# How a given society's criminal activity are influenced by police policy

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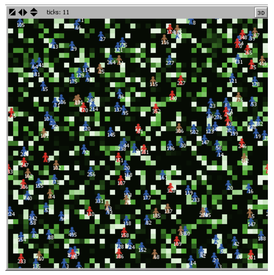
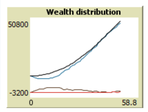
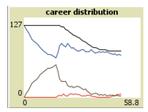
## What the model does

Given a society, what kind of polices will lead everyone in society die or thrive ?
The model wants to show how the criminal activity is influenced by police policies (tax rate and police pay), also show the career distribution and wealth distribution over time.

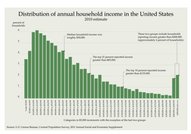


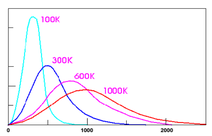



## Assumption

There are three kinds of careers
Everyone wants to be richer
Only reason to change career is money
Salary obeys Boltzmann Distribution
Tax rate is linear of salary
Paying police is tax's only use
Living expense is same for everyone
There is no travelling fee




## Rules

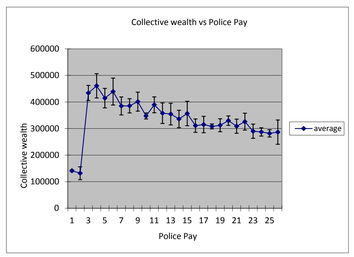
If I am a police:
I first see if there is some thief here, if so, punish him by taking half of his money
Then I walk around
Then I have chance to change my career: If I find a job with higher salary than police pay, I become worker.
Else I check average wealth of worker and thief, I will become the higher one if it is also higher than police pay.

## Rules (con.)

If I am a worker:
If my salary is enough for living, I will work here and get money, then I pay tax, otherwise I will search job, I keep moving until I find a patch without anyone else
If my salary is lower than living expense, I will become a thief
Otherwise I have 70% chance to change job and 30% to change career.
If I choose to change career, first if my job salary lower than police pay, I will become police
Otherwise if average worker wealth is lower than average thief wealth, I will become thief.

If I am a thief:
I first see if there is some worker around me, if so, grab half of his money
Then I walk around
Then I have chance to change my career if my money is less than average wealth of worker or police. Then I will become the one with higher average wealth.

## Analyze how police pay matters

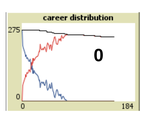


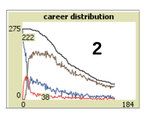

The worst case is police pay is zero.

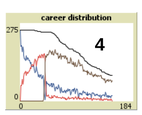
When police pay is higher than some value(6 in this case), higher police pay leads to worse result.

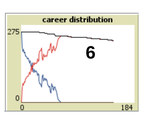
The speed become worse decrease and to some point it is almost still.

Standard derivation is independent of police pay.



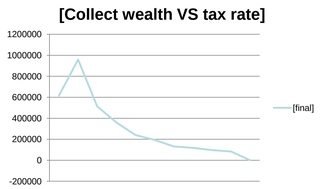

When police pay is 2, population decrease, actually the society is more promising

## Analyze how police pay matters (con.)

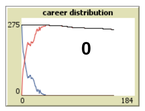
When police pay is 4, at early stage there is no police because tax is not enough to pay for police. When people is attracted by the high police pay thus become police, they cannot get the money as promised, so they tend to change back. At the middle stage government has enough tax to pay for police, the situation becomes as similar as the second case.

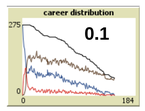
When police pay is 6, interestingly the situation is like first case when police pay is zero. The reason is in this case government cannot afford police before working's dying out. In fact, set the police higher, the result will the same because government cannot afford police if police pay is higher than some value.

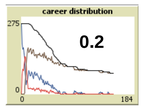
## Analyze how tax rate matters

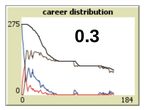


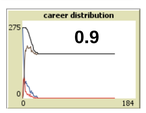

When tax rate increase, collective wealth first increase and to some point decrease dramatically. But the speed is decreasing

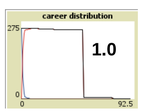


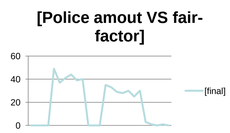



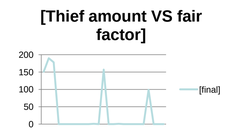




It takes a while for police to appear. It is because it takes government a while to collect the money which can afford police.

When tax-rate ranges from 0.2 to 0.9, there is no apparent difference of final career distribution, almost everyone becomes police. There is still a subtle difference, when tax rate becomes higher, the situation everyone becomes police comes earlier, and fewer people will change to other careers. This is because when tax rate becomes higher, government can collect money faster, thus in the situation of police pay is high(recall that we set it to 4), everyone wants to become police and they can get paid.

## Same policies behave in different society



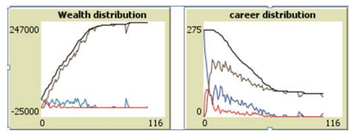



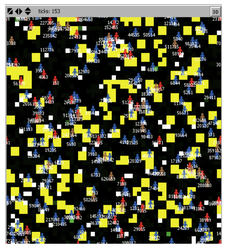

When police amount is large, thief amount is small. Because in the case of one roles die out, the wealth of that role becomes zero, when other roles wants to change career it is less likely to become that role. So once some role die out, it is hardly to reappear.

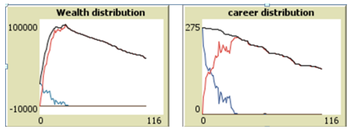
For some point result changes dramatically.

## Extension: catastrophe

Turn off or on :

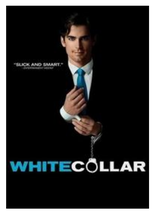


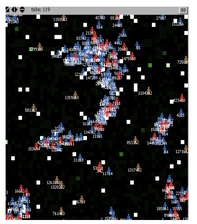


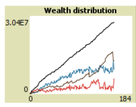

catastrophe destroy jobs, so tax rate is also not enough to pay for police

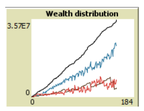
## Extension: Thief escape




Thief tend to together and when salary there is high they tend to become worker will stay there, so form a flock in area with high salary






1. police wealth decreases: police can punish less thieves
2. The population increases: less people are close to die.
3. The wealth of thief remain same while worker's increase More thieves will survive, more people have chance to become worker thus produce more wealth.

## HubNet model