ON CRIME AND UNEMPLOYMENT: AN APPROACH USING TWO-WAY CAUSALITY

Yun Hariadi
(faust_doktor@yahoo.com)
Bandung Fe Institute

Abstract

This paper will discuss the effect of crime and crime rate to the increase of unemployment using extended logistic equation, further modeled as a competition between criminal and worker. The main finding is that to keep the amount of unemployment at certain level will finally only bring the amount of unemployed itself. And the most striking finding is, there will be no zero-unemployment at all.

Keywords:
crime, unemployment, logistic equation, competition model

1. Introduction

There are many qualitative and empirical studies that focus on correlation between unemployment and crime rates. The most common and more acceptable is unemployment causes crime. But unclear whether crime causes unemployment, Calvo-Zeno provide a simple theoretical framework that explain how crime rate affects unemployment rate through social networks.

Two-way causality between crime rate and unemployment rate make view different on understanding unemployment that not only economic problem but on unemployment there are social problem. Thus correlation between unemployment and crime can be seen as correlation between macroeconomic and macro social. The aim of this paper is to observe the behavior of unemployment on simple model unemployment rate, logistic model, with two-way causality between crime rate and unemployment rate.

The paper is organized as follows. Section 2 presents main result of Calvo-Zeno social network, where crime rate causes unemployment. Section 3 develop simple model of unemployment rate. Section 4 simulates from section 2 to observe behavior unemployment on long time.

2. Crime affects unemployment.

Let n number population on time t, with network size s, u unemployment rate, thus the number of employed is (1-u) s and the number of unemployed is us. Job vacancies are determined by rate v, employed lose their job with probability σ. Denote by P(s,u,v) the individual probability of hearing job from personal contacts through words of personal contacts. Therefore, the individual of finding job through friend is:

$$P(s,u,v) = 1 - [1\text{-}ve(1 - e^s)/(s(1\text{-}e))]^s,\ e=1\text{-}u$$

the matching function for labor market where workers partly on personal contacts to find a job is

$$M(s,u,v) = u[v + (1 - v)P(s,u,v)].$$

When the size of the social network increases the labor market frictions are thus alleviated while the equilibrium of unemployment rate u decrease, when the network size decreases the unemployment rate increase. Formally $\delta u/\delta s < 0$.

In community with n individuals, individuals belong to mutually exclusive groups, such group consist on knit cluster of f close friends. Let φ represents the proportional of social interaction that occur outside the close set of friends, therefore number of contact is $(1-\varphi)f+\varphi n$. denoted by ρ the fraction of community individuals that commits crime, the average number s of personal contacts is:

$$s = (1 - \varphi(\rho))f + \varphi(\rho)(1 - \rho)\, n.$$
$$ds/dt = \varphi'(\rho)[(1-\rho)n - f] - \varphi(\rho)n.$$

because $\varphi'(\rho)<0$ and $\partial s/\partial\varphi>0$ implies that $\partial s/\partial\rho<0$.

Therefore $\partial u/\partial\rho = \partial u/\partial s \times \partial s/\partial\rho > 0$,this represents that increasing crime rate affects rising of the unemployment.

3. A Model of unemployment rate.

The growth rate of population depends on the population it self, let N(t) be the population at time t, the simplest model that the rate of change of N is proportional to the current value of N, that is,

$$dN/dt=rN,$$

where r is constant of proportionality, but for $t>>0$ thus $N(t)=\infty$ that impossible occurrence in the real world since the world have limitation on space, food supply, etc. To solve this problem the limitation of the environmental aspect are made to become important factor for the growth rate of population, replace r with f(N), we have:

$$dN/dt=f(N)N,$$

to present the limitation of environmental aspect, choose f(N) so that $f(N)\cong r>0$ for N is small, f(N) decreases as N grows larger, and $f(N)<N$ when N sufficiently large, the simple function having these properties is $f(N)=r-aN$, $a>0$,

$$dN/dt=(r-aN)N,$$

it is known as logistic equation, it is often convenient to write in the equivalent form

$$\frac{\partial}{\partial t}\mathrm{N}(t) = r_N\,\mathrm{N}(t)\left(1 - \frac{\mathrm{N}(t)}{K_N}\right)$$

where K=r/a, r denote intrinsic growth rate, K is environmental carrying capacity/ saturation level.

Let L(t), W(t), C(t) are numbers represents the labor force, worker, crime at time t, with the growth rate as logistic growth.

$$\frac{\partial}{\partial t}\mathrm{L}(t) = r_L\,\mathrm{L}(t)\left(1 - \frac{\mathrm{L}(t)}{K_L}\right)$$
$$\frac{\partial}{\partial t}\mathrm{W}(t) = r_{\mathrm{W}}\,\mathrm{W}(t)\left(1 - \frac{\mathrm{W}(t)}{K_{\mathrm{W}}}\right) \qquad \text{(a)}$$

$$\frac{\partial}{\partial t}\mathrm{C}(t) = r_C\,\mathrm{C}(t)\left(1 - \frac{\mathrm{C}(t)}{K_C}\right) \qquad \text{(b)}$$

Where r_L r_W and r_C are the intrinsic growth of labor force, worker, and crime, respectively. K_L , K_W and K_C are saturation level of the labor force, employed, and crime respectively.

Say the number of the unemployed within time t is U(t) = L(t) - W(t). Because

$$\partial C/\partial U>0$$

which means that the increasing of the amount of the unemployment causes the increasing of crimes. β_{UC} denotes the rate of crime caused by unemployment, then

$$\frac{\partial}{\partial t}\mathrm{C}(t) = \frac{r_C\,\mathrm{C}(t)\,(K_C - \mathrm{C}(t) + \beta_{UC}\,\mathrm{U}(t))}{K_C} \qquad \text{(i)}$$

Because

$$\partial U/\partial C>0,$$

which means the increasing of crimes brings the increasing of the unemployment.

Now let us take β_{CW} which denotes the decreasing of workers caused by the increasing of crime. Then

$$\frac{\partial}{\partial t}\mathrm{W}(t) = \frac{r_{\mathrm{W}}\,\mathrm{W}(t)\,(K_{\mathrm{W}} - \mathrm{W}(t) - \beta_{CW}\,\mathrm{C}(t))}{K_{\mathrm{W}}} \qquad \text{(ii)}$$

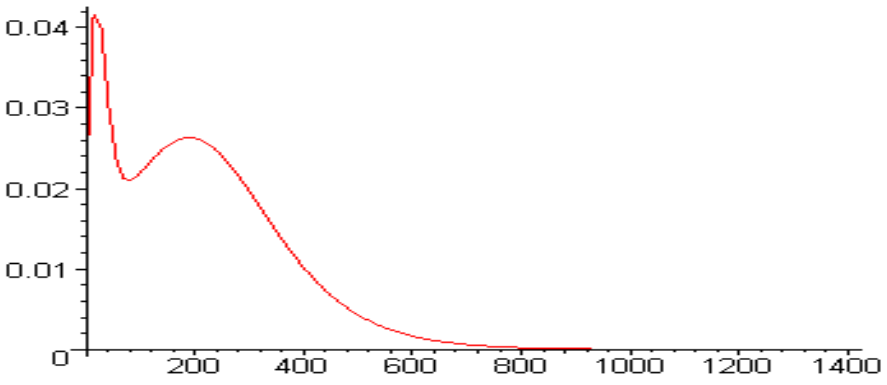
If β_{UC} = β_{CW} = 0, or no influence of crime to unemployment and vice versa, then the equations i) and ii) will become the equations a) and b).

4. Simulation Result

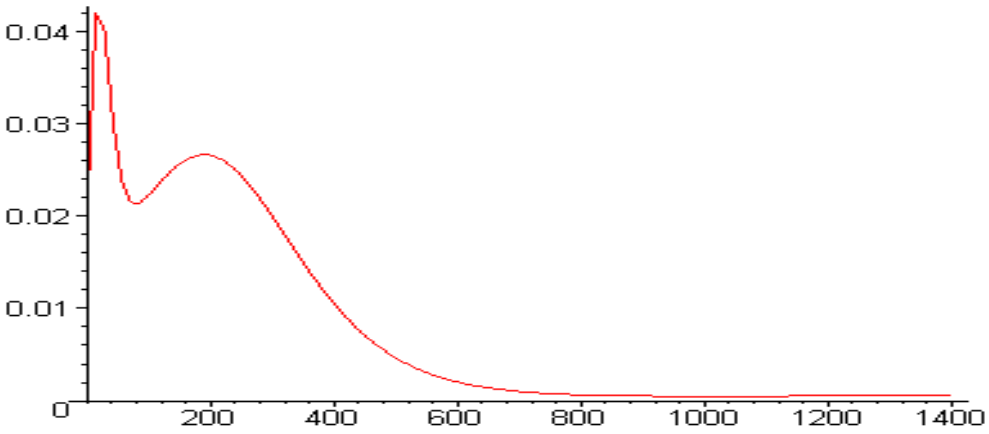
Here several simulations are presented to describe some behaviors of the condition of the unemployment if crimes can bring unemployment, compared with the crimes that can not. In the first case, model from equations a) and b) is used, and in the last case, equations 1) and 2) is used with K_N=1, K_L=N(t), K_W=L(t), K_C=W(t)/4, for both cases.

n(0)=0.15,w(0)=0.05,c(0)=0.001,l(0)=0.07

A. r_L=r_W=0.1,r_C=0.01



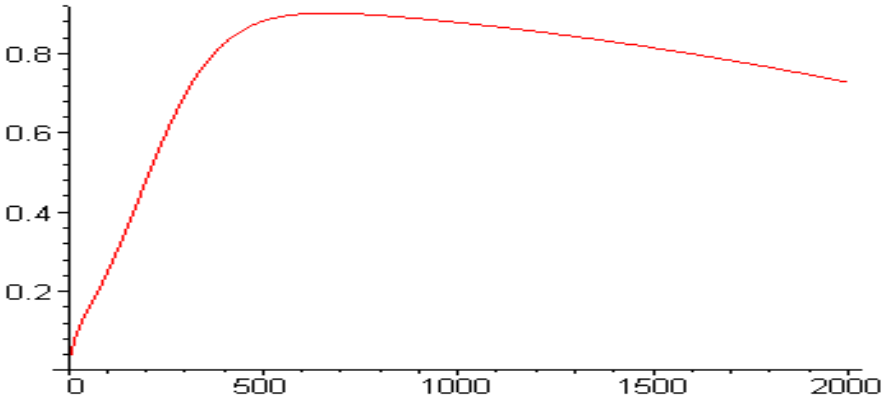
β_{CW}=0, U(t) vs t, $U(t)=0$



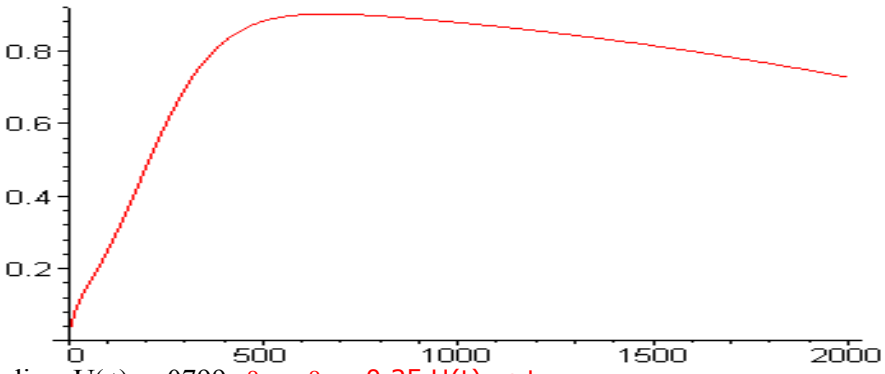
$\beta_{CW}=\beta_{UC}=0.25$ U(t) vs t, $\lim_{t\to\infty} U(t) = .0799$

in the first case, the expectation of zero-unemployment achieved will be reached at t=800, but the same condition is not suited for the second case, this show that there exist the increasing amount of unemployment for t=1000 even while t=8000 the amount of unemployment has exceeded the initial amount of the unemployment. This difference of both case because crimes in the last case causes the decreasing of job-offers or the dismissals of worker that finally bring the amount of unemployment to certain point.

B. $r_L=0.1, r_w=0.01, r_c=0.01$



$\beta_{CW}=0$, U(t) vs t, $\lim_{t\to\infty} U(t) = 0$



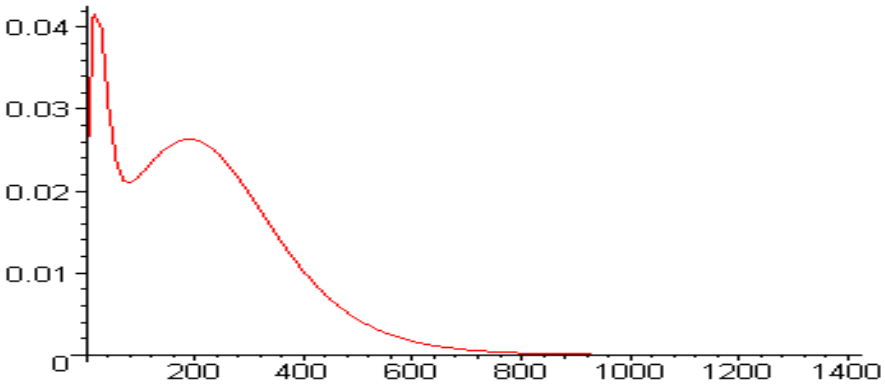
$\lim_{t \to \infty} U(t) = .0799$ $\beta_{CW}=\beta_{UC}=0.25$ U(t) vs t,

it is obvious that the both of the cases are different, but the behavior of the amount of the unemployment of each cases seems to be the same. It is represent that the role of crime does not influence much to the increase of the amount of the unemployed since the very high amount of unemployed only makes too few workers interested to commit crimes. In the other word, criminal behavior mostly belongs to the unemployed, while the unemployed worker tend to stay at their jobs.

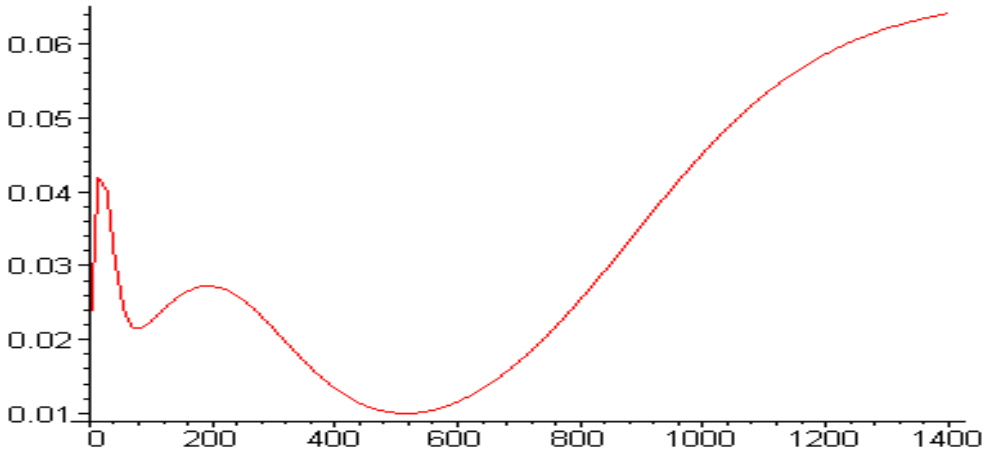
The same thing also happen for $r_L=0.1$, $r_W=-0.01$,$r_C=0.1$, for this condition, the rate of crime is not influential enough to increase the amount of unemployment for the same reason mentioned above. The only difference is, for both cases:

$$\lim_{t \to \infty} U(t) = 1$$

C. $r_L=r_W=r_C=0.1$



$\lim_{t \to \infty} U(t) = 0$ $\beta_{CW}=0$, U(t) vs t,



$\beta_{CW}=\beta_{UC}$=0.25 U(t) vs t, $\lim_{t \to \infty} U(t) = .0799$

As compared with the result of simulation A, the higher crime rate makes the unemployed achieve higher amount in shorter period of time. The second case of simulation C, at t=550, has the same behavior as the case of simulation A at t=1000. but still for simulation C of the second case, the stability will appear at t=2000, where the amount of the unemployed exceeds initial amount of unemployed. This only leads to the impossibility to reaching zero-unemployment.

5. Conclusion

The increasing of crime rate causes the increasing of the unemployed, and vice versa. Here we deal with vicious circle of unemployment and crime.

Crime only brings the impossibility to achieve zero-unemployment. Even remaining in the same amount of the unemployed at certain level will obviously be useless, because the initial amount of the unemployed will be exceeded, and it is more devastating for labor force without sufficient employment. And as far as we can see, zero-crime is a non-sense at all.

At the very high rate of unemployment, almost all of crimes are committed by unemployed for long period of time, hence the amount of workers will grow smaller and smaller.

It is part of the importance to consider that unemployment is not merely a problem of economics. It is not sufficient to anticipate the amount of the unemployed by creating job-offers as demanded. On the other hand, law enforcement is our strongest candidate to solve the problem of the unemployment along with creating necessary job-offers.

6. Future work

It must be a part of our common-knowledge that not all job-vacancies will be fulfilled by applicants, and further, the decrease of unemployment itself. Will any analytical approach suggest some strategies that in the future will create zero-crime and zero-unemployment, using discrete logistic equation?

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