successful arrest and prosecution rate of the crime (e.g., Pyle, 1984) or police levels (e.g., Levitt, 1997). The perceived severity of punishment,  $f$ , is often measured by the current and/or past length of sentence (e.g., Myers, 1983). The socio-economic variables that are often considered in prior research include unemployment rate, percentage of poor families and total population.

## B. The Parole System in Taiwan

Parole is a period of conditional supervised release following a prison term. It originated in Europe and was part of the general nineteenth-century trend in criminology that progressed from punishment to reformation. Proponents of parole believe that such a system contributes to prisoner reform by encouraging participation in programs aimed at rehabilitation rather than punishment. Another major advantage of parole is that it provides an immediate solution to prison crowding.

In Taiwan, a parole system was formally adopted in 1911. A parole board in each prison has authority to determine whether a prisoner is qualified to be conditionally released according to a statutory determination of eligibility. All cases, however, need to be submitted to the Department of Justice for final approval. The regulations of parole have been changed three times since then to reflect different political, economic and social considerations.<sup>2</sup> For example, because of the prison crowding problem, in 1994 Taiwan lowered the threshold level at which a prisoner would be eligible for a parole release. In 1997, in response to the call for higher public safety, the parole policy was modified again to increase the threshold level for an inmate to be eligible for conditional release. Under the prior system, offenders of certain crimes needed to serve at least 1/3 of their sentence in prison before becoming eligible for release. The new policy in 1997, however, raises the threshold from 1/3 to 1/2. In addition, for repeat offenders to

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<sup>2</sup> The parole policy was revised on July 21, 1954, January 28, 1994, and November 26, 1997.

be eligible for early release, they must serve at least 20 years and the length must exceed 2/3 of their prison terms.

Consistent with the adoption of a more stringent parole policy, parole releases in Taiwan had steadily decreased, from 16,639 in 1996 to 14,596 in 1998. By 1999 the number of parole releases declined to 13,310. In 2000, only 11,691 Taiwanese prisoners were released on parole, a 30% decrease from 1996 (the year before the most recent change in parole policy). In addition, parole releases as a percentage of all releases from prison declined from 54.40% in 1996 to 44.50% in 2000. The parole approval rate by the Department of Justice in Taiwan also decreased from 90% in 1996 to 63.10% in 2000.

Statistics also show that inmates released on parole served longer in prison after the adoption of the tougher parole policy in 1997. In 1996 prisoners released on parole had served an average of 55 months in prison, while those released in 2000 had served 65 months. In addition, parolees served a larger percentage of their prison sentences after 1997. In 2000 parole releases in Taiwan served 59.80% of their total prison sentence, up from 51.30% in 1996.<sup>3</sup>

### C. Hypotheses

In this study, we first address the question regarding whether the parole policy change, which occurred in Taiwan in 1997, is associated with a change in crime activity. As discussed earlier, the new parole policy requires that offenders convicted of certain crimes serve at least 50% of their sentence in prison before becoming eligible for conditional release. This heightened threshold level for parole release leads to, on average, a longer term of imprisonment for criminals, which is likely to change the perceived severity of punishment and therefore increase the expected cost of committing a crime. According to the rational choice theory, an individual will commit fewer crimes if the costs of crime increase or the benefits decline. Thus, we expect that the tougher parole policy implemented in 1997 is likely to be associated with a decline in crime activity in Taiwan. This leads to our first hypothesis, which is formulated as follows:

#### **H1 Crime rates in Taiwan decline after the parole policy change implemented in 1997.**

Our second research question examines whether correctional institution

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<sup>3</sup> Excludes sentences of life and death.

costs change after the 1997 parole policy change. There are two possibilities. On the one hand, inmates will stay in prison for a longer time due to the higher parole threshold, and therefore, the costs incurred in correctional institutions may rise after 1997. On the other hand, if the tougher parole policy results in deterrence effects, then crime rates are expected to decline and therefore the total prisoner population may fall. In addition, Schmidt and Witte (1984) suggest that it is less expensive to incarcerate the inmates with a longer term of imprisonment. Thus, the combination of fewer criminals and lower cost with longer term of imprisonment may lead to lower costs of correctional institutions after the 1997 change. Given the two sides of the argument, our second hypothesis regarding the effect of the parole policy change on correctional institution costs is formulated in the null form as follows:

**H2 There is no change in the correctional institution costs in Taiwan after the parole policy change implemented in 1997.**

### **III. Sample and Data**

We use two sets of data to test the above hypotheses: aggregate-level and individual-level data. In the aggregate-level analysis, nationwide data on crime rates and correctional institution costs are used. In the individual-level analysis, we collect relevant data from each correctional institution in Taiwan to test the impact of the parole policy change on (1) the number of new prisoners admitted to each institution and (2) the costs incurred in each institution. In conducting the analyses, we also consider other control variables that are suggested by theory or prior research to be associated with crime rates and correctional institution costs. The control variables used in the crime rate analysis include unemployment rate, education level, conviction rate, and police expenditures. For the analysis on the correctional institution costs, we consider three control variables: the juvenile crime rate, total criminal population, and whether the Taiwanese government issues year-end bonuses in that particular month. The specific empirical models in each type of analysis and the related control variables are further discussed in the later section of the paper.

Since the new parole policy was implemented on November 26, 1997, we use monthly data from July 1996 to December 2000 to examine the change in crime activity before and after the policy change. The crime and parole

data are obtained from the “Monthly Bulletins of Statistics of Justice” and Bureau of Statistics in the Ministry of Justice (1996–2000). Correctional institution costs are hand collected from Department of Accounting in the Ministry of Justice. For other variables, unemployment rate and education level data are from “Monthly Bulletins of Statistics of the Republic of China” (1996–2000), and the police expenditures data are from the website of the Directorate General of Budget, Accounting and Statistics (DGBAS) (1996–2000).<sup>4</sup> Conviction rate is collected from the “Monthly Statistical Bulletins of Police Administration” (1996–2000) by National Police Agency of Ministry of the Interior.

## IV. The Aggregate-Level Analysis

### A. Empirical Models and Variables Measurement

To address the autocorrelation concern in the aggregate-level analysis that uses time series data, we use the Prais-Winsten regression model, which assumes that the error terms follow a first-order autoregressive process and then standards errors are re-weighted to correct the bias.<sup>5</sup> The specific empirical models in the aggregate-level analysis are as follows:

$$\begin{aligned} \text{CRIME}_t &= a_0 + a_1 \text{POLICY}_t + a_2 \text{UNEMPLOY}_{t-1} + a_3 \text{POLICE}_{t-1} \\ &\quad + a_4 \text{CONVICT}_t + a_5 \text{EDU}_t + e_t \\ \text{COST}_t &= a_0 + a_1 \text{POLICY}_t + a_2 \text{JUVENILE}_t + a_3 \text{POPULA}_t + a_4 \text{BONUS}_t \\ &\quad + e_t \end{aligned}$$

where:

$\text{CRIME}_t$  is the crime rate in month  $t$ . Four types of crime rates are considered in this study: misdemeanor, felony, prisoner recidivism and parolee recidivism. In each category, crime rate is defined as the number of people convicted per ten thousand of population. The classification of misdemeanor and felony is based upon the length of imprisonment. According to Taiwanese laws, a convicted crime is classified as misdemeanor (felony) if

4 For conducting this study, we visited the detention house in Taipei to understand the operation and management of correctional institutions. We also interviewed several correctional officers to discuss how to measure certain variables that are included in our analyses.

5 The results of Cochrane-Orcutt are the same as Prais-Winsten, but Cochrane-Orcutt drops the first observation while Prais-Winsten does not.

the length of imprisonment in the final verdict is shorter (longer) than 3 years.

$POLICY_t$  is an indicator variable which has value of 0 for months in the pre-change period (months before November 1997), and its value is 1 for the months in the post-change period (months after November 1997).<sup>6</sup> If the policy change has a deterrence effect and reduces crime rates, the coefficient on  $POLICY$ ,  $a_1$ , is expected to be negative.

$UNEMPLOY_{t-1}$  is the unemployment rate at month  $t-1$ . Unemployment rate is included in the model as a control variable because it has been considered in many prior studies as an important socio-economic variable that explains criminal behavior (e.g., see Chiricos, 1987; Hsieh and Pugh, 1993; Lester, 1995). Some studies have shown that unemployment is associated with high crime commission rates and more arrests (e.g., see Bushway and Reuter (2002) for a complete review). The positive relation between unemployment rate and crime activity is consistent with the low monetary opportunity cost of the unemployed and the effect of economic disruptions on socially deviant behavior. Conversely, as argued by Eide (1994), a negative relation could be expected because an increase in unemployment might be associated with a decrease in wealth and thus in the amount of goods that can be stolen, which in turn, could reduce crime rates. In this study, unemployment rate is calculated as the number of people unemployed divided by total population in labor force.

$POLICE_{t-1}$  is the police level, measured by total police expenditures divided by total population. Many prior studies have examined the effect of police levels on crime, and extant evidence is mixed. While some studies support the notion that additional police deters crime, others give little evidence that more police reduces crime (see Marvell and Moody (1996) for a

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6 Since the crime rate in this study is calculated in terms of the number of people convicted and it normally takes a few months to reach the final verdict for all crime types, we also consider an alternative cutoff point to classify our observations to the pre- and post-change periods. Specifically, for misdemeanor crimes, the post-change period is defined as the months after February 1998 because it usually takes at least 3 months to reach the final verdict. For felony crimes, the post-change period begins on August 1998 because it takes even longer to reach the final verdict for felony crimes. For both overall recidivism and parolee recidivism rates, the post-change period is assumed to begin on May 1998, six months after the effective date for the new parole policy. All empirical analyses are repeated using this cutoff point. Results are very similar to those reported using November 1997 as the cutoff point.

complete review).

$CONVICT_t$  is the crime conviction rate, which is computed as the number of convicted criminals divided by the total number of defendants. It is a proxy for the law enforcement ability of a government and is expected to have a deterrence effect on crime behavior (e.g., Pyle, 1984; Mui and Ali, 1997).

$EDU_t$  is the number of people with college degrees per thousand of population. It has been argued in the literature that education level could affect an individual's incentives and expected costs of engaging in criminal activities (e.g., Usher, 1997). With the rise of education, the monetary and non-monetary opportunity costs of committing crime increase, thus reducing the level of crime activities (e.g., Nettler, 1984; Deutsch et al., 1990).

$COST_t$  is the total correctional institution costs, which include labor costs, operating costs, transportation costs, investment and facility costs, and food costs. Correctional institution costs may exhibit the "sticky cost" behavior (see Anderson et al. (2002) for a description of the cost behavior). For example, declining crime rates would lead to fewer convicted criminals, but it is impossible to reduce the overall capacity of correctional institutions immediately. In addition, government agencies must operate within the statutory requirements enacted by the legislative branch. Under legislative restrictions, it is relatively difficult to change these statutory requirements (see Anthony and Young, 2002). Therefore, we adjust correctional institution costs by scaling the budget growth rates.<sup>7</sup>

$JUVENILE_t$  is calculated as the number of juvenile criminals divided by the number of adult criminals. According to the policy of the Ministry of Justice in Taiwan, the main purpose of the treatments for juvenile criminals is "rehabilitation" rather than "punishment". As a result, higher costs are expected to be incurred when the ratio of juvenile to adult criminals increases, because the correctional institutions would need to hire more full time instructors and/or increase facilities for the purpose of correctional education.

$POPULA_t$  is the total criminal population for all correctional institutions each month. Because the authorities for correctional institutions allocate the resources based on the criminal population, we include it as one of

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<sup>7</sup> We use 1996 as the base year and scale the following year's budget growth rate. The budget growth rate of each year is 112% for 1997, 115.72% for 1998, 130.22% for 1999 and 144.26% for 2000, respectively.

the control variables.

$BONUS_t$  is an indicator variable with the value of “1” if the government issues a year-end bonus and “0” otherwise. Because the Taiwanese government pays the year-end bonus in either January or February every year, correctional institutions costs (primarily employee salaries) are usually higher for these two months relative to the rest of year.

A complete description and definition of the above dependent and independent variables are included in Table 1.

**Table 1**  
**Variable Definition and Measurement in the Aggregate-Level Analysis**

| Variables  | Variable Measurement   |
|--|--|
| <b>Dependent Variables</b>   |  |
| <b>CRIME (Misdemeanor, Felony, Recidivism, and Recidivism of Parolees)</b> | <b>CRIME</b> is the crime rate. Four types of crime rates are considered in this study: misdemeanor, felony, prisoner recidivism and parolee recidivism. In each category, crime rate is defined as the number of people convicted per ten thousand of population. |
| <b>COST (millions, in Taiwanese dollars)</b>                               | <b>COST</b> includes labor costs, operating costs, transportation costs, investment and facility costs, and food costs of correctional institutions.   |
| <b>Independent Variables</b>   |  |
| <b>POLICY</b>  | <b>POLICY</b> is an indicator variable which has value of 0 for months in the pre-change period (months before November 1997) and its value is 1 for the months in the post-change period (months after November 1997).  |
| <b>UNEMPLOY</b>  | <b>UNEMPLOY</b> is the unemployment rate, which is calculated as the number of people unemployed divided by total population in labor force.   |
| <b>POLICE</b>  | <b>POLICE</b> is the police level, measured by total police expenditures divided by total population.  |
| <b>CONVICT</b>   | <b>CONVICT</b> is computed as the number of convicted people divided by the number of defendants.  |
| <b>EDU</b>   | <b>EDU</b> is the number of people with college degrees per thousand of population.  |
| <b>JUVENILE</b>  | <b>JUVENILE</b> is calculated as the number of juvenile criminals divided by adult criminals.  |
| <b>POPULA</b>  | <b>POPULA</b> is the total criminal population for all institutions each month.  |
| <b>BONUS</b>   | <b>BONUS</b> is “1” if government issues a year-end bonus, and “0” otherwise.  |

## B. Results

Table 2 presents descriptive statistics for the variables used in the aggregate-level analysis. The average misdemeanor rate in Taiwan over the 1996–2000 period was 0.751, indicating that, on average, 0.751 people per ten thousand of population were convicted in the misdemeanor category. The average crime rate for the felony, recidivism, and parolee recidivism is 0.230, 0.381, and 0.031, respectively.

Table 2 also shows that, over the 1996–2000 period, the average unemployment rate in Taiwan was 2.8%. The average ratio of police outlays to total population was \$5.75 (Taiwanese dollars) per person, the average conviction rate was 71.8%, and the average number of people with college

**Table 2**  
**Descriptive Statistics for the Variables Used in the Aggregate-level Analysis**

| Variables                             | Mean                   | Standard Deviation     | Minimum                | Maximum                |
|---------------------------------------|------------------------|------------------------|------------------------|------------------------|
| <b>Dependent Variables</b>            |                        |                        |                        |                        |
| <b>CRIME (Misdemeanor)</b>            | 0.751                  | 0.166                  | 0.510                  | 1.090                  |
| <b>CRIME (Felony)</b>                 | 0.230                  | 0.094                  | 0.110                  | 0.370                  |
| <b>CRIME (Recidivism)</b>             | 0.381                  | 0.108                  | 0.210                  | 0.590                  |
| <b>CRIME (Recidivism of Parolees)</b> | 0.031                  | 0.012                  | 0.008                  | 0.066                  |
| <b>COST</b>                           | \$422.677<br>(million) | \$104.241<br>(million) | \$260.984<br>(million) | \$843.507<br>(million) |
| <b>Independent Variables</b>          |                        |                        |                        |                        |
| <b>POLICY</b>                         | 0.685                  | 0.469                  | 0.000                  | 1.000                  |
| <b>UNEMPLOY</b>                       | 0.028                  | 0.002                  | 0.023                  | 0.033                  |
| <b>POLICE</b>                         | \$5.748                | \$0.212                | \$5.470                | \$6.150                |
| <b>CONVICT</b>                        | 0.718                  | 0.087                  | 0.530                  | 0.910                  |
| <b>EDU</b>                            | 42.100                 | 5.040                  | 34.300                 | 49.400                 |
| <b>JUVENILE</b>                       | 0.035                  | 0.005                  | 0.030                  | 0.040                  |
| <b>POPULA</b>                         | 40,960                 | 2,657                  | 37,342                 | 45,493                 |
| <b>BONUS</b>                          | 0.074                  | 0.264                  | 0.000                  | 1.000                  |

Notes: See Table 1 for the definition of all variables.

degrees per thousand of population was 42.

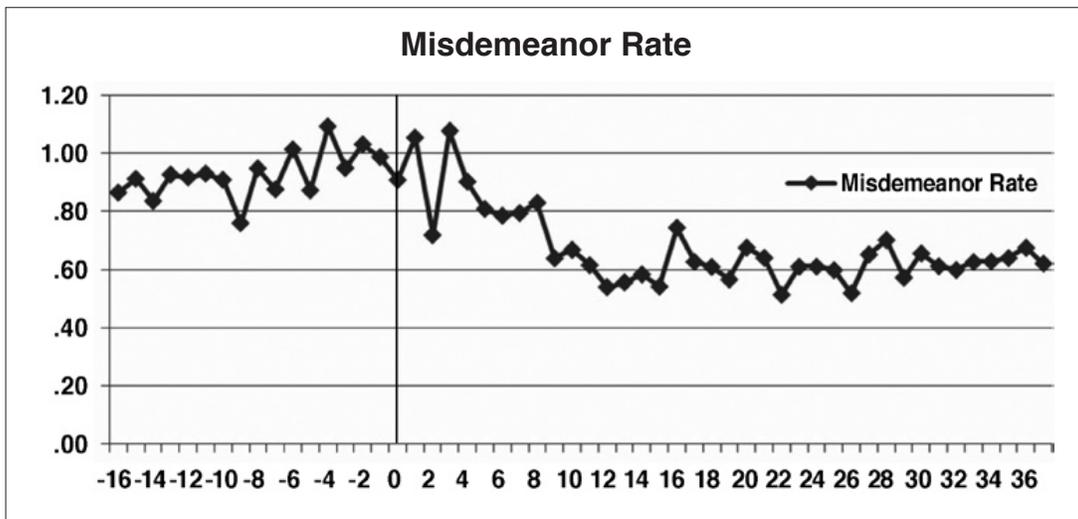
For the cost analysis, Table 2 indicates that the average correctional institution costs over the 1996-2000 period were \$423 million (Taiwanese dollars) per month. The average ratio of juvenile to adult criminals was 0.035, and the average criminal population was 40,960.

Figure 1 plots the monthly crime rates and correctional institution costs

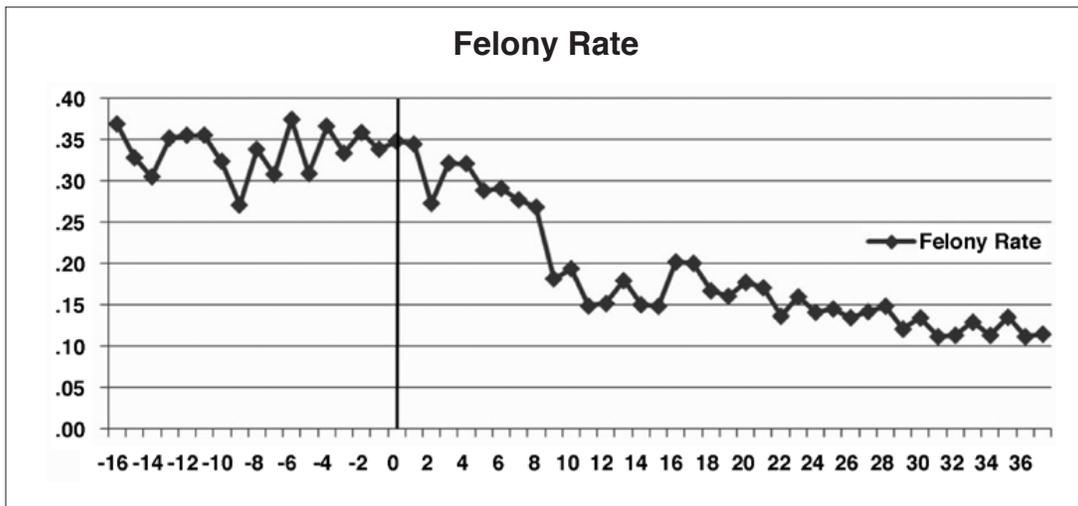
Figure 1

Monthly Crime Rates for the Pre- and Post-Change Periods

Panel A: Misdemeanor Rates



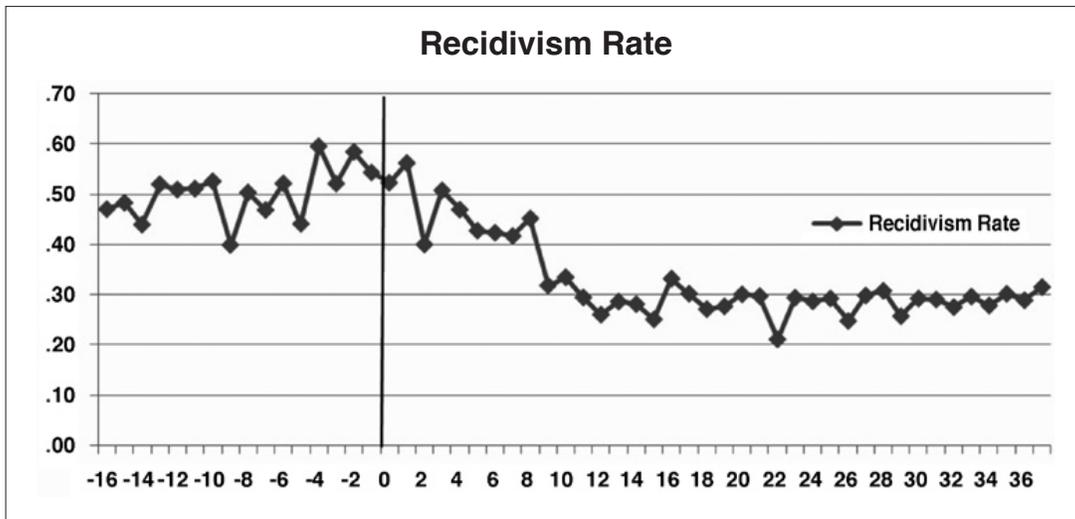
Panel B: Felony Rates



for the pre- and post-change periods. As discussed earlier, rational choice theory suggests that crime rates are likely to decline after a tougher parole policy is implemented because criminals are likely to perceive higher costs of committing crimes due to the increase in the severity of punishment. Consistent with this prediction, we find declining crime rates in the post-change period for each crime category (see Panels A through D). In addition,

**Figure I (continued)**  
**Monthly Crime Rates for the Pre- and Post-Change Periods**

**Panel C: Recidivism Rates**



**Panel D: Recidivism Rates of Parolees**

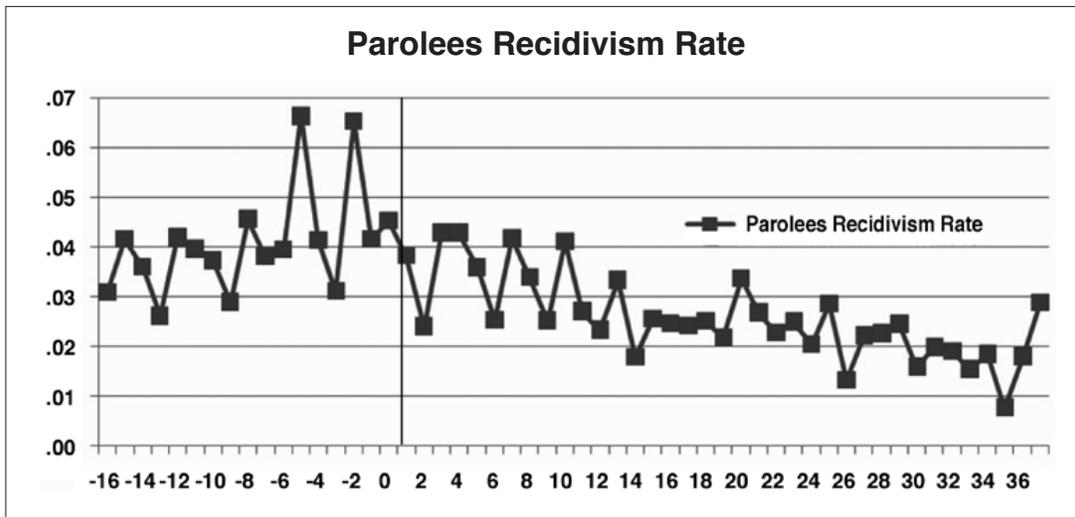
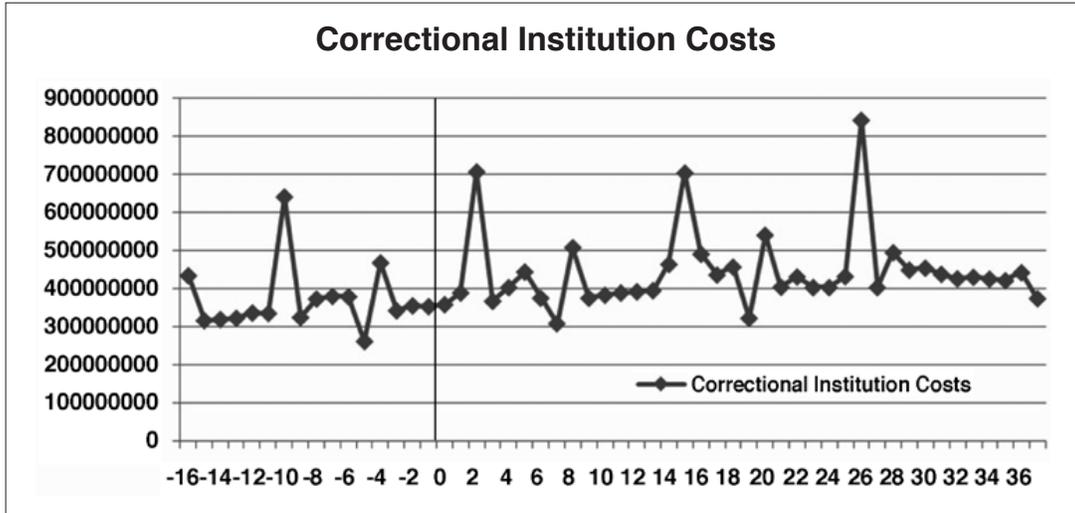


Figure 1 (continued)  
Monthly Crime Rates for the Pre- and Post-Change Periods

Panel E: Correctional Institution Costs



as indicated in Panel E, correctional institution costs appear to have more than doubled in certain months. This is because the Taiwanese government normally pays a year-end bonus to employees every January or February.

Tables 3 and 4 display the Pearson correlations among the variables included in the aggregate-level analysis. As shown in Table 3, the crime rates of four categories are all significantly and positively correlated with each other. The correlation between CRIME and POLICY is significantly negative at the 1% level for all crime types, indicating that the crime rates in Taiwan declined significantly after the passage of the new 1997 parole policy. Inconsistent with prior research, we find a significantly negative correlation between CRIME and UNEMPLOY. The correlation between CRIME and POLICE is not significant at the conventional levels (10% level or better). The negative correlation between CRIME and CONVICT suggests that the law enforcement ability of the Taiwanese government has a deterrence effect on crime activity. Finally, we find a significantly negative correlation between CRIME and EDU, suggesting that education level could increase the opportunity cost of committing crimes, which in turn, reduces the crime level.

Table 4 shows that the correlation between COST and POLICY is significantly positive, indicating that the correctional institution costs in Taiwan increased after the passage of the new 1997 parole policy. The positive

correlation between COST and JUVENILE is consistent with the government devoting more resources to juvenile criminals. Finally, the positive correlation between COST and BONUS shows the significant impact of the year-end bonus on correctional institution costs.

In Table 5, we report the multiple regression results. Column (1) shows the results for the misdemeanor crime rate. As shown, the coefficient on POLICY is negative and significant at the 1% level with a two-tailed test, indicating that misdemeanor rate is lower in the post-change period (i.e.,

**Table 3**  
Correlation Analysis for the Variables Used in the  
Aggregate-Level Analysis-CRIME RATE

|   | CRIME<br>(Misdemeanor) | CRIME<br>(Felony) | CRIME<br>(Recidivism) | CRIME<br>(Recidivism of Parolees) | POLICY            | UNEMPLOY          | POLICE            | CONVICT           | EDU               |
|---|------------------------|-------------------|-----------------------|-----------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| <b>CRIME<br/>(Misdemeanor)</b>            | 1<br>.                 | .927<br>(0.000)   | 0.977<br>(0.000)      | .731<br>(0.000)                   | -.719<br>(0.000)  | -0.394<br>(0.003) | 0.224<br>(0.103)  | -0.287<br>(0.035) | -0.738<br>(0.000) |
| <b>CRIME<br/>(Felony)</b>                 |                        | 1<br>.            | 0.959<br>(0.000)      | 0.750<br>(0.000)                  | -0.785<br>(0.000) | -0.474<br>(0.000) | 0.089<br>(0.523)  | -0.203<br>(0.141) | -0.897<br>(0.000) |
| <b>CRIME<br/>(Recidivism)</b>             |                        |                   | 1<br>.                | 0.739<br>(0.000)                  | -0.768<br>(0.000) | -0.411<br>(0.002) | 0.206<br>(0.136)  | -0.276<br>(0.044) | -0.804<br>(0.000) |
| <b>CRIME<br/>(Recidivism of Parolees)</b> |                        |                   |                       | 1<br>.                            | -0.611<br>(0.000) | -0.361<br>(0.007) | 0.083<br>(0.549)  | -0.200<br>(0.148) | -0.706<br>(0.000) |
| <b>POLICY</b>                             |                        |                   |                       |                                   | 1<br>.            | 0.082<br>(0.558)  | 0.156<br>(0.260)  | 0.118<br>(0.394)  | 0.769<br>(0.000)  |
| <b>UNEMPLOY</b>                           |                        |                   |                       |                                   |                   | 1<br>.            | -0.207<br>(0.133) | 0.000<br>(0.999)  | 0.306<br>(0.025)  |
| <b>POLICE</b>                             |                        |                   |                       |                                   |                   |                   | 1<br>.            | -0.213<br>(0.123) | 0.137<br>(0.322)  |
| <b>CONVICT</b>                            |                        |                   |                       |                                   |                   |                   |                   | 1<br>.            | 0.051<br>(0.712)  |
| <b>EDU</b>                                |                        |                   |                       |                                   |                   |                   |                   |                   | 1<br>.            |

Notes: Numbers represent Pearson correlations, **p-values are in parentheses.**

See Table 1 for the definition of all variables.

**Table 4**  
**Correlation Analysis for the Variables Used in the**  
**Aggregate-Level Analysis—COST**

|                 | <b>COST</b> | <b>POLICY</b>    | <b>JUVENILE</b>  | <b>POPULA</b>     | <b>BONUS</b>     |
|-----------------|-------------|------------------|------------------|-------------------|------------------|
| <b>COST</b>     | 1           | 0.342<br>(0.011) | 0.316<br>(0.020) | -0.184<br>(0.182) | 0.827<br>(0.000) |
| <b>POLICY</b>   |             | 1                | 0.740<br>(0.000) | -0.236<br>(0.086) | 0.039<br>(0.777) |
| <b>JUVENILE</b> |             |                  | 1                | -0.515<br>(0.000) | 0.023<br>(0.867) |
| <b>POPULA</b>   |             |                  |                  | 1                 | 0.006<br>(0.965) |
| <b>BONUS</b>    |             |                  |                  |                   | 1                |

Notes: Numbers represent Pearson correlations, **p-values are in parentheses**.  
 See Table 1 for the definition of all variables.

months after November 1997) than in the pre-change period (i.e., months before November 1997), after controlling for other factors that are likely to be associated with the misdemeanor crime rate. Columns (2) through (4) of Table 5 show the regression results for the other three crime types. Consistently, we find a significantly negative coefficient on POLICY, suggesting that felony rates, recidivism rates and parolee recidivism rates all declined after the implementation of the tougher parole system in 1997. These results are consistent with the first hypothesis (H1) and support the view that a tougher parole policy has a deterrent effect on criminal behavior. Column (5) of Table 5 shows that COST is significantly and positively associated with POLICY, which suggests that although the new parole policy reduced the crime rates, correctional institution costs increased after the policy change.

Regarding the control variables in the regression, the results indicate that, for three of the four crime categories, the crime rate is positively and significantly associated with police level. This is inconsistent with what is predicted on the basis of deterrence considerations. The coefficient on UNEMPLOY is significantly negative for all crime types. In addition, the coefficient on EDU is significantly negative, suggesting that crime activity is reduced with the increase of education level. We also find a significantly negative relation between the crime conviction rate (CONVICT) and the

**Table 5**  
**Aggregate Level Regression Analysis for the Association between**  
**Parole Policy Change, Crime Rate, and Correctional Institution Costs**

| Variable                      | CRIME<br>(Misdemeanor)<br>(1) | CRIME<br>(Felony)<br>(2) | CRIME<br>(Recidivism)<br>(3) | CRIME<br>(Recidivism<br>of Parolees)<br>(4) | COST<br>(5)           |
|-------------------------------|-------------------------------|--------------------------|------------------------------|---|-----------------------|
| <b>Intercept</b>              | 0.978***<br>(2.80)            | 0.643***<br>(4.38)       | 0.512**<br>(2.60)            | 0.070*<br>(1.98)                            | 430.634***<br>(3.23)  |
| <b>POLICY</b>                 | -0.166***<br>(-5.25)          | -0.063***<br>(-4.31)     | -0.102***<br>(-5.68)         | -0.006*<br>(-1.77)                          | 53.018***<br>(3.72)   |
| <b>UNEMPLOY</b>               | -15.804***<br>(-3.67)         | -8.245***<br>(-4.38)     | -9.111***<br>(-3.73)         | -0.836*<br>(-1.91)                          |                       |
| <b>POLICE</b>                 | 0.189***<br>(4.03)            | 0.071***<br>(3.39)       | 0.128***<br>(4.82)           | 0.008<br>(1.62)                             |                       |
| <b>CONVICT</b>                | -0.404***<br>(-3.33)          | -0.091**<br>(-2.07)      | -0.210***<br>(-3.17)         | -0.012<br>(-1.00)                           |                       |
| <b>EDU</b>                    | -0.011***<br>(-3.56)          | -0.011***<br>(-8.05)     | -0.009***<br>(-5.25)         | -0.001***<br>(-3.60)                        |                       |
| <b>JUVENILE</b>               |                               |                          |                              |   | 1858.283<br>(1.13)    |
| <b>POPULA</b>                 |                               |                          |                              |   | -0.003<br>(-1.43)     |
| <b>BONUS</b>                  |                               |                          |                              |   | 322.687***<br>(14.43) |
| <b>Rho</b>                    | -0.256                        | 0.197                    | -0.144                       | -0.181                                      | -0.397                |
| <b>Durbin-Watson</b>          | 1.941                         | 2.022                    | 1.918                        | 1.998                                       | 1.992                 |
| <b>Adjusted R<sup>2</sup></b> | 0.837                         | 0.895                    | 0.878                        | 0.628                                       | 0.779                 |
| <b>F value</b>                | 55.61***                      | 90.94***                 | 77.33***                     | 18.89***                                    | 47.79***              |

Notes: All variables are defined in Table 1

**t-statistics are in parentheses.**

\*\*\*significant at the 1% level at a two-tailed test

\*\*significant at the 5% level at a two-tailed test

\*significant at the 10% level at a two-tailed test

crime rates for misdemeanor, felony and recidivism crimes, confirming the deterrence effect of the law enforcement ability of the government. Finally, Table 5 shows a significantly positive association between COST and

BONUS.

## V. The Individual-Level Analysis

### A. Empirical Models and Variables Measurement

In the individual-level analysis, we use the data from 23 correctional institutions in Taiwan during the sample period to examine the association between the parole policy change, criminal activities, and correctional institution costs. Panel data analysis is employed and the models are specified as follows:

$$\begin{aligned} \text{PRISONER}_{i,t} &= \mathbf{b}_0 + \mathbf{b}_1 \text{POLICY}_t + \mathbf{b}_2 \text{JUVEN2}_{i,t} + \mathbf{b}_3 \text{HIGH}_{i,t} + \mathbf{b}_4 \text{LOW}_{i,t} \\ &\quad + \mathbf{b}_5 \text{POLICY}_t * \text{JUVEN2}_{i,t} + \mathbf{b}_6 \text{POLICY}_t * \text{HIGH}_{i,t} \\ &\quad + \mathbf{b}_7 \text{POLICY}_t * \text{LOW}_{i,t} + \mathbf{e}_t \\ \text{COST2}_{i,t} &= \mathbf{b}_0 + \mathbf{b}_1 \text{POLICY}_t + \mathbf{b}_2 \text{JUVEN2}_{i,t} + \mathbf{b}_3 \text{HIGH}_{i,t} + \mathbf{b}_4 \text{LOW}_{i,t} \\ &\quad + \mathbf{b}_5 \text{POPU2}_{i,t} + \mathbf{b}_6 \text{BONUS}_t + \mathbf{b}_7 \text{POLICY}_t * \text{JUVEN2}_{i,t} \\ &\quad + \mathbf{b}_8 \text{POLICY}_t * \text{HIGH}_{i,t} + \mathbf{b}_9 \text{POLICY}_t * \text{LOW}_{i,t} + \mathbf{e}_t \end{aligned}$$

where:

$\text{PRISONER}_{i,t}$  is the number of new prisoners admitted to the correctional institution  $i$  at month  $t$  divided by the total number of prisoners within the correctional institution  $i$  at month  $t$ .

$\text{COST2}_{i,t}$  is the total costs incurred within the correctional institution  $i$  at month  $t$ . Consistent with the definition of COST in the aggregate-level analysis, COST2 includes labor costs, operating costs, transportation costs, food costs, and other costs for each correctional institution each month.

$\text{POLICY}_t$  is an indicator variable which has value of 0 for months in the pre-change period, and its value is 1 for the months in the post-change period.

$\text{JUVEN2}_{i,t}$  is a dummy variable with value of 1 if the correctional institution is classified as a juvenile prison at month  $t$ , and its value is 0 otherwise.

$\text{HIGH}_{i,t}$  is a dummy variable with value of 1 if the security level of the correctional institution is classified as “high” at month  $t$  and zero otherwise.<sup>8</sup>

<sup>8</sup> In Taiwan, the security-level of a prison is classified into three categories: high, medium, and low. A high-security prison is designed to accommodate inmates who committed more violent crimes. It has more supervision, control, and surveillance of

$LOW_{i,t}$  is a dummy variable with value of 1 if the security level of the correctional institution is classified as “low” and zero otherwise.

$POPU2_{i,t}$  is the total number of inmates in the correctional institution  $i$  at month  $t$ .

$BONUS_t$  is an indicator variable with value of 1 if the government issues a year-end bonus at month  $t$  and 0 otherwise.

Table 6 contains a complete description of the dependent and independent variables used in the individual-level analysis.

## B. Results

Table 7 presents descriptive statistics for the variables used in the individual-level regression analysis. As shown, the mean admission rate for new prisoners was 5.1% for all correctional institutions in Taiwan during the 1996–2000 years. The mean of JUVEN2 is 0.130, indicating that about 13% of the correctional institutions in Taiwan during the 1996–2000 period were classified as juvenile prisons. In addition, the mean of HIGH (LOW) is 0.261 (0.130), indicating that about 26% (13%) of the prisons in Taiwan were high-security (low-security) prisons during the sample period. In other words, approximately 61% of the correctional institutions were classified as medium-security prisons. Finally, the mean of POPU2 shows that the average number of inmates in the correctional institutions each month over the sample period was 1,818.

Tables 8 and 9 present the correlations among the variables included in the individual-level analysis. Table 8 reveals a significantly negative Pearson correlation of  $-0.078$  between PRISONER and POLICY, indicating that the admission rate for the correctional institutions in Taiwan declined significantly after the passage of the new 1997 parole policy. The correlation between PRISONER and JUVEN2 is significantly positive, suggesting that the admission rate is higher if the correctional institution is classified as a juvenile prison. In addition, we find a significantly positive (negative) correlation between PRISONER and HIGH (LOW), indicating that the admission rate is higher (lower) for high-security (low-security) prisons relative to the

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inmates, and the buildings and policies within it are more likely to restrict the inmates' movement and minimize their control over the environment. Conversely, a low-security prison is relatively open and it controls the inmates based on trust rather than bars. A low-security prison normally accommodates inmates with less violent crimes and/or good records of prior conduct during the term of imprisonment.

**Table 6**  
**Variable Definition and Measurement in the Individual-Level Analysis**

| Variables                                     | Variable Measurement  |
|---|---|
| <b>Dependent Variables</b>                    |   |
| <b>PRISONER</b>                               | <b>PRISONER</b> is the new prisoner admission rate, defined as the number of new prisoners admitted to the correctional institution divided by the total number of prisoners within that correctional institution.      |
| <b>COST2 (millions, in Taiwanese dollars)</b> | <b>COST2</b> includes labor costs, operating costs, transportation costs, food costs, and other costs for each correctional institution each month.   |
| <b>Independent Variables</b>                  |   |
| <b>POLICY</b>                                 | <b>POLICY</b> is an indicator variable which has value of 0 for months in the pre-change period (months before November 1997) and its value is 1 for the months in the post-change period (months after November 1997). |
| <b>JUVEN2</b>                                 | <b>JUVEN2</b> is an indicator variable with the value of 1 if the correctional institution is classified as a juvenile prison and its value is 0 otherwise.   |
| <b>HIGH</b>                                   | <b>HIGH</b> is an indicator variable with the value of 1 if the security level of the correctional institution is classified as "high" and zero otherwise.  |
| <b>LOW</b>                                    | <b>LOW</b> is an indicator variable with the value of 1 if the security level of the correctional institution is classified as "low" and zero otherwise.  |
| <b>POPU2</b>                                  | <b>POPU2</b> is the number of inmates in the correctional institution.  |
| <b>BONUS</b>                                  | <b>BONUS</b> is "1" if government issues year-end bonus, and "0" otherwise.   |

medium-security prisons. In Table 9, a significantly positive correlation between COST2 and POLICY indicates that the correctional institution costs increased after the passage of the new 1997 parole policy. The correlation between COST2 and POPU2 is significantly positive, suggesting that the cost is higher if there are a greater number of criminals in the correctional institution. In addition, we find a significantly positive (negative) correlation between COST2 and HIGH (LOW), indicating that the cost is

**Table 7**  
**Descriptive Statistics for the Variables Used in the Individual-Level Analysis**

| Variables                    | Mean                   | Standard Deviation    | Minimum               | Maximum                |
|------------------------------|------------------------|-----------------------|-----------------------|------------------------|
| <b>Dependent Variables</b>   |                        |                       |                       |                        |
| <b>PRISONER</b>              | 0.051                  | 0.041                 | 0.000                 | 1.022                  |
| <b>COST2</b>                 | \$15.153<br>(millions) | \$9.780<br>(millions) | \$2.100<br>(millions) | \$79.921<br>(millions) |
| <b>Independent Variables</b> |                        |                       |                       |                        |
| <b>POLICY</b>                | 0.685                  | 0.464                 | 0.000                 | 1.000                  |
| <b>JUVEN2</b>                | 0.130                  | 0.337                 | 0.000                 | 1.000                  |
| <b>HIGH</b>                  | 0.261                  | 0.439                 | 0.000                 | 1.000                  |
| <b>LOW</b>                   | 0.130                  | 0.337                 | 0.000                 | 1.000                  |
| <b>POPU2</b>                 | 1,818                  | 1,625                 | 9,000                 | 7,123                  |
| <b>BONUS</b>                 | 0.074                  | 0.264                 | 0.000                 | 1.000                  |

Notes: See Table 6 for the definition of all variables.

higher (lower) for high-security (low-security) prisons relative to the medium-security prisons.

Results of the individual-level regression analysis, including the fixed effects model and random effects model, are presented in Table 10. Consistent with the aggregate-level results, the coefficients on POLICY in both column (1) and (2) are negative and significant at the 1% level, suggesting that the admission rate of new prisoners to the correctional institutions in Taiwan declined after the passage of the new parole policy in 1997.<sup>9</sup> The coefficient on the interaction variable, POLICY\*JUVEN2 is significantly positive, indicating that, after the new parole policy was implemented, the admission rate for juvenile prisons was higher than non-juvenile prisons. This evidence suggests that, relative to adult crimes, juvenile crimes are less responsive to the tougher parole policy implemented in Taiwan. Finally, the coefficient on POLICY\*LOW is significantly positive, indicating that low-security correctional institutions had higher admission rates after the imple-

<sup>9</sup> An insignificant p-value is associated with the Hausman test. Therefore, it is safe to use the random effects model.

**Table 8**  
**Correlation Analysis for the Variables Used in the**  
**Individual-Level Analysis—PRISONER**

| Variable        | PRISONER | POLICY            | JUVEN2           | HIGH              | LOW               |
|-----------------|----------|-------------------|------------------|-------------------|-------------------|
| <b>PRISONER</b> | 1<br>.   | -0.078<br>(0.007) | 0.094<br>(0.001) | 0.176<br>(0.000)  | -0.385<br>(0.000) |
| <b>POLICY</b>   |          | 1<br>.            | 0.000<br>(1.000) | 0.000<br>(1.000)  | 0.000<br>(1.000)  |
| <b>JUVEN2</b>   |          |                   | 1<br>.           | -0.230<br>(0.000) | -0.150<br>(0.000) |
| <b>HIGH</b>     |          |                   |                  | 1<br>.            | -0.230<br>(0.000) |
| <b>LOW</b>      |          |                   |                  |                   | 1<br>.            |

Notes: Numbers represent Pearson correlations, **p-values are in parentheses**.  
 See Table 6 for the definition of all variables.

**Table 9**  
**Correlation Analysis for the Variables Used in the**  
**Individual-Level Analysis—COST2**

|               | COST2  | POLICY           | POPU2             | HIGH             | LOW               |
|---------------|--------|------------------|-------------------|------------------|-------------------|
| <b>COST2</b>  | 1<br>. | 0.136<br>(0.000) | 0.799<br>(0.000)  | 0.269<br>(0.000) | -0.342<br>(0.000) |
| <b>POLICY</b> |        | 1<br>.           | -0.034<br>(0.228) | 0.000<br>(1.000) | 0.000<br>(1.000)  |
| <b>POPU2</b>  |        |                  | 1<br>.            | 0.330<br>(0.000) | -0.352<br>(0.000) |
| <b>HIGH</b>   |        |                  |                   | 1<br>.           | -0.230<br>(0.000) |
| <b>LOW</b>    |        |                  |                   |                  | 1<br>.            |

Notes: Numbers represent Pearson correlations, **p-values are in parentheses**.  
 See Table 6 for the definition of all variables.

**Table 10**  
**Individual-Level Regression Analysis for the Association between**  
**Parole Policy Change, New Prisoners Admitted, and Correctional Institution Costs**

| Variables               | PRISONER                           |                       | COST2                                     |                       |
|-------------------------|------------------------------------|-----------------------|---|-----------------------|
|                         | Fixed Effects<br>(1)               | Random Effects<br>(2) | Fixed Effects<br>(3)                      | Random Effects<br>(4) |
| Intercept               | 0.0562***<br>(29.79)               | 0.063***<br>(5.73)    | 13.795***<br>(21.01)                      | 11.067***<br>(9.45)   |
| POLICY                  | -0.013***<br>(-4.09)               | -0.013***<br>(-4.09)  | 2.680***<br>(8.30)                        | 3.019***<br>(9.05)    |
| JUVEN2                  | (dropped)                          | -0.0004<br>(-0.02)    | (dropped)                                 | -3.589*<br>(-1.64)    |
| HIGH                    | (dropped)                          | 0.007<br>(0.38)       | (dropped)                                 | 1.872<br>(1.12)       |
| LOW                     | (dropped)                          | -0.062***<br>(-2.63)  | (dropped)                                 | -6.360***<br>(-2.89)  |
| POPU2                   |                                    |                       | -0.001**<br>(-1.97)                       | 0.001***<br>(4.26)    |
| BONUS                   |                                    |                       | 10.991***<br>(28.22)                      | 10.953***<br>(27.09)  |
| POLICY*JUVEN2           | 0.016**<br>(2.26)                  | 0.016**<br>(2.26)     | -0.808<br>(-1.17)                         | -1.233*<br>(-1.73)    |
| POLICY*HIGH             | 0.008<br>(1.47)                    | 0.008<br>(1.47)       | 0.686<br>(1.28)                           | 0.687<br>(1.24)       |
| POLICY*LOW              | 0.014*<br>(1.94)                   | 0.014*<br>(1.94)      | -1.717**<br>(-2.49)                       | -2.180***<br>(-3.05)  |
| Adjusted R <sup>2</sup> | 0.0148                             | 0.1524                | 0.4473                                    | 0.5266                |
| F value                 | 4.58***                            |                       | 163.62***                                 |                       |
| Wald Chi <sup>2</sup>   |                                    | 25.85***              |   | 968.09***             |
| Hausman test (p-value)  | 0 (1.000)<br>(Random effect model) |                       | 116.61 (0.000)***<br>(Fixed effect model) |                       |

Notes: See Table 6 for the definition of all variables.

**t-statistics are in parentheses.**

\*\*\*significant at the 1% level at a two-tailed test

\*\*significant at the 5% level at a two-tailed test

\*significant at the 10% level at a two-tailed test

mentation of the new parole policy.

Columns (3) and (4) of Table 10 show the impact of the policy change on correctional institution costs for each institution.<sup>10</sup> The result indicates that the correctional institution costs in Taiwan increased after the 1997 parole policy change. The coefficients on BONUS are significantly positive, indicating that year-end bonus has a positive association with correctional institution costs. Finally, the coefficient on POLICY\*LOW is significantly negative, indicating that low-security correctional institutions had lower costs than medium-security correctional institutions after the implementation of the new parole policy.

## VI. Concluding Remarks

In this paper, we investigate whether a tougher parole policy, which was implemented in Taiwan during 1997, is associated with a decline in crime activity. This new parole policy heightens the threshold level before an inmate could be considered for early release, and therefore it increases the average length of prison terms served by criminals. Economic theory suggests that an individual will commit fewer crimes if the costs of crime increase or the benefits decline. Thus, a tougher parole policy is likely to deter crime by making criminals perceive that the costs of committing crimes will increase through an increase in the severity of punishment.

Using an event study approach, our results indicate that the overall crime rate in Taiwan declined significantly after the implementation of the new parole policy that was introduced in 1997. This is reflected in both misdemeanor and felony crime rates. We also find that both the overall recidivism rate and the parolee recidivism rate declined significantly after the implementation of the new policy. These results hold after controlling for other variables that are likely to be associated with crime rates such as unemployment rate, educational level, crime conviction rate, and police outlays. Thus, our results reveal that the tougher parole policy has a deterrent effect on criminal behavior, which is consistent with the deterrence hypothesis.

In addition, in the individual-level analysis, we find that the number of

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<sup>10</sup> In the cost regression model, the Hausman test shows a significant p-value. Therefore, we should use the fixed effects model.

new prisoners admitted to correctional institutions declined significantly after the passage of the new parole policy. This evidence reinforces the findings of the aggregate-level analysis and suggests that criminal activities are responsive to harsher sanctions. Results also indicate that the decrease in juvenile crimes is not as large as the corresponding reduction in crimes for adults. Finally, our findings show that, after the budget growth rate is taken into consideration, the total correctional institution costs in Taiwan increased after the implementation of the new policy in both the aggregate-level and the individual-level analyses.

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# 台灣假釋政策之實證研究

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## 摘 要

在本文中，我們提供懲罰對於犯罪行為嚇阻作用的台灣經驗。具體而言，本研究探討1997年採行提高門檻的假釋政策是否與犯罪率的降低有關。研究結果顯示，台灣實施新的假釋政策後，整體犯罪率顯著下降，包括輕罪與重罪，結果也發現新的假釋政策實施後，累犯率和假釋犯再犯率大幅下降。這些結果在控制與犯罪率相關的變數後仍獲得支持，包括失業率、教育程度、定罪率、和警政支出。另外，在通過新的假釋政策後，新入監人數也顯著下降。總體而言，本研究結果顯示：較嚴格的假釋政策對於犯罪行為的確存在嚇阻作用，符合嚇阻假說。最後，本研究發現在1997年新的假釋政策宣告後，矯正機關成本有顯著增加的現象。

**關鍵字：**假釋政策、犯罪率、嚇阻作用、矯正機關成本