A Simple Model of Crime with Identical Individuals

One of the questions we may like to ask is whether some observed behavior is central to social interactions. In the context of crime, few societies have not had sanctions against specific behaviors. Consequently, it is reasonable to conjecture that the phenomenon of criminal behavior is central to social structure. That being said then under widely varying behavioral assumptions, what we call "crime" should emerge as a robust outcome from our models.

Dan Usher[1] has developed a model that captures this spirit. It is a particularly attractive model insofar as it is simple, or in this context, it is essential. For our purpose the thrust of the matter is to show that even in a society in which individuals are indistinguishable in their aptitudes, intelligence or human capital, nonetheless the available technologies of production and theft will lead to one fraction of society preying on the other. The size of this fraction and changes in it resulting from changes in technology or other parameters of the model although well specified are of less interest than the observation that potentially crime emerges even in the most simple of consumption maximizing frameworks.

The model

The model begins with the premise that all individuals are the same. This is a powerful assumption in the model-building context since it does not presuppose that there are "good" people and "bad" people or that some people are more crime prone than others. There may be a place for assumptions like this (see for example, Block and Heinke[2]), but at this level of generality, starting by assuming that some are criminal and others are law-abiding smacks of assuming the answer rather than finding that criminal behavior emerges as an outcome of the model.

Productive activity is accomplished by farmers, F, who produce output, X (imagine wheat), with a fixed-coefficient technology. This means that each farmer's labor can produce a constant amount of output.

Farming is a competitive activity. This is a powerful assumption because it allows us to say that the value of output will equal the costs of production:

$$PX = WF$$

[1] Dan Usher, "Education as a Deterrent to Crime" Canadian Journal of Economics xxx. No. 2 (May, 1997): 367-384.

[2] M. K.Block and J. L. Heinke, "A Labor Theoretic Analysis of Criminal Choice" American Economic Review Vol. 65 No. Issue 3 (June 1975): 314-325.

Where P is the product price, X the level of output, W the wage received by each farmer who supplies F units of labor to produce output. This can be rewritten on a per unit or average cost basis so that with competition the price is equal to the unit cost:

$$P = W\left(\frac{F}{X}\right)$$

Rewriting this to expose the wage and therefore the production by each farmer we have that:

$$W = P\left(\frac{X}{F}\right)$$

The wage is equal to the value of the marginal product since $\left(X/_F\right)$ is measured in units of output (per unit of labor) and since output per labor input is fixed, the average product is equal to the marginal product. This in turn can be further simplified by recognizing that there is only one product in our economy so that the price can be taken as unity, 1. The final expression for W, the income received by each farmer simply depends on the (fixed) input-output technology and is measured in terms of output, "wheat".

Farmer Income

Sadly, farmers do not receive all of their output. Bandits steal some of their output. As a result, the expression for a farmer's consumption, c^F, is:

$$c^F = (1-s)W\ .$$

The wage, W, is the constant amount of "wheat" produced by each farmer of which sW is stolen.

Bandit Income

Bandits are able to steal sW wheat. Consequently, consumption per bandit depend upon

$$c^B = \frac{sWF}{B}$$

for which s is the share of the farm crop stolen, WF (the output of wheat per farmer times the number of farmers) is the amount of wheat produced, and B is the number of bandits.

If there are a total of T citizens in our economy, and T=F+B, a convenient thing to do is to write $\left(\frac{B}{T}\right) = n$, so that n is the fraction of bandits in the population, and *(1-n)* is the fraction of farmers. Bandits' consumption is then:

$$c^B = sW\left(\frac{1-n}{n}\right)$$

The Technology of Theft

The production technology for stealing is assumed to depend on the fraction of the population that is engaged in theft. In symbols,

$$s = s(n)\text{, and that } s'(n) > 0 \text{ and } s''(n) < 0.$$

This means that as the faction of the population engaged in theft increases, it is able to steal a higher proportion of output, $s'(n) > 0$, but at a decreasing rate, $s''(n) < 0$. Not unreasonably, stealing displays diminishing returns as a function of the fraction of those in society who are bandits.

Equilibrium

Finally, we assume an equilibrium condition. In particular we assume that given the alternatives between farming and stealing from farmers, people will engage in the two activities until the level of consumption received by each are equal. After all, if farming gives a higher level of consumption than stealing, thieves would beat their crowbars into plowshares. Alternatively, if stealing yields a higher level of consumption than farming, farmers would move to a life of crime.

$$c^F = c^B$$

Solving the model

The crucial variable in this story is *n*, the share of bandits in the society. We tend to be prejudiced against bandits. They produce nothing, and yet they eat as well as farmers who do all the work producing food.[3] It is in that sense that we brand them as criminals as are redistributing income without a voluntary exchange.

The easiest way to solve the model and generate a solution for *n* is to draw a picture. Let *n* run along the horizontal axis, and let per capita consumption be placed along the vertical axis.

Plot consumption per farmer. Since the wage rate is fixed, consumption per farmer falls from a maximum of W (when there are no criminals, *n*=0 and consequently s(0)=0), toward the *n*-axis as *n* increases and, consequently, s(*n*) increases. This curve is labeled FF. Income per farmer falls in proportion to the share that is stolen.

Next plot the consumption of bandits. First, notice that when n=0, there is no bandit consumption. Second, notice that when n and consequently s(n) increases, the slope of

[3] There is no disutility of work in this model. Farmers have to farm and burglars have to burgle. At this level of abstraction, who is to say which generates more disutility? It is inessential for the argument here.

the burglar consumption schedule BB is steeper than that of the farmer's FF schedule. The reason for this is a little complicated.

Think initially of the first bandit. He garners some share of output all of which he consumes. To make the analysis interesting, assume that his initial consumption is higher than that of the rest of the (farmer) population. The second bandit increases the share of the harvest that is stolen, although not in proportion to the initial bandit ($s''(n) < 0$). Thus the two bandits together have more output than the first bandit alone, but their average consumption, their consumption per bandit, is lower than the consumption of the first bandit alone. In addition, total output falls as one farmer has become the second bandit and that too reduces per bandit consumption as there is less to steal.

In comparing the slope of the per farmer and per bandit income schedules, so long as BB starts above FF, the slope of BB is steeper than that of FF as output declines, and the number of burglars increases.[4]. Farmers' income FF falls in proportion to $s'(n) > 0$.

Although increases in the share of the population turning to banditry increase the share of wheat stolen by the bandits, this share increases at a decreasing rate. Further, total production of wheat falls in proportion to the declining number/proportion of farmers. Consumption per burglar falls in proportion to the (increasing) number of bandits.

What is established at the intersection of FF and BB is the point at which there is equilibrium. Per capita consumption of both groups is the same at c*, and the proportion of bandits (and of course farmers) can be read off the horizontal axis at n*.

Although it is interesting to explore the comparative statics of a better or worse theft technology, or technical change in agriculture that increases or decreases the output per farmer, or imagine even a share of stolen output destroyed by thieves, that is not central to the point at this stage. The key point is that with no prior identification of individuals each of whom has access to the same technologies in two sectors, farming and banditry, the ability (read technology) to thieve has given rise to an equilibrium in which consumption is equalized between productive farmers and bandits. Although many issues remain to be described, the essence of this model is that crime in this perhaps limited sense is likely to be with us, always.

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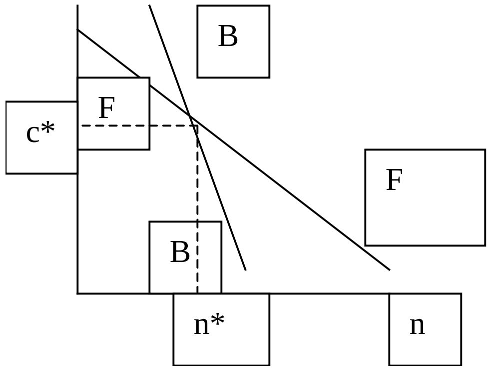
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