

Title	Studies of Quantitative Criminology Based on Complexity Theory
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Citation	
Issue Date	2005-11
Type	Conference Paper
Text version	publisher
URL	http://hdl.handle.net/10119/3899
Rights	2005 JAIST Press
Description	The original publication is available at JAIST Press http://www.jaist.ac.jp/library/jaist-press/index.html , IFSR 2005 : Proceedings of the First World Congress of the International Federation for Systems Research : The New Roles of Systems Sciences For a Knowledge-based Society : Nov. 14-17, 2109, Kobe, Japan, Symposium 4, Session 4 : Meta-synthesis and Complex Systems Complex Problem Solving (II)



Studies of Quantitative Criminology Based on Complexity Theory

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ABSTRACT

The article firstly poses the concept of quantitative criminology, analyzes its status, functions and significance in social and economic development, and formerly provides a skeleton of criminal quantity analysis. With the coordinating quantitative convey method, the article concludes with a depicting systematic construction of criminal describing, and we have acquired a series of macroscopic crime math models upon criminal studies. Thereafter, this paper is valuable on theoretical aspects, and has current significance as well.

Key words: quantitative criminology, criminal model, crime control, and crime entropy.

1. INTRODUCTION

It is a common knowledge that crime is a very sensitive and complicated social phenomenon and has significant influence on the economic development of a society. Governments and their police forces have to handle the problem seriously, and to take efficient measures to control the criminal activities. However, it is difficult to study the problem due to the uncertainties and the complexities of the social crime. Our study shows that the mechanism of the social criminal activities should be analyzed by the theory of the system self-organization in order to gain the information on criminal uncertainty, and to get the processing method. In this way, a purpose-oriented crime control is achievable [1].

In the 60s last century, the US senate once pointed out that in face of the coming key era, to realize the people's merciful aims, the ruthless math methods will play a exclusive role. We know, when a certain science transfers from determination to quantitative methodology, a new theoretical system and thinking way should be created. Otherwise, quantitative theory emphasizes more than numbers. Its basic role is to realize what theory means. Anyway, to certain the quantity of the criminal effective aspects is not the goal of the quantitative criminology.

Similarly we have higher request for practical sense in

establishing the mathematical model of social crime. For instance, crime entropy is an important quantitative character in non-equilibrium crime system. Crime system has great effect on studying possible space of social crime. Because crime system is in chaos, the theory and method in this system can be completely used to analyze the crime system.

The important content of quantitative criminology is to establish the nonlinear dynamic equation in crime system. If we can quantitatively describe crime system, we may predict its development law. According to the nature of social crime, mutation could happen. This mutational act makes crime phenomena potentially uncertain. This potential uncertainty explains that crime system doesn't have obvious statistical law. If we want to establish that, the key point is to set up the mutation model of crime system [2].

The article comes from the real social crimes, and it puts forward the concept of quantitative criminology. On the other hand, it will provide an outline of criminal quantitative analysis. The macroscopic crime system is described quantitatively in detail.

2. THE CONTENT AND SIGNIFICANCE OF QUANTITATIVE CRIMINOLOGY

There are two aspects of quantitative analysis regarding the social crime studies. For the one hand, to found the macroscopic criminal system model nationally or regionally, thus, with the analysis of this model, we can get the measure of the social stability. In the 21st century, the social progress and development not only depend on the economical scale and the scientific level, more importantly, also the people's habitant environment and quality. Two elements that influence our habitant environment are significant: the natural hazard and the artificial hazard. The harms brought by the natural hazard are well known, while the harms brought by the artificial hazard should not be ignored either. For example, social crime problem is one of them. Macroscopic crime system model describes quantitatively the effect of crime on the social economy and quantity characters, which is related to crime affairs. Through the analysis of macroscopic crime system

model, we can get quantity index about controlling crime; for example, crime rate and detection rate are both important indexes. At the same time, it's also very important that national or regional investment in the striking and controlling crime get the number relationships between the crime model and social economic structure [3].

The other is to describe microcosmic crime action model of crime attribute. Crime action model is the base of solving a case with computer. The rapid development of artificial intelligence and expert system offers an effective tool to criminal investigation automation. But establishing criminal inspecting expert system is very difficult, for we don't have right quantity of crime action and logic expression. And crime action is complicated; we can't analyze quantitatively the idiographic crime attribute. But we can describe macroscopic crime action through great sorts of crime attribute. In society the emergence of crime is decided by different human action. One differs from others in action. Everyone has an act character, which is fixed. It cannot be separated from its act frame. In spite it has all kinds of representation forms. This is human action's fixity and we will analyze in committed parts.

The development of modern criminology owes to the study of crime statistics and recessive case. Crime statistics is a researching way. For example, it explains the dimensions that one participates in crime and it offers quantity basis to the supposition of crime cause and correlative theory. If we compare crime statistical number with population statistical number, we will understand that crime is affected by many factors, such as industrialization, motorization, inflation and unemployment.

From crime statistics we can deduce with crime rate of residence collectivity or areas that above average. By this way we can predict the crime trend in given areas. So the quantitative analysis of crime problems is based on the crime statistics. However, nowadays crime statistical methods are not perfect and it is very limited in quantitative description. Because we are lack of statistical scientific measure to analyze crime action, especially limited in policemen statistics number. We can't get enough recessive crime information. These years the study of recessive case has rapid progress, but we still don't have unique ways to handle these problems. From 1980's the U.N. has been investigating the whole territorial crime many times, analyzing some crime actions such as homicide, person harm, sex crime, plunder, kidnapping children, theft, fraud and selling heroin, etc. They wanted to find unique ways but failed. The study of Quantitative Criminology is based on the traditional statistics and puts forward statistical ways of

recessive crime. Accordingly, it establishes crime probability set mapping space theory [3,5].

Generally speaking, physics concept and methods could be used in study of social phenomena by two ways. One is discussing qualitatively through the structural similarity. The other is using detailed quantitative mathematics methods to study and calculate. Social process with mathematics is different from physical process with mathematics. For example, classic physics explains that according to the Lapels determinism, we can predict the physical process at any time in future, if we know the first condition and moving direction. While in social problems, even if we do with the short-term developing process, we couldn't do this way, such as crime action. In these years, the developed phase change theory and synergetic have pointed out that when physical system's macroscopic situation changes dramatically, we still couldn't correctly predict what appears in future. But we can study macroscopic changes' common characteristic in physics and sociology fields by synergetic. The main difference between criminology and physics which both have social characteristic is the problem which could be repeated. In physics (astrophysics excepted) we could repeat the same test. Simple test result is uncertain, so we get distributing function of result through repeating test. And then we ensure accordant function. Irreversible process of social crime couldn't return and the same case couldn't happen once again. Of course we cannot permit it happens again. But we could use quantitatively analyzing way to establish mathematic model, review the macroscopic change of social crime phenomena and active theory of microcosmic crime action. For example, we can get the distillation function of crime attribute through statistical analysis of crime investigation in some areas. We contrast true process of social crime by this function, and get quantity characteristics, which have crime control value. It also helps us analyze all kinds of crime action with supposition [6].

Quantitative Criminology has great characteristic in argumentation of mathematics and physics, which emphasize practical expressed sensation of mathematical model. In mathematical and physical economy the result which is demonstrated by economic mathematics theory, must be tested by practical economic problems, otherwise this mathematical model has no sense. Similarly we have higher request for practical sense in establishing the social crime mathematical model. For instance, crime entropy is an important quantity character in non-equilibrium crime system. Crime system has great effect on studying possible space of social crime. Because crime system is in chaos, the theory and method in this system can be completely used to analyze

the crime system. The study intention is to get crime situation attracter.

The important content of quantitative criminology is to establish crime system nonlinear kinetic equation. If we can quantitatively descript crime system, we will predict its evolvement rule. According to the essence of social crime, crime has mutation. This mutational act makes crime phenomena potentially uncertain. This potential uncertainly explains that crime system doesn't have obvious statistical rule. If we want to establish that, the key point is to put up the mutation model of crime system [7].

3.THE STUDY METHODS OF QUANTITATIVE CRIMINOLOGY

3.1 The mechanisms of the social crime

Crime is an extremely complicated social phenomenon, and has the features of random mutation according to its occurrence, development and the trend of its evolution. From the viewpoint of government management, society security and crime prevention is the aim of crime control. According to the existing concept on crime control, the control process is determined by three factors:

- 1) Determine the possible space of a social crime;
- 2) Select some states from the possible space as targets;
- 3) Create the necessary conditions to make the crime control reach the preset aim.

It is known that the term "possible space" is the assembly of all the possibilities faced in the development process of an object. The possible space of a social crime is determined by the conditions leading to a crime. Generally speaking, the possible factors related to a crime involve the victims and the criminals, the motives and the opportunities, and the means and the scenes for a crime. These factors have their characteristic possible spaces, differing from each other in the amounts and the forms, and may interchange from one to another. When a possible space of a crime is developing into a certain state, it may turn into a new possible space. The occurrence of several possible spaces in the development of a social crime makes the crime process appearing in different stages. In other words, the target of crime control changes as the possible crime space varies.

For a complicated crime control process, the possible crime space may have many states. Moreover, these states may have different ways of appearances, and the conditions influencing the form of a crime are sophisticated and complicated as well. Accordingly, the control-selecting process is complex. Conditions and factors to be controlled vary as the stages of the crime

change. Furthermore, the concurrence between the conditions and the factors, as well as the interactions between the developing states, have to be taken into account. As an example, the urban environment, space and the social economy, together with the formation of the criminal conditions, directly determine the ways of crime control.

It accords the laws of the development of a society to use cybernetics to process the problem of the social crimes. Cybernetics adopts the view points of system theory and kinetics, structure and function, action and target, as well as information and cybernetics.

In general, however, it has not been practiced, up till now, to use the methods of Cybernetics for a systematic analysis of the crime problems for a society as a whole, and to give a quantitative description. At present, human society has entered the information era. The so-called information highway has extended itself into every field in the society. Briefly, the information society is characterized by the exchange, processing, and storage of the information. The Social crime systems are complicatedly structured, possess various features and interrelated to a large extent. Therefore, it is necessary to treat the crime control problem with Informatics and Cybernetics.

To sum up, the mechanism of the crime control is to use Informatics and Cybernetics in the possible crime spaces in order to achieve the purpose of the crime control.

3.2 The study methods of social crime

The main reason of the complexity and uncertainty of social crime is that we cannot grasp the internal law of criminal behaviors. For example, when crime happens (C when), where it happens (C where), what's it (C, what), why it happens (C why), what change it has (C what change). In short, those are 5CW questions. Nowadays, mathematical methods could do nothing with them.

In science research, the things with law will usually bring about quantitative methods. Mathematical model is an effective way in solving the problems. The things with no law will be qualitatively analyzed with experience and instinct, which is called qualitative inference. If they are combined together, it is the so-called the method of the combination of the both.

5W questions constitute a space expressing method. It consists of two mapping i.e. Situation Mapping and Relationship Mapping, which forms the Situation Relationship Structure (SR Structure). [3]

The point of quantitative criminology study lies in the crime situation relationship structure (CSRS). It establishes situation model and relationship model. By combining them together, we get SR analysis of practical

crime system. The form is that we use the mathematical model coming from the quantitative analysis to get the key, then based on which we make qualitative inference. At the same time, according to the SR set mapping which gets from qualitative inference, we establish mathematical model through all kinds of set mapping space hypothesis. Two results will be fed back through self-organized SR and finally form a feasible result. If social crime system is made up of variables C_1, C_2, \dots, C_n , and there are controlling parameters K_1, K_2, \dots, K_m , then crime dynamic equation is described as the following:

$$\begin{aligned} \frac{dC_1}{dt} &= f_1(\lambda, C_1, C_2, \Lambda, C_n) \\ \frac{dC_2}{dt} &= f_2(\lambda, C_1, C_2, \Lambda, C_n) \\ &\Lambda \Lambda \Lambda \Lambda \Lambda \Lambda \Lambda \Lambda \Lambda \Lambda \Lambda \\ \frac{dC_n}{dt} &= f_n(\lambda, C_1, C_2, \Lambda, C_n) \end{aligned} \quad (1)$$

In crime system Sc, Situation variable is the key factor to form crime system. The effective choice of situation variable is critical to reflect the real social crime and describe social stability and the degree of the social development. The economic growth and consumption level reflect human social development. In economy study, if we lack the analysis of crime factors, our conclusion of the economy analysis will not be reliable. Among the former study of social crime, there are many factors constructing crime system, such as economy factor, education factor, social ethos, law factor, people relationship and management factor. Because these factors lie in different situations, the characteristics of crime system are different. The evaluation of social stability and development depends on the choice of controlling parameter. For example unemployment rate, relative number of income difference, controlling proportion of 1 informal social groups, management efficiency of public spots and education quality.

$$\begin{aligned} \frac{dC_i}{dt} &= f_i(\{C_j\}, \{k_a\}) \\ i, j &= 1, 2, \dots, n \quad a = 1, 2, \dots, m \end{aligned} \quad (2)$$

Suppose equation (2) is self-organization power system, this system acts with a sudden change that has the statistical characteristics. But crime action is invisible. The asymmetry of information makes it uncertain in the economic loss and investment when we solve cases and control criminals. Therefore, the statistical prediction in

criminal numbers and efficient estimate in solving criminal cases are very important in macroeconomic analysis and growth, together with in the control the social stability.

Crime case is looked as crime number $n(t)$, which is decided by time (t) 's function. It happens randomly. Because crime happening and solving criminal cases are two variables, and crime number is decided by these variables, we suppose expectation of crime number $E\{n(t)\} = n(t)$, then

$$E[n(t)] = N(t) = \sum_{n=0}^{\infty} nP_n(t)$$

In the formula mentioned above, $P_n(t)$ indicates that time (t) has n crime rate. Above all, by instinct, the changing rate of the expectation crime number, whose rate changes with time, is $dN(t)/dt$. If $\lambda(t)$ is average happening rate done by a man who has crime action. During the time (t) , this happening rate explains the new crime and repeated crime. So in a certain area, the whole expected crime rate is that average rate $\lambda(t)$ counted on population multiplies the expected crime number. Here supposing $\lambda(t)$ is given on per ten thousand people, for example, $\lambda(t=1/1/2001)=0.0011$ shows that there are 11 criminals in ten thousand people every year from Jan. 1st, 2001. In the same way, if $\mu(t)$ is average rate of solving case of a criminal at time t , $\mu(t)n(t)$ is the general expected rate. So

$$\frac{dN(t)}{dt} = [\lambda(t) - \mu(t)]N(t) \quad (3)$$

This is called social crime situation model. By analyzing the crime attribute in certain area, if the criminal doesn't transfer between inside and outside, i.e. specific crime rate and cracking rate doesn't change with time, then $\lambda(t) = \lambda, \mu(t) = \mu$, formula (3) will change into

$$\frac{dN(t)}{dt} = (\lambda - \mu)N(t) \quad (4)$$

In formula (4) result could be validated by replacing.

$$N(t) = N(0)e^{(\lambda - \mu)t} \quad (5)$$

In the formula, $N(0)$ is crime number when time is zero. When $\lambda - \mu > 0$, it explains that practical crime cracking is less than practical crime rate. From study of recessive case, we know that the number that people didn't report the case and crime actions haven't been found are great many. So controlling aim of crime

system is $\lambda - \mu \rightarrow 0$.

We find from above analysis that the indication of crime number has great effect on social development, especially on economy. If there is no crime economy dynamic analysis in macroscopic economy analysis, macroscopic economy analysis will be half-baked. Here is a social crime number interval $[N_{\min}, N_{\max}]$; the number of crime case happening is controlled among interval. Supposing two trends, $N(t) \rightarrow N_{\min}$ and $N(t) \rightarrow N_{\max}$, crime controlling degrees k_{α} and k_{β} are replaced by $\lambda(t) - \mu(t)$ then

$$k_{\alpha} = [\lambda(t) - \mu(t)]_{\alpha} = \left[1 - \frac{N(t)}{N_{\min}}\right](\lambda - \mu)$$

$$k_{\beta} = [\lambda(t) - \mu(t)]_{\beta} = \left[1 - \frac{N(t)}{N_{\max}}\right](\lambda - \mu) G$$

etting result of differential equation.

$$[N(t)]_{\alpha} = \frac{N_{\min} e^{(\lambda-\mu)t}}{\left(\frac{N_{\min}}{N(0)}\right) - 1 + e^{(\lambda-\mu)t}},$$

$$[N(t)]_{\beta} = \frac{N_{\max} e^{(\lambda-\mu)t}}{\left(\frac{N_{\max}}{N(0)}\right) - 1 + e^{(\lambda-\mu)t}}$$

Here supposing that the degree of crime controlling is chosen randomly between k_{α} and k_{β} and. logarithm $[k_{\alpha}, k_{\beta}]$ is the ideal key to crime-controlling. It can be inferred from the following.

$$\begin{aligned} [N(t)]_c &= \int_{t_0}^{t_n} \frac{[N(t)]_{\alpha} + [N(t)]_{\beta}}{2} dt \\ &= \int_{t_0}^{t_n} \left[\frac{N_{\min} e^{(\lambda-\mu)t}}{\left(\frac{N_{\min}}{N(0)}\right) - 1 + e^{(\lambda-\mu)t}} \right. \\ &\quad \left. + \frac{N_{\max} e^{(\lambda-\mu)t}}{\left(\frac{N_{\max}}{N(0)}\right) - 1 + e^{(\lambda-\mu)t}} \right] 2^{-1} dt \end{aligned} \quad (6)$$

Formula (6) shows the general number characteristics of crime-controlling level over a certain period of time.

Through the above discussion we know that the key point determining $[N(t)]$ is to get $\lambda(t)$ and $\mu(t)$, and the key point getting result is to establish equation (1) and (3). Establishing equation (1) is decided by analysis of crime situation variable and equation (3)'s situation system structure. At the same time, crime statistics and the methods of crime information's measurement is very

important.

4. THE CRIME CONTROL SYSTEM ON BASE QUANTITATIVE ANALYSIS

4.1 Non-equilibrium crime control system

Using non-equilibrium system theory to study the problems of crime control is relatively new. Crime is a common social phenomenon. Crime prevention and control originate as crimes occur. The extent of the social stability is dependent on what level the crime is under control. Reducing the social crimes to the lowest extent means that the society advancing.

Philosophically, equilibrium exists temporarily and relatively. Non-equilibrium exists commonly and absolutely. The equilibrium achieved in the crime control system refers to the unified behavior of the control activity under the predictive crime model. This is a static point of view for the crimes and their control. Equilibrium can be understood as a process of adapting with the crimes and adjusting crime control, from the kinetic point of view. This reflects the characters of the non-equilibrium process. Since the social crimes appear to be kinetic in nature as the society is developing, crime control system should be a non-equilibrium process.

Both equilibrium state and steady state do not change with time. But the two states are different in definition. Equilibrium state refers to crime and control, and steady state is the symbol of the social stability. Ordered structure is a kind of steady state. However, not all the steady states are in equilibrium states. For instance, ordered structure in a non-equilibrium state is a kind of steady state, but not in an equilibrium state.

The social crimes can be treated as a complicated system. There are rules to follow as the system changes and develops. The crime control will be effective once these rules are known. The rules of the social crimes play a dominant role in the existence and development of the crimes. These rules are a type of relationship correlating to the occurrence of the crime in a society. Inevitability and contingency determine the development of all systems. The two factors coexist in the social crimes, including the causality relationship in the occurrence of a crime. Inevitable crimes are a phenomenon resulted from the non-coordination and inadaptability factors in the field of economy, policy, management and education. This type of crimes dominates the social crime system. Contingent crimes are caused by some specific reasons. These crimes may or not occur, may occur in this way or the other way. In short, the inevitable crimes can be realized through a large number of the contingent crimes reflect the inevitable relationship in the social crimes. In the modern societies, the rules in the criminal activities

can be found out by studying a large number of the random and contingent cases. The role of crime statistics is to describe the properties of the social crimes in macroscopic scale based on the statistical analysis of the crimes on a microscopic scale.

However, the role of the crime statistics should not be exaggerated. It has to be pointed out that the objectives processed by the statistics should be independent incidences, and large numbers and have a random feature. Strictly speaking, the individual cases in a macroscopic crime study do not fully fulfill the above mentioned assumptions.

The statistics used before are not accurate and complete enough in describing the society crime problem as a whole. Therefore, the needs are rising for a better theory to describe the social crime thoroughly, and to take both microscopic and macroscopic viewpoints into consideration. From the view point of non-equilibrium system theory, the combination of statistics with kinetics should be useful in solving the problem mentioned before. The cooperation theory applies statistics for both microscopic and macroscopic investigations for the objectives under study. The needs for a large number of objectives are no long a necessity. It is statistically meaningful on one hand, and it emphasizes the interactions in the social crimes on the other. Synergetic can be used to reveal the rules of the evolution of the crime problems from the point of time, space and forms. Therefore, the social crime problems can be described in a more strict and complete ways according to this theory, and the effective crime control can be found with the help of this comprehensive statistical method.

The evolution of the social crime problems is partly dependent on the changes of the social environment, and partly dependent on the control means and conditions of the government. According to the analysis of the mutation model, it is clear that the crime state model for studying the evolution pattern can be established by finding out the state variables representing the quantitative change, and the condition variables (i.e. controlling variables) which cause the change of the state of the crime-affected state in the social development.

For the analysis of the local crime problem, the same principles apply. There are a number of factors, which affect the crime variations. The difficulty is to find out the dominant variables. All the crime variables can be divided into two groups: direct variables (directly affect the occurrence of a crime). Once the relationship between the direct variables and the state variables is known, the mathematics model can be obtained, and the quantitative analysis can be carried out for the rules of the changes of the crime state.

4.2 The Entropy Characteristic of the Crime System

The crime system is non-equilibrium, so its feature is decided by the degree of the system disorder, which is determined by proper measurement. In physics, entropy denotes the amount of system probability, which quantitatively describes irreversible process. For crime system, any crime case couldn't happen again. It cannot restore. The macroscopic situation of crime system corresponds to many microcosmic crime situation numbers. The more they correspond, the larger uncertainty of crime system has. Thereby, it reflects the disorder of crime system. It's obvious in crime problems. Because crime action is complicated and changeable, and crime form and way are so various that we cannot predict. The characteristics in number of microcosmic crime action situation can decide macroscopic crime index of social system. Crime system disorder can be measured by all kinds of crime case probability. Crime entropy shows how much probability of each type of case happens in social system. Supposing λ_c is macroscopic crime system happening rate, and k_c is crime macroscopic controlling constant, then

$$S^c = k_c \sum_{j=1}^n \ln \lambda_c^j \quad (7)$$

S^c is social system crime entropy, which is decided by adding trait and controlling constant of macroscopic crime system λ_c .

In fact, crime system is an open system. It shows that population flowing makes criminals move between region inside and outside. Supposing the population in a region is M , in M there are M_{ic} people who probably commit a crime, then $dS_i = M_{ic} / M$ shows the change of inner entropy in crime system. At the same time, due to the population flowing, the probability of crime has changed., resulting in the change of exterior entropy. $dS_o = M_{oc} / M$ M_{oc} is the number of flowing population in a region, and M_{oc} is the number of crime probably happening among the flowing population. Then the change of entropy in crime system is described as the following.

$$dS^c = dS_i^c + dS_o^c$$

$$d[k_c \sum_{j=1}^n \ln \lambda_c^j] = \frac{M_{ic}}{M} + \frac{M_{oc}}{M} \quad (8)$$

$$\prod_{j=1}^l \lambda_c^L = e^{\frac{1}{k_c} \int_T (\frac{m_{ic} + m_{oc}}{m})_c dt} \quad (9)$$

$$(l \in (1, 2, \Lambda, n))$$

The general expected number of a regional crime doesn't always happen which must be combined with crime rate. We study the law of crime system according to non-equilibrium changing model. At the same time, we will know how macroscopic crime system situation affects social and economic system based on crime rate and its solving rate, together with changes of order parameter. [5,6]

5. THE CRIME CONTROL AND DESCRIPTION

5.1 From having and develop to the crime to control

The evolution of the social crime problems follows the sequence of quantitative change to qualitative change to qualitative change to qualitative change, etc. The evolution has a waving type of pattern. The mutation theory points out that the conversion of one state to another can be completed in two ways, mutation and gradation. These different ways of evolution generate different impacts on the social stability.

The evolution of the social crime problems is partly dependent on the changes of the social environment, and partly dependent on the control means and conditions of the government. According to the analysis of the mutation model, it is clear that the crime state model for studying the evolution pattern can be established by finding out the state variables representing the quantitative change, and the condition variables (i.e. controlling variables) which cause the change of the state of the crime-affected state in the social development.

For the analysis of the local crime problem, the same principles apply. There are a number of factors, which affect the crime variations. The difficulty is to find out the dominant variables. All the crime variables can be divided into two groups: direct variables (directly affect the occurrence of a crime). Once the relationship between the direct variables and the state variables is known, the mathematics model can be obtained, and the quantitative analysis can be carried out for the rules of the changes of the crime state [10,11].

5.2 From basic attribute of the crime system to controlling

Indicate through analyzing, the non-equilibrium mechanism that controls of the social crime is: Using the views of the information and control, in the possibility space of crime, the ones that realized to various kinds of uncertain criminal offences and states were discerned, Chooses and appraises and achieve the purpose that the crime control through the information. To crime characteristic of system, with what kind of angle

analyzed to crime state and behavior of system, The key question is that target and state to the system classify and appraise. For example, what key element is seven of the crime cases to form the state of the crime case system: What, after a crime case happens, should confirm the type of the crime case, Have established the type of every crime case in the crime system; When, crime time refers to the development order and continuity of criminal offence, Namely the course of the crime; Where, where point crime space, implement the scene of the crime; What thing, what thing means what kind of guilty tool crime people use; What feeling, what feeling means under which kind of state the crime is carried on, including the course of the crime, characteristic and way of the activity; Why, why answer and make why crime, namely motive, purpose problem of crime it will be sinner; Who, still include the characteristics, such as the criminal's sex, age, appearance, habits and customs, physiological characteristic, etc..

The social crimes can be treated as a complicated system. There are rules to follow as the system changes and develops. The crime control will be effective once these rules are known. The rules of the social crimes play a dominant role in the existence and development of the crimes. These rules are a type of relationship correlating to the occurrence of the crime in a society. Inevitability and contingency determine the development of all systems. The two factors coexist in the social crimes, including the causality relationship in the occurrence of a crime. Inevitable crimes are a phenomenon resulted from the non-coordination and inadaptability factors in the field of economy, policy, management and education. This type of crimes dominates the social crime system. Contingent crimes are caused by some specific reasons. These crimes may or not occur, may occur in this way or the other way. In short, the inevitable crimes can be realized through a large number of the contingent crimes reflect the inevitable relationship in the social crimes. In the modern societies, the rules in the criminal activities can be found out by studying a large number of the random and contingent cases. The role of crime statistics is to describe the properties of the social crimes in macroscopic scale based on the statistical analysis of the crimes on a microscopic scale.

However, the role of the crime statistics should not be exaggerated. It has to be pointed out that the objectives processed by the statistics should be independent incidences, and large numbers and have a random feature. Strictly speaking, the individual cases in a macroscopic crime study do not fully fulfill the above-mentioned assumptions.

5.3 Control method and take precautions against decision

Crime control has the nature of socialites and is a kind of government administrations. Its execution is dependent on the coordination from different departments and divisions. Based on system analysis, and in combination with the principle of Synergetic, the main frame for the cooperated control on the social crimes is formed. The following factors should be taken into consideration.

1) Non-equilibrium factors

It is known that a society is a non-equilibrium open system. According to Synergetic, an equilibrium system hardly has any advance to make.

In an opened social security management system, exchanges of substance, energy, and information between system and environment are constantly occurring. Hence, the system will deviate from equilibrium. Each of the functional divisions in the system is not equally distributed, but showing a non-equilibrium and a non-linear type of interaction. This type of behavior is called non-equilibrium behavior.

2) The factors involved in information

Gaining the information and processing it are the preconditions for crime control.

The key point for a security protection system is the establishment of a criminal information system. The decision-maker's task is to receive all the sufficient and necessary information on the social crimes, make a proper judgment and issue the necessary crime control information.

The effective crime control is dependent on the reliable information on crime. The information provide the platform for the prediction of the future trends in the social crimes. The blindness in security protection can be overcome if the information can be gained in time, and used defectively for both original information and the high-quality derived information. The determination of the reliability of the information also is an important factor.

6. CONCLUSIONS

How to recognize the social crime and what relationship between social crime and economic development & social progress are both studied in quantitative criminology. But according to the crime problems' essence, solving inconsistent problem of controlling crime is very difficult and not understands characteristic of complication, we need research new theory and method. It also offers an effective way and methods for controlling social crime.

Consequently, in order to apply the mathematics to the criminal system significantly, we must anticipate the complication of the criminal system initially. Thus, the quantitative analysis derives from practice, and guides practice. This is the real aim of the quantitative criminology.

Quantitative Criminology's study has just begun. We believe that it will have great theory study value and application foreground. When we study its theory, we should combine it with problems of social crime and make the valuable crime controlling case and idiographic quantity index. This is a very significant work.

REFERENCES

- [1] Becker G S. Crime and punishment: An economic approach. *Journal of Political Economic*. 76(2): 169-217
- [2] He Ping Research on the Quantity Analysis of Social Crime. *Journal of Liaoning Police Academy*.2004, (3):1-6
- [3] He Ping. Quantitative Criminology: Concept Model and Significance. *Journal of Liaoning Police Academy*. 2002, (2):1-5
- [4] He Ping Research about Criminal Investigation Specialist Expert System. *Advances in Management Information System About China*.1985:355-358.
- [5] Lang Yanhuai He Ping. The Self-Organized Fuzzy Neural Networks and Crack a Criminal Case Fuzzy Reasoning. *Advances in Systems Science and Application*.2000, (2) :200-203.
- [6] He Ping. Fuzzy relationship mapping inversion and the automatic reasoning of crime detective. *Pattern Recognition and Artificial intelligence*.2003, 16(1): 5862
- [7] He Ping. The fresh means of economic system acquirement. Dalian : Dalian University of Technology press, 1989
- [8] Miao Dongsheng. The system science pick. Beijing: People University of China press, 1998
- [9] Yichuiciang, Non-lineal Science and its use in geology. Meteorology Press, 1995.
- [10] Hao Bai-lin. Elementary Symbolic Dynamics and Chaos in Dissipative Systems. World Scientific Publishing.1989, PP:396.
- [11] He Ping. A study on statistical theory of social crime and time series analysis. *Journal of Liaoning Police Academy*. 2005, 8 (2):1-5