

A Model of Self-Fulfilling Firm Beliefs Concerning Criminal Behaviour Among Minority Youth

Daniel Goetz

Introduction

A lingering issue for sociologists and economists publishing on crime is why the rate of incarceration for young Black men in the United States is almost unbelievably high. For example, during 1996 significantly more than one third of all African American men aged 20-35 passed through the penal system (Western and Pettit 2000). Parallel to the research on crime and disproportionate incarceration, economists have generated a considerable body of literature on why Black adults working in the United States earn so much less than White adults – only two thirds as much on average in 1995 (Altonji and Blank 1999).

Western (2002) works to bring these two issues together in a natural way by arguing that the rate of imprisonment for young Black men is so high that it serves to skew the wage distribution of all Blacks. Part of the reason average wages for Blacks are so low, he argues, is because there are so many Black ex-convicts. Western shows that former prison inmates receive low wages after their release and, furthermore, continue to experience low wage growth throughout the life course. The fact that African Americans have consistently had much higher incarceration rates than non-Hispanic Whites helps to explain why the wage distribution for Blacks has a much lower mean than the wage distribution for Whites, even for relatively unskilled labour.

The analysis presented by Western (2002) does not fully explain the issue: wages may be lower for Blacks because that group contains a greater number of ex-inmates, but why are there so many Black inmates to begin with? Freeman (1999) provides a simple answer: many Blacks turn to crime because the legitimate wages they can expect to earn, even when older, are quite low. The problem of mass imprisonment and low average wages for the Black population, far from being distinct, should thus be thought of as simultaneous phenomena with an unobserved factor causing both.

In this paper, I suggest that pervasive pessimistic firm beliefs about the probability that a Black male committed a crime when young relative to a White male to be that unobserved factor. This reasoning is inspired by the statistical discrimination literature where firms, expecting Black workers to be less skilled than Whites, offer them lower wages – an incentive Blacks respond to by acquiring less skill when young, making employer beliefs self-fulfilling. The innovation of this paper is to analyze low average wages and high incarceration

rates among Blacks, not as two separate issues where one might cause the other, but rather as a discriminatory equilibrium in an environment where firms have self-fulfilling beliefs about the level of criminality among young Black males. Having constructed and justified this equilibrium, I then perform simple policy analysis on how raising the minimum wage and abolishing young offender privacy protection can lead to a higher average wage and lower incarceration rate among young Black men.

The Model

Imagine a large number of identical employers and a much larger population of workers. As in Coate and Loury (1993), employers do not choose which individuals they would like to hire, but rather are randomly matched with many workers. Workers belong to one of two identifiable groups, B or W, with B and W non-empty. Both firms and workers are assumed to be risk-neutral.

Workers

Workers live for two periods. When workers are young, they are able to earn a minimum wage w_0 . They also have the opportunity to commit a crime, the value of which varies among workers. For now, assume that the distribution of the benefit of crime is the same for each of the groups B and W; that is, let b be the benefit a worker gets from crime when young and let $F(b)$ be the fraction of workers whose benefit from crime is less than or equal to b . In line with the work of authors such as Freeman (1999), I assume that an individual's choice to commit crime when young does not preclude him from earning a legitimate wage at the same time; thus, a worker who commits a crime gets $b + w_0$ while a worker who does not earns only w_0 . However, making additional money from criminal activities is a risky prospect: with probability q , the young offender will be apprehended and incarcerated, losing both his benefit from crime b and his potential to earn wages w_0 . The expected benefit from crime is thus $(1 - q)(b + w_0)$.

Committing a crime when young can be considered a negative investment that has consequences in the second period of life. The effect of pursuing criminal opportunities is to prevent oneself from forming "the habits of action and thought that favor good performance in skilled jobs" (Arrow 1972, 97). Thus, an individual who decides to commit crime when young becomes a "bad" worker (B) whereas one who decides not to commit a crime becomes a "good" worker (G). Bad workers cannot be trusted to act independently and require constant supervision, while good workers are able to take on more responsibilities. These distinctions manifest as a difference in the productivities of the two types when old: bad workers earn x_B for the firm while good workers earn x_G , where $x_G > x_B$.

Firms

Firms behave in the following way. When workers are young, employers will pay them the minimum wage w_0 ; when individuals are old, firms would like to pay good and bad workers their respective productivities x_G and x_B . However, firms cannot observe whether a worker is good or bad – they can only observe a noisy signal of trustworthiness emitted during an interview. Specifically, a good worker will emit signal T (for trustworthy) with probability 1, and a bad worker who has not been caught will emit signal T with probability $1 - p$ and signal NT (for not trustworthy) with probability p . I assume for now that there is no young offender protection in place, so that a criminal who was incarcerated when young is forced during the interview later in life to reveal this fact, leading him to signal NT with probability 1. The chance of performing better in the interview is thus higher for criminals who were not incarcerated ($1 - p > 0$), and is higher still for those who did not commit a crime when young ($1 > 1 - p$).

Employers observe each worker's group identity and the distribution of the noisy signal of trustworthiness, which varies among good and bad types as above. Firms will thus choose to pay workers their expected productivity conditional on the signal a worker emits during the interview: workers who signal T receive w_T and workers who signal NT receive w_{NT} , where the formulae for these wages are as follows:

$$\begin{aligned} w_T &= \Pr(G|T)x_G + \Pr(B|T)x_B \\ w_{NT} &= \Pr(G|NT)x_G + \Pr(B|NT)x_B = x_B \end{aligned} \quad (1)$$

The wage given to workers who emit NT collapses to x_B by assumption on the distribution of the signal of trustworthiness. However, the probabilities needed to determine the wage for T workers must be evaluated using Bayes' Rule. In particular, denote by μ_i an employer's prior belief about the chances that a worker from group $i \in \{B, W\}$ committed a crime when young. Then the probability of a worker from group i being "good" given the trustworthy signal is:

$$\Pr\left(G\left|T\right.\right) = \frac{\mu_i}{\mu_i + (1 - q)(1 - p)(1 - \mu_i)}$$

And accordingly, the wage given to workers who appear trustworthy in an interview is:

$$w_T(u_i) = x_B + \left(\frac{\mu_i}{\mu_i + (1 - q)(1 - p)(1 - \mu_i)} \right) (x_G - x_B) \quad (2)$$

Equilibrium

Workers will choose to commit a crime when they are young if the lifetime value of being “bad” is greater than the benefit received from pursuing a more righteous path. That is, the rational worker commits a crime if the expected benefit when young outweighs the expected loss when old. The expected benefit of being bad is $b + w_0 + w_T + (q + p(1 - q))(w_{NT} - w_T) - q(b + w_0)$ whereas the benefit from being good is simply $w_0 + w_T$. The workers’ assessments of how much they stand to lose if they become bad depends on the firm’s prior concerning the chance that any worker from that group has committed a crime. Being good is preferred to being bad if and only if the value of crime b satisfies the following:

$$b < \frac{(q + p(1 - q))}{1 - q} (w_T(\mu_i) - x_B) + \frac{q}{1 - q} w_0$$

An equilibrium in this model is a belief held by an employer that is self-confirming. In other words, by supposing a worker from a particular group had a certain probability of committing a crime when young, employers induce workers from that group to actually commit crimes when young at the rate which was postulated by the initial firm beliefs. Mathematically, a belief satisfies the property of being self-confirming when:

$$\mu_i = F \left[\frac{(q + p(1 - q))}{1 - q} (w_T(\mu_i) - x_B) + \frac{q}{1 - q} w_0 \right] \quad (3)$$

Depending on the shape of the distribution F , it is possible for the above fixed-point problem to have multiple solutions in μ_i . A discriminatory equilibrium is a pair of such μ_i in which workers from a particular group are believed more likely to have committed a crime in their youth. For example, if we have an equilibrium (μ_B, μ_W) with $\mu_B < \mu_W$, then firms believe that individuals coming from group B are relatively more likely to have committed a crime when young. Since the derivative of equation (2) with respect to μ_i is positive, a lower μ_i is associated with a lower wage for trustworthy individuals. This lower wage reduces the expected payoff from not committing a crime and leads more youth to engage in criminal activities, a choice which confirms the firm’s initial dismal assessment.

Discussion

If criminals are less productive later in life than non-criminals, pessimistic firm beliefs about the probability that a Black worker engaged in illegal activities when young can be self-fulfilling – even if there is no ex ante difference between Blacks and Whites. In this model, different priors for Blacks and Whites are the sole factor necessary to explain why the incarceration rates for the Black subpopulation are higher and why their average wage is lower than the similar statistics for Whites. A low equilibrium value of μ_B will induce more Blacks to

commit crimes by decreasing the payoff to being good when old; more Black criminals imply more are caught and imprisoned. On the wage side, felons are unable to earn an income while incarcerated, dragging down the average lifetime earnings of Blacks. The low equilibrium value of μ_B will also decrease the wages that non-incarcerated Blacks can expect to make when old, leading to further reductions in the average Black earnings by shifting the upper end of the wage distribution downwards.

Here, individuals trade off the benefit of committing a crime today not just against the probability of being caught and sacrificing their earnings when young, but also against the reduced wages they will receive when older if they are perceived (correctly) as being unproductive; individuals are thus assumed to be quite forward-thinking. A contentious issue in the literature is whether or not youth – especially those contemplating crime – are actually patient enough to incorporate the effects on their future wages of their actions today (Lochner, 2010). Evidence that even delinquent youth care about their long-run prospects is offered by Levitt and Venkatesh (2000). Levitt and Venkatesh observe that young men in gangs often earn less than minimum wage, but may continue their membership in the hope that given enough time they will be promoted to a high-paying leadership position. Public perception of juveniles aside, it seems as though there is enough disagreement in the literature that the forward-thinking youth needed by this model are not an unreasonable requirement.

Having established and justified the legitimacy of a discriminatory equilibrium, the remainder of this paper analyzes the effect of two policies on the average wages and the incarceration rates of young Blacks: raising the minimum wage and removing young offender protection.

Increasing the Minimum Wage

The objective of this section is to demonstrate that raising the minimum wage can serve to decrease the incarceration rate among Blacks and increase their average wages. Before analyzing this issue in the context of the present model, however, it is helpful to review the answers provided by established literature.

A basic result from labour theory shows that if one raises the minimum wage above its equilibrium value in the market, then it will make those employed better off but will increase unemployment among young, unskilled workers. One might expect an increase or decrease in the average wage of low skill individuals depending on the elasticities of demand and supply, and similar ambiguous effects for high skill workers depending on whether high and low skill workers are complements or substitutes in production. Presumably, some of those young, unskilled workers who are newly unemployed would now turn to crime, which would increase incarceration rates (Freeman, 1999).

Some empirical studies attempt to determine how a rise in wages for low skilled workers might affect participation in criminal activities. Gould et al. (1998) report elasticities to property crime to the pay of low skilled workers ranging from -0.31 to -1.0. Similarly, Grogger (1997) reports youth participation in all types of crime with respect to wages has an elasticity of -0.6 to -0.9. However, both studies control for employment; therefore, while it is clear that those enjoying the higher wages would commit fewer crimes, it is less obvious that this gain outweighs the greater amount of crime arising from the newly unemployed individuals.

This discussion highlights the fact that the above model has a major shortcoming: raising the minimum wage does not lead to greater unemployment among the young. Here it is assumed that there are sufficient numbers of jobs for everyone who wishes to work. For youth, the elasticity of crime with respect to the unemployment rate is estimated by Freeman and Rodgers (1999) to be only 1.5 percent. Farrington et al. (1986) used longitudinal data on over 400 adolescent males to show that property crime rates were higher when the subjects were unemployed, but not significantly so. These papers suggest that excluding unemployment effects might not completely invalidate the model's results.

In aggregate, the literature does not provide a clear and straightforward answer on what the effect of an increase in the minimum wage will be on either the level of crime and incarceration, or on the average wage of Blacks. A higher minimum wage may lead those receiving it to commit fewer crimes and induce the newly unemployed to commit more crimes, but this latter change will be small; the prediction on what happens to average wages for all Blacks is even less clear. To offer some additional insight on this question, we now consider the results from the present model.

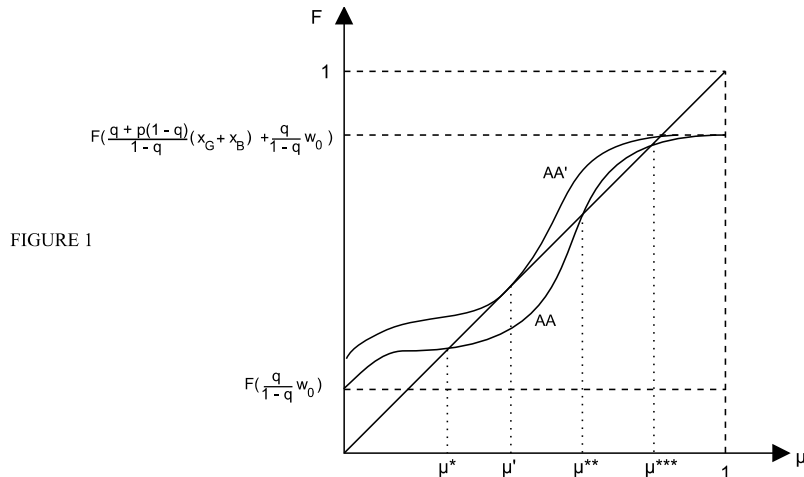


Figure 1 illustrates this model's analysis graphically. The horizontal axis measures the employers' belief, while the vertical axis describes the value of the cumulative distribution function F of b . The 45 degree line is the employers' belief μ , corresponding to the left-hand side of equation (3). The locus AA is the

right-hand side of equation (3), which is the fraction of individuals not committing a crime given firms' prior μ . An equilibrium value of μ occurs wherever AA intersects the 45 degree line, since these will be precisely the values of μ that solve equation (3). Note that over the range of valid μ , F is non-decreasing and is bounded below and above when $\mu = 0$ and when $\mu = 1$ respectively.

Consider an initial baseline level of the minimum wage $w_0 = m$. This value for w_0 is associated with the locus AA, and has three potential equilibrium values for μ : μ^* , μ^{**} , and μ^{***} . Suppose we are in a discriminatory equilibrium where $(\mu_B, \mu_W) = (\mu^*, \mu^{***})$ so that a Black worker is believed to be more likely to have committed a crime when young than a White worker, and Blacks and Whites act when young in such a way as to support perfectly these beliefs. Now consider what happens when the minimum wage is raised from $w_0 = m$ to $w_0 = m'$. For any given value of $\mu \in [0, 1]$ the right-hand side of equation (3) is larger than before; hence, more individuals will choose not to commit a crime when young, implying an upwards shift from AA to AA'. The new equilibrium values of μ are found in the same way as before by observing the intersections of AA' with the 45 degree line (the new 'high' equilibrium is left off the graph.)

Notice that the low equilibrium has shifted up from μ^* to μ' – firms believe that fewer Blacks committed crimes when young, and Blacks validate this improved opinion with their behaviour. The mechanism behind this shift is simple: as in much of the crime literature, increasing the opportunity cost of crime decreases the number of criminals. However, this model also postulates a reinforcing effect, whereby the substitution away from crime when young allows firms to sustain more optimistic beliefs about the level of criminality among Blacks, inducing a higher wage for “trustworthy” types (see equation (2)). This higher wage when old will lead even more Blacks to reject crime when young, allowing still more optimistic beliefs until eventual convergence to μ' .¹ The recommendation of this model is thus that an increase in the minimum wage can lead to lower incarceration rates and a higher average wage among Blacks by allowing firms to sustain more optimistic beliefs about the level of criminality among the Black population. However, it should once again be emphasized that in this environment, an increase in the minimum wage will not lead to increased unemployment— an omission which casts some doubt on the strength of the result.

¹ There is also the possibility of a discriminatory equilibrium (μ^{**}, μ^{***}) , in which case raising the minimum wage will actually worsen firms' beliefs about Blacks. This possibility arises from the fact that not every criminal gets caught, and raising the minimum wage raises the expected benefit from crime when young. However, in fixed point problems such as this one where there are an odd number of equilibria, the “middle” equilibria tend to be unstable (see for example Foster and Vohra (1992)) and are thus not suitable as a long term basis for discrimination.

Removing Young Offender Protection

A question not thoroughly addressed in the economics literature is the effect of young offender privacy protection on the wages and incarceration rates of young Black men. The model presented in this paper can be used to show that removing such protection will both increase the average wages of Black men and decrease their incarceration rate. Although the author was unable to find any studies that explicitly estimated the effects of privacy protection on incarceration, there is some circumstantial evidence in the literature that weakly contradicts this result. Sullivan (1989) and Grogger (1995) both uncover some evidence that arrestees find it difficult to conceal their criminal records from their employers. This result seems to suggest that young offender protection has little effect on wages one way or another, since the offender will reveal himself anyway.

More detailed analyses of young offender protection can be found in the sociology literature. For example, Lam and Harcourt (2003) approach the issue from several angles, but two are most relevant: first, they find evidence that there is employer discrimination against ex-convicts, and thus that these individuals should be protected so they can realize their ‘deserved’ wage. Second, the authors suppose that the failure to protect offenders will have negative effects on society at large, since if they are not gainfully employed, these individuals will commit further crimes.²

The proposed model thus provides a seemingly unprecedented look, at least from an economist’s perspective, at how young offender protection will affect not just the wages of those who were incarcerated, but the wages of members of their visible minority group who did not commit crime but who are perhaps being penalized because of the bad behaviour of their fellows.

The previous iteration of the model did not have young offender protection in place; the first step in the analysis is thus to derive the equilibrium for the same model but without anonymity for felons. With probability q , an individual who decides to commit a crime when young will still be caught and incarcerated. However, they will not be forced to reveal this fact in the interview later in life, and will thus have the same chance of emitting a trustworthy signal as those criminals who were not apprehended. The only effect of being imprisoned is to lose the benefit from one’s crime and the minimum wage one can earn when young.

The equilibrium concept remains the same, being a pair of employer beliefs about the probability that any individual from group B or W spent their youth recklessly pursuing criminal gains. While the wage for those emitting the untrustworthy signal will remain at x_B , the wage for high types will now be determined by the following expectation, conditional on the firm’s prior μ :

² This claim is not necessarily an obvious one, since criminal activity tends to drop off as one gets older (see, for example, Freeman (1999)).

$$w_T(u_i) = x_B + \left(\frac{\mu_i}{\mu_i + (1-p)(1-\mu_i)} \right) (x_G - x_B) \quad (4)$$

This wage will then influence the benefit of committing a crime when young relative to staying on the straight and narrow; the equilibrium value of firms' beliefs will be given by those μ that solve the fixed point problem:

$$\mu_i = F \left[\frac{p}{1-q} (w_T(\mu_i) - x_B) + \frac{q}{1-q} w_0 \right] \quad (5)$$

A Simple Example

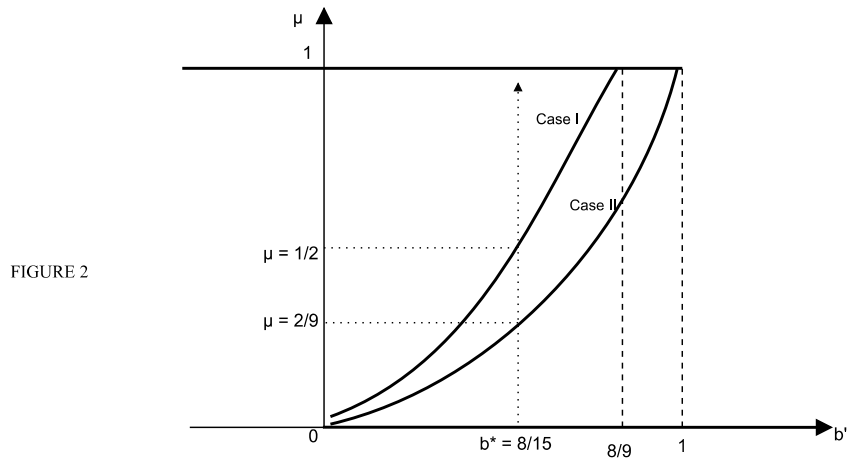
Relative to the scenario where ex-inmates are not forced to reveal their criminal past, this model can be used to demonstrate that abolishing such protection can lead to a higher average wage and a lower incarceration rate for Blacks. For simplicity of exposition in comparing the equilibria with and without young offender protection, values for exogenous parameters are provided and the distribution of the benefits from crime is fixed. Specifically, take $\{w_0 = 0, x_B = 1, x_G = 2, p = 2/3 \text{ and } q = 1/4\}$ and let F be the degenerate point b' .

Collapsing the distribution of benefit to crime still allows for multiple equilibria. For b' less than a certain high cutoff, $\mu = 1$ can be sustained for both groups, while for benefits from crime higher than a certain low cutoff, $\mu = 0$ is possible for both Whites and Blacks. For b' between the two cutoffs, three equilibria are possible: the high $\mu = 1$ and low $\mu = 0$ equilibria, and an equilibrium with $\mu \in (0, 1)$ where b' is precisely the value that makes individuals indifferent between committing a crime and not. Table 1 illustrates the differences in cutoffs in the scenario where firms cannot observe whether or not a youth was incarcerated (Case I) and the situation where youth are forced to reveal this fact (Case II). The possible equilibrium values of μ for any value of b' are illustrated graphically in Figure 2 as the bolded lines Case I and Case II.

Notice first that in Case II, the equilibrium belief $\mu = 1$ can be sustained over higher values of b' . If the benefit of crime is fixed in the range $(8/9, 1)$, then if firms could not observe incarceration their only equilibrium belief is that everyone commits a crime when young, whereas if firms could observe incarceration, both $\mu = 1$ and some mixed equilibrium would also be feasible beliefs. Thus, one might expect that being able to observe incarceration leads to more favourable equilibria.

	Case I	Case II
Range of b' over which $\mu = 1$ can be sustained	$b' < 8/9$	$b' < 1$
Range of b' over which $\mu = 0$ can be sustained	$b' > 0$	$b' > 0$
Given b' in the intersection of the above intervals, the μ that makes one indifferent between crime/no crime	$\mu = \frac{\frac{2}{3}b'}{\frac{8}{9} - \frac{1}{3}b'}$	$\mu = \frac{\frac{1}{4}b'}{1 - \frac{3}{4}b'}$

Consider a specific value for $b' \in [0, 8/9]$, say $b' = 8/15$. Using the above formula, if firms cannot observe incarceration, then the belief μ that makes youth indifferent between committing a crime and not committing a crime is $\mu = 1/2$.³ Let $(\mu_B, \mu_W) = (1/2, 1)$ so that there is a discriminatory equilibrium. Now suppose that the government abolishes young offender protection, so that ex-convicts must reveal that they were incarcerated. Assume that although individuals will react immediately to this fact, firm beliefs are sticky.⁴



As shown in Figure 2, for any value of b' the mixed equilibrium can now only be sustained with a lower value of μ in Case II relative to Case I: for the specific value of $b' = 8/15$, the mixed equilibrium can be sustained by firm beliefs of $\mu = 2/9$ (firm beliefs $\mu_W = 1$ remain unchanged). Since firm beliefs are sticky, after the new policy is implemented firms will temporarily retain the expectation that the probability that a Black individual did not commit a crime is $1/2$. However, with this value of μ and b' in Case II, no Black youth find it optimal to be

³ This value is an equilibrium because if $1/2$ of youth commit a crime and $1/2$ do not, then there is no incentive for either type to deviate (since they are indifferent) and firms' beliefs are validated.
⁴ See Krugman (1991) for an excellent discussion of when one can expect equilibria to adjust instantly and when sticky expectations can lead to a slower convergence.

criminal and so all now choose not to commit offenses. Employers, instead of adjusting their belief μ_B downwards, will respond to this behaviour by bringing it up to eventually equal 1. This constructed example has led to an interesting result: eliminating young offender protection can destroy the discriminatory equilibrium, and no Black or White youth will choose to commit crime.

Because crime has been eradicated among Black youth post-policy change, it is obvious that none are being imprisoned and the incarceration rate drops. Some simple substitution of the assumed parameter values and equilibrium μ_B into equations (2) and (4) also shows that the average wage (taking into account the wages earned by ex-convicts, criminals, and “good guys”) among the Black population has increased from 29/20 to 2.

Intuitively, there is nothing elaborate about the incarceration or wage results. Protecting ex-convicts allows them potentially to send the “trustworthy” signal and thereby increase their expected wage. The sociology literature is correct in assessing that no protection is harmful to released felons. However, protecting them in such a manner means that firm expectations of the productivity of “trustworthy” types is much lower (since there are more “bad” guys sending this signal) so that everyone who is not an ex-inmate suffers lower wages. Removing protection increases the “trustworthy” high wage, increases wage punishment of ex-inmates later in life, and thereby decreases the incentive to commit crimes. In the above example, this effect is such to induce no Black youth to pursue criminal activities, decreasing incarceration rates to zero. The interests of the ex-convicts have been sacrificed to make their identifiable subpopulation better off, resulting in a potential scenario where there are no convicts in the first place.

Conclusion

There is significant and longstanding debate in economics and sociology about both the low average wages and the very high incarceration rates of the Black population in the United States. This current analysis brings the two issues together by hypothesizing that pessimistic firm beliefs about the probability that Black individuals committed a crime when young can lead to a self-fulfilling equilibrium where Blacks do commit crimes at the higher rates postulated by employers. In the model, differing firm beliefs for different identifiable populations, and the fact that those who committed crime when young are less productive when old, are all that is necessary to ensure that Blacks have a higher incarceration rate and a lower average wage than Whites.

After the model was constructed, it was then applied to two policy issues: the effect of raising the minimum wage, which is familiar to economists, and the effect of removing privacy protection from young offenders, about which there has been little discussion. Increasing the minimum wage is found to decrease incarceration and raise the average wage for individuals belonging to a group for which a firm has low equilibrium μ ; however, there are reasons to question the

robustness of this prediction. Likewise, forcing ex-inmates to reveal that they were convicted for a crime when young can increase the average wage and lead to a lower rate of imprisonment.

Even with this simple and unrealistic model, there remain many different avenues of interest to pursue. A central problem in the economics of crime is attempting to determine how increasing the probability that a criminal is caught will affect the number of individuals incarcerated; a greater chance of being arrested will lead to more individuals in jail if the number of criminals remains the same, but the deterrent effect of this increased expected punishment will also cause fewer individuals to commit crime. The model presented in this paper adds an additional component to this analysis suggesting that increasing the probability of incarceration will also have an effect on firm beliefs – and hence on the wages paid to criminals and non-criminals.

Further, this model assumes that the distributions of the benefits of crime are identical for Blacks and Whites, which is almost certainly not true. If the distributions are indeed different, then an interesting issue might be whether it is possible to eliminate the discriminatory equilibrium with programs such as affirmative action, or whether such programs are doomed to failure.

In summary, I suggest that the simple model of firm beliefs can be incorporated into a full general-equilibrium environment. While it is not possible to construct a social welfare function in this limited analysis, in a more complete situation it would be possible to do so. One could then estimate, for example, whether raising the probability of arrest leads to a net gain for society, given that costs of police and incarceration must be paid for by taxes on wages. It would also be possible to assess more controversial issues: supposing that wrongful arrests of visible minorities can be decreased by hiring more police but that they can never be fully eliminated, one would be able to determine a society's equilibrium level of wrongful arrest for minority groups.

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