

After-School Programs and Juvenile Delinquency:

An Economic Model of Crime Reduction

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Abstract

Since 2005, the United States has experienced a significant and sustained decline in juvenile delinquency, often attributed to increased arrest and incarceration rates. However, scholars have sought alternative, non-punitive approaches to further reduce delinquency. One such approach is after-school programs, which have been tested for their effectiveness. This article develops a theoretical framework using a utility-maximizing decision model that incorporates uncertainty and time allocation to analyze offenders' opportunities and payoffs within an infinitely repeated game framework. The model suggests that extended school hours reduce juvenile delinquency by limiting opportunities for criminal behavior, both by decreasing potential victims and increasing teacher supervision. In addition, the model suggests that aligning school hours with societal working hours strengthens the effectiveness of delinquency prevention policies. Beyond theoretical analysis, this study provides empirical evidence suggesting the effectiveness of after-school programs. The findings also offer valuable perspectives for countries with weak law enforcement, where juvenile delinquency disrupts education and lowers its returns.

I. Introduction

Juvenile delinquency, the violation of law by people under 18 years of age, played a critical role in criminal studies from various fields of the academy. Although federal data have shown a persistent and drastic decrease in all types of offenses since the late 20th century, and the declination of which is often explained by the crime opportunity and rational choice theory, where offenders evaluate their expected marginal benefit against the potential marginal cost.¹ The declination of juvenile delinquency, however, has not been explicitly investigated.

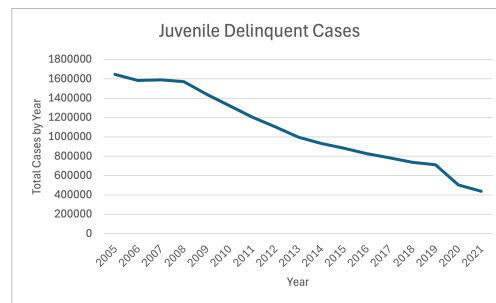


Figure 1: Juvenile Delinquency Court Cases Each Year

Nevertheless, pure observation provides us with invaluable data to diagnose juvenile delinquency during weekdays. In 2019, Fight Crime: Invest in Kids released a report documenting the peak juvenile criminal activities between 2 pm and 6 pm.² Though it has long been known to law enforcement, its implication brought scholars' attention to several targeted programs and strategies that have long been utilized.

1. Graham Farrell, Nick Tilley, and Andromachi Tseloni, "Why the crime drop?," *Crime and justice* 43, no. 1 (2014): 421–490.

2. Fight Crime: Invest in Kids, *From Risk to Opportunity: Afterschool Programs Keep Kids Safe When Juvenile Crime Peaks*, technical report (Council for a Strong America, October 2019), 15.

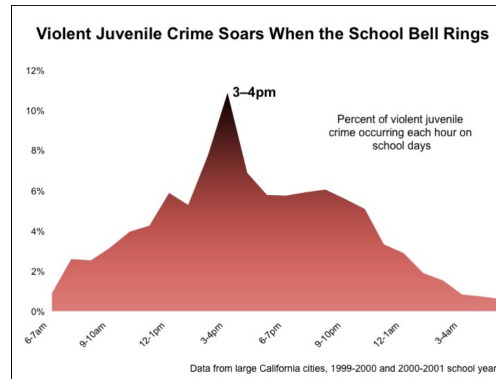


Figure 2: Juvenile Delinquent Time Distribution

One of such strategies, according to some hypotheses, linked to a "broken-window" policing technique where police are expected to execute stricter enforcement to prevent minor crimes from deteriorating into severe offenses later in the future. Some research have shown its effectiveness by establishing a strong positive correlation between an increased incarceration rate of misdemeanors and a decline in violent crimes, but the same phenomenon is not ubiquitous.³ In addition to the effectiveness, putting kids in jail has become increasingly concerning, both to their development and to public finance.

Given this context, after school programs (ASPs) are investigated. Many advocates believe that ASPs provide alternatives to street crimes and drug consumption, as ASPs are increasingly funded by federal government under a variety of acts.⁴ Research has shown that juveniles who left the program are more likely to be arrested than program participants during the initial intervention period, because lacking of supervision and boredom lead to

3. George L Kelling and William H Sousa, *Do police matter?: An analysis of the impact of new york city's police reforms* (CCI Center for Civic Innovation at the Manhattan Institute, 2001); Wesley G Skogan, *Disorder and decline: Crime and the spiral of decay in American neighborhoods* (Univ of California Press, 1992).

4. *Federal Afterschool Policy*, <https://www.afterschoolalliance.org/policyFederal.cfm>.

poorer choices made, thus more likely to involve in risky illegal behaviors.⁵ Naturally, several hypotheses formed to inquire the rationale. Juvenile delinquencies, however, are a complex social phenomenon involving malleable youth who are generally considered to be incapable of distinguishing socially acceptable behaviors from those unacceptable. To understand this multidimensional problem, the author draw assumptions from rational crime theory and crime opportunity theory that work closely to rational decision-making under economics framework. Based on those assumptions, the author provides a theoretical rationale for ASPs' effectiveness by showing that those programs reduce deviant behaviors by extending period of supervision, which increases opportunity cost for potential offenders. For simplicity, this article draws and modifies pre-established models from Becker's work. The derived model will then put into the analysis under the game theory framework.

The remainder of this paper proceeds as follows: Section II summarizes important literature that discusses this issue. Section III discusses a variation of Becker's criminal activity model and the theoretical framework. Section IV demonstrates the theoretical results of the formulated model and some optimization conditions. Section IV presents the implications and behavioral changes in juvenile delinquency. Section VI shows some empirical evidence, and Section VII discusses policy implications and some drawbacks in this model. Conclusion will be presented in Section VIII.

5. S LaFrance et al., "A safe place for healthy youth development: A comprehensive evaluation of the Bayview Safe Haven," *San Francisco, CA: BTW Consultants and LaFrance Associates*, 2001, National Ctr on Addiction, Substance Abuse at Columbia University (CASA), and United States of America, "National Survey of American Attitudes on Substance Abuse XIII: Teens and Parents," 2003,

II. Literature Review*

In the discussion of effectiveness of After-School Programs, one controversial issue has been the underlying rationale that defines the nature of their effectiveness. Several ASPs are promoted by law enforcement for their exceptional effectiveness in reducing deviant behaviors, those include Chicago's Becoming a Man (BAM) program, Wisconsin's 21st Century Community Learning Center (CCLC) program, and many more of the like. The essential theme shared among those programs, in the eyes of the police, is the continuation of supervision from trustworthy and responsible adults after the school day, when students are more susceptible to street crimes, such as assault, theft, and drug-related crimes, otherwise.⁶ From this perspective, supervision and regulation are emphasized, which may further fan the flame of criticism towards paternalism, and even fuel disagreement among scholars studying criminology and education. On the other hand, Gottfredson et al. argue for a different explanation that contradict common sense.

Note: other scholars' perspectives must also be demonstrated to show the comparison.

III. Basic Analysis

To demonstrate the implication of After-School Programs have on juvenile delinquencies, the author follows the theoretical framework from Becker to re-derive the model.⁷

6. Susan Manheimer and Joshua Spaulding, "After School: The Prime Time for Juvenile Crime—Partnering with After-School Programs to Reduce Crime, Victimization, and Risky Behaviors Among Youth," *Police Chief Online*, August 2020,

7. Gary S Becker, "Crime and punishment: An economic approach," *Journal of political economy* 76, no. 2 (1968): 169–217; Gary S Becker, "A Theory of the Allocation of Time," *The economic journal* 75, no. 299 (1965): 493–517.

A. *The Cost of Juvenile Delinquency*

Although juvenile delinquency only take up a minimum share of total criminal activities, that is, the number of youth incarceration only account for 8% or an estimated 424300 of total imprisonment.⁸ Even taking into account of unobserved cold cases, juvenile crime in general is still relatively insignificant. However, people afraid that juvenile delinquency might further deteriorate into serious offenses, increasing gang activities and drug usage the financial challenges imposed to society, especially taxpayers, are no less troublesome.

Justice Policy Institute analyzed the cost of juvenile incarceration in year 2014 and 2020, showing a tremendous upsurge in per juvenile incarceration cost in many states, even with a persistent declination of juvenile delinquency rate.⁹ The author draw out some of the most expensive incarceration and rehabilitation programs for further discussion.

Table 1 lists 12 states where the yearly cost of incarceration per person higher than \$250,000.00. Except those, other 40 states spend their tax money at least \$100,000 per year for a single youth's confinement.¹⁰ The same amount of money could have been spent on other community based training programs or higher education for better net returns. After-school programs, often suggested by law enforcement, usually costs from \$140 to \$750 per

8. Charles M Puzzanchera, *Trends in youth arrests for violent crimes* (US Department of Justice, Office of Justice Programs, Office of Juvenile . . ., 2022).

9. A Petteruti, M Schindler, and J Ziedengerg, *Calculating the full price tag for youth incarceration*. Justice Policy Institute, 2014; *Sticker shock 2020: The cost of youth incarceration*, Justice Policy Institute, 2020.

10. *Sticker shock 2020: The cost of youth incarceration*.

States with the Highest Yearly Cost Per Juvenile Incarceration			
State	Per Day	Per Year	Percentage Change from 2014
Alaska	\$1542.49	\$563,008.85	N.A.
California	\$833.59	\$304,259.00	46%
Connecticut	\$750.00	\$273,750.00	23%
Maine	\$689.22	\$251,565.30	12%
Maryland	\$1,136.79	\$414,929.00	41%
Montana	\$1,111.00	\$405,515.00	131%
Nebraska	\$734.70	\$268,165.50	111%
New Hampshire	\$1,479.45	\$540,000.00	152%
New Jersey	\$794.05	\$289,827.00	48%
New York	\$2444.40	\$892,206.00	153%
Rhode Island	\$722.60	\$263,750.00	42%
Vermont	\$1447.00	\$528,155.00	135%

Table 1: Selected States with the Highest Per Youth Incarceration Cost.

month. Showing great cost-effective potential as an alternative, if it is efficient at the same level.

B. Total Damages

The damages to social welfare from criminal offenses can be generally considered as:

$$D_i(O_i) = H_i(O_i) - G_i(O_i),$$

where $D_i(O_i)$ is the net damage caused by O_i number of cases, $H_i(O_i)$ is the harm offenders impose to other members of the society, and $G_i(O_i)$ is the social value of gain offenders received from their illegitimate behaviors.¹¹ In general, we would assume that harm and

11. Following Becker's convention, the i th subscript will be omitted whenever only one activity is being discussed. Since we only consider juvenile delinquency, i will be suppressed.

gain tends to increase with activity level, that is,

$$H' = \frac{dH}{dO} > 0 \text{ and } G' = \frac{dG}{dO} > 0. \quad (1)$$

Behavioral economics and other psychological research verified the general tendency of diminishing marginal utility, therefore in this model, the author believe offenders eventually will receive diminishing marginal gains, $G'' < 0$, while causing increasing marginal harm from additional offenses, $H'' > 0$, thus,

$$D'' = H'' - G'' > 0. \quad (2)$$

However, since both first-order derivatives of H and G are both greater than zero, then the sign of D' depends on their relative magnitudes. From (2), we have

$$\forall O > O_s, \text{ if } D'(O_s) \geq 0, \text{ then } D'(O) > 0. \quad (3)$$

Although mathematical equation shows the possible $D'(O) < 0$ case when $O < O_s$, it is not relevant to the inquiry of the relationship this article discusses at the current status.

C. The Cost of the After School Program

The apprehension and incarceration of juvenile delinquencies are extremely costly. To make the after-school programs more appealing to be the next alternative, those programs have to be both efficient and cost-effective. One strategy for cost-benefit analysis is through benchmarking, where the bar for ASPs are set against police operational cost and daily

incarceration and rehabilitation cost. Therefore, the base assumption would be that the cost of ASPs is equivalent to the police operational cost. The author kept Becker's model that captures police operational cost, and redefine a model for ASPs.

In Becker's article, he constructed cost of police activity as

$$C = C(A), \tag{4}$$

where A denotes police activity (in terms of production) as a function of manpower m , materials r , and capitals c . That is, $A = f(m, r, c)$. In his assumption, the level of police activities can be estimated through number of cases convicted. Therefore,

$$A = h(p, O, a) \cong pO, \tag{5}$$

where p denotes the probability that an offense is cleared by conviction, and a stands for other determinants of "activity."

To discuss the ASP and juvenile delinquency, the author set police activities as intermediary variable that align the level of ASPs to the reduced number of juvenile offenses. For after school programs, as it seems plausible, the more being paid to teachers and schools to provide different types of activities, the easier it is to attract students, especially those who are susceptible to risky behaviors due to boredom or those who prefer maximizing utility through delinquent behaviors, staying inside the school. If after-school programs are sufficiently attractive, we could safely assume that the net result to be a lowered number of free hours available for adolescents to commit juvenile delinquencies after school without

supervision. One can postulate a relation between the output (lowered number of juvenile delinquency cases) and the level of such programs with various inputs of wages and educational resources,¹² as in $P = f(w, r)$, where f is the production function that combines different elements necessary for an effective program. Given the production function f , increasing school length and providing a variety of programs would be costly, and summarized by the following relationship:

$$C = C(P) \tag{6}$$

and

$$C' = \frac{dC}{dP} > 0.$$

The cheaper the wage (or equivalently the more specialized teachers are available), resources, and capitals, the cheaper it would be to extend the length of after school period and provide more various activities for different students, such as photography club, sports club, and computer science club.

A theoretical measure of the effectiveness of such programs would be the number of juvenile delinquencies prevented, equivalently, the program should reflect numbers of young offenders apprehended and convicted had the program not existed, that is

$$P = f(m, r, c) = A \cong pO, \tag{7}$$

where we expect, for programs to be effective at the margin, unit input should yield same level of output. Here, the effectiveness of ASPs should at least be the same as police operations,

12. Assume that the cost of teaching faculties only consists of wages and salaries.

or, the numerical magnitudes of juvenile cases prevented by adopting ASPs is congruent to number of juvenile delinquencies convicted by police interventions. By substituting (7) into (6) and differentiating, one has

$$C_p = \frac{\partial C(pO)}{\partial p} = C'O > 0 \text{ and } C_o = C'p > 0, \quad (8)$$

if $pO \neq 0$. An increase in either the probability of juvenile delinquency conviction (indicating more resources are utilized for this purpose) or the number of offenses would increase the cost of such programs. If the marginal cost of program is rising, further implications would be that

$$\begin{aligned} C_{pp} &= C''O^2 > 0, \\ C_{oo} &= C''p^2 > 0, \end{aligned} \quad (9)$$

and

$$C_{po} = C_{op} = C''pO + C' > 0.$$

In general, given that the cost of program is consistent with police activities at the baseline, we can consider the cost of ASPs as having the following relationship:

$$P = h(p, O, a). \quad (10)$$

Substitution provides the following relationship $C = C(p, O, a)$. Since it is very likely that h_p , h_o , and h_a are all greater than zero, then C_p , C_o , and C_a are all greater than zero.

To restrict corner solutions, it is sufficient to assume that

$$\begin{aligned} C_{pp} &\geq 0 \\ C_{oo} &\geq 0 \end{aligned} \tag{11}$$

and

$$C_{op} \cong 0$$

Data show that on average, youth incarceration costs \$588 per day, or \$214000 per year in year of 2020.¹³ So the benchmark for after-school programs is

$$AC = \frac{C(p, O, a)}{O}, \tag{12}$$

though normally ASPs cost less, ranging from \$140 to \$750 per month.

*D. The Demand for Juvenile Delinquency**

To derive the classical Marshallian demand for juvenile delinquency, several assumptions must hold. In this case, we assume juveniles are, in a degree, rational utility maximizers who compare marginal benefit against potential marginal cost. More importantly, we should note that to potential offenders, delinquent activities are indifferent from socially acceptable behaviors. That is, if bullying, assaulting, and reckless driving yields higher utility compare to being responsible, then rational agent will choose risky behaviors.

Certainly, this assumption often being criticized by criminologists.

13. *Sticker shock 2020: The cost of youth incarceration.*

Consider people committing delinquent behaviors as a way to maximize their utility.

Denote offenses as:

$$O_i = O_i(p_i, n_i, u_i) \quad (13)$$

where number of offense is a function of number of potential targets n and time t during each day. Then, in general, number of offenses has the following property:

$$O_{ni} = \frac{\partial O_i}{\partial n_i} > 0, \text{ and } \frac{\partial O'}{\partial^2 n} < 0 \quad (14)$$

For the relationship between number of offenses and time period in a day however, empirical evidence suggests that violent juvenile crime tends to reach the peak right after the end of school and then diminishes, so it behaves like a function with period and frequency. Assume its period is 24 hours and peak at 3 p.m., then it diminishes until reach another peak around 10 pm. Then, we expected O and t to have the following relationship,

$$\frac{\partial O}{\partial t} = 0 \text{ when } t = 15 \quad (15)$$

Then we can construct O as:

$$\log(n) \cdot (\gamma \cdot \cos(\frac{2\pi}{24}(t - 15)) \sin(\frac{2\pi}{12}t) + \gamma) \quad (16)$$

Where b is the coefficient for juvenile crime intensity in different locations.

Therefore, a utility maximizing individual would have the following utility function:

$$U = U(O)U'(O) > 0, \text{ and } U''(O) < 0 \quad (17)$$

E. The Supply for Juvenile Delinquency

F. Game Theory Framework

1. Delinquency as A One-shot Game
2. Infinitely Repeated Game with Perfect and Complete Information

IV. Optimal Conditions

Still working.

V. Shift in Behaviors

Still working.

VI. Empirical Evidence

Still working.

VII. Discussion

After demonstrating the constraint for potential offenders,

This paper neglected the positive impact ASPs may impose on potential offenders who can subsequently alter their preference lean towards more caring and socially acceptable trajectory.¹⁴

14. Denise C Gottfredson et al., "Do after school programs reduce delinquency?," *Prevention science* 5 (2004): 253–266.

VIII. Conclusion



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