The dynamics of poverty and crime

Haiyun Zhao\textsuperscript{1*}, Zhilan Feng\textsuperscript{2}, Carlos Castillo-Chavez\textsuperscript{3}

(1. Law School, Yale University, New Haven, CT 06511, USA;
2. Department of Mathematics, Purdue University, West Lafayette, IN 47907, USA;
3. Mathematical and Computational Modeling Sciences Center, Arizona State University, Tempe, AZ 85287, USA)

Abstract: Poverty and crime are two maladies that plague metropolitan areas. The economic theory of crime\textsuperscript{[1]} demonstrates a direct correlation between poverty and crime. The model considered in this study seeks to examine the dynamics of the poverty-crime system through stability analysis of a system of ordinary differential equations in order to identify cost-effective strategies to combat crime in metropolises.

Key words: Mathematical model; Poverty and crime; Crime control strategies

CLC number: O 175.1, TQ 018 Document code: A Article ID: 1000-5137(2014)05-0486-10

MSC: 34A34, 37N40

1 Introduction

There is a direct correlation between the poverty and criminality\textsuperscript{[2–5]}. Becker’s economic theory of crime\textsuperscript{[1]} assumes that people resort to crime only if the costs of committing the crime are lower than the benefits gained. Those living in poverty, therefore, have a much greater chance of committing property crime\textsuperscript{[3–4]} than the general population, as they stand to gain more with each crime. Property crime includes the offenses of burglary, larceny-theft, motor vehicle theft, and arson\textsuperscript{[5]}. In his 1968 paper\textsuperscript{[1]}, Becker used statistical and economic analysis to determine the optimal control of crime. Here, we use a system of ordinary differential equations (ODEs) to try and get a more realistic, dynamical solution to that same question.

Property crime is a major problem in metropolises. In the Bronx borough of New York City alone there are nearly 45,000 cases of property crime reported in 2013\textsuperscript{[6]} in a population of over 1.4 million\textsuperscript{[7]}. Each criminal costs society about $5,700 per year due to lost productivity\textsuperscript{[8]}, and a total of $24 billion in goods is lost in the US each year to property crime\textsuperscript{[9]}. The victims of crime suffer an aggregate burden of $472 billion per year, including mental and physical suffering\textsuperscript{[10]}.

Crime is clearly an important problem that must be confronted. Ehrlich\textsuperscript{[11]} suggests that the successfulness of rehabilitation and incapacitation programs do have an effect on the aggregate crime level. However, it costs $20,000 – $30,000 to detain a person in a federal prison each year\textsuperscript{[12]}. It also costs about $15,000 – $20,000 annually for a prison cell\textsuperscript{[9]}. We see that from an economic standpoint, detaining every prisoner is actually a greater burden on society than crime itself is. Therefore, the issue becomes one of balance. Ultimately,