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Who gets caught?

Statistical discrimination in law enforcement.

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Ambrose Leung, Frances Woolley, Richard E. Tremblay and Frank Vitaro

Contact information:
Ambrose Leung Department of Economics, University of Winnipeg, Winnipeg, Canada
e-mail: a.leung@uwinnipeg.ca
Frances Woolley Department of Economics, Carleton University, Ottawa, Canada tel:
613 520 2600 x 3756 fax: 613 520 3906 e-mail: **frances_woolley@carleton.ca.**
Richard E. Tremblay and Frank Vitaro GRIP, University of Montréal, 3050
Edouard-Montpetit, Montréal, H3T 1J7

Abstract

Some people are more likely to be convicted of a crime than others. In this paper we explain why group characteristics, such as race or age, might influence individual probabilities of conviction. Our model is motivated by the simple observation that it is prohibitively costly to investigate every crime. Police and other enforcement agencies may rationally use "statistical discrimination" to minimize search costs. We test the model on a sample of Montreal youth, using information on self-reported juvenile delinquency to see if, controlling for the level of delinquent behavior, individuals' characteristics have an independent effect on the probability of making a court appearance. We find that characteristics do indeed influence the probability of appearing in court, while a number of forms of delinquent activity have no or even negative impacts in court appearances.

Who gets caught?

Statistical discrimination in law enforcement.

Some people are more likely to be convicted of a crime than others. Men, blacks, aboriginals, the economically disadvantaged and the mentally ill are convicted of more crimes than are women, whites, the affluent and the mentally healthy (Carrington, 1998; Chesney-Lind and Shelden, 1998; Harris, 1999; Jernigan, 2000; Rowe et al., 1995, Weitzer, 1996). There is wide-spread agreement on facts. For example, in the US, a young African-American male is more likely to spend time in jail than go to college (Weitzer, 1996; Wordes and Bynum, 1995). Yet there is debate about causes. Are certain groups convicted more often because they commit more crimes? Or are some people are more likely to be caught? In this paper we develop a simple model to explain why group characteristics, such as race or age, might influence individual probabilities of conviction. We then test the model using a unique set of data on Montreal youth, one that records both self-reported delinquent behavior and court appearances.

Our model is motivated by the simple observation that it is prohibitively costly to investigate and solve every crime. Police and district attorneys (crown prosecutors in Canada) use discretion in deciding which suspects to investigate and which cases to bring to court. For example, when investigating a young person, a police officer can decide to take no further action, warn the young person, administer a caution, or lay charges (Canadian Center for Justice Statistics, 1998). The Crown counsel has the power to stay or withdraw any charge and therefore prevent further proceedings in the court (Corrado

and Markwart, 1996). Once a case is brought to court, there is variation in sentencing

decisions between different judges when given similar cases (Doob and Beaulieu, 1992).

If police and other enforcement agencies wish to maximize the number of cases

resolved, it will be rational to attempt to minimize search costs in each case.[1] Various

methods can be used to minimize search cost. For example, in the US "war on drugs,"

police use "profiling", that is, behavioral or personal characteristics are used are used to

choose potential suspects. Pulling over erratic drivers for breathalyser tests is a simple

example of behavioral profiling, in that police are using a behavioral characteristic (erratic

driving) to decide who to investigate.

More controversial is the use of personal characteristics, such as age, gender or

race, in profiling (Harris, 1999). The 1993 case of *Whren v. United States* is sometimes

considered as the Court's decision to legitimize racial profiling (Jernigan, 2000).

However, as Knowles, Persico and Todd (2001) argue, the judicial standpoint on racial

profiling is not clear-cut. They conclude: "Whether discrimination is deemed reasonable

or not by the courts depends on assessments about the degree to which discrimination

assists in apprehending criminals, the benefits of apprehending criminals, and the costs

imposed on people erroneously searched or detained."

Profiling employed solely to minimize search costs -- to assist in apprehending

criminals -- is similar to what is known as statistical discrimination in the economics

literature.   Yet the parallel between profiling and statistical discrimination has received

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[1]We ignore other possible functions of law enforcement, for example, deterrence and
retribution.

minimal attention in the law and crime literature. Knowles, Persico and Todd (2001) is one of the first papers to provide a rigorous analysis of the issue. However our model expands upon theirs, first, by considering alternative explanations of inter-group differences in arrest and conviction rates, including imperfect information, differential enforcement costs and crime severity. Second, we have a much richer data set with which to test our model. While there is a growing interest in optimal law enforcement (see, for example, Garoupa, 2000), most papers in the literature do not allow for group differences in criminal behavior, therefore cannot address the issue of discrimination.

In the next section of the paper, we develop a simple model of statistical discrimination, based on Phelps (1972). In subsequent sections, we test the model on a sample of Montreal youth, using information on self-reported juvenile delinquency and individual characteristics to see if, controlling for the level of delinquent behavior, individual characteristics have an independent effect on the acquisition of a delinquent record.

1   Theory

Many crimes, from homicide to bicycle theft, are not directly observed by law enforcement agencies. Rather, investigations, arrests, and convictions are based on a set of evidence available to law enforcement officials. Sometimes law enforcement agents use age, race, gender or other characteristics when evaluating the evidence against a suspect. In the first part of this section, we develop a theory of statistical discrimination to explain this behavior. In the second part of this section, we expand the theory to

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include the effects of history and imperfect information, differential enforcement costs, and crime severity.

Pure Statistical Discrimination

Let q represent an individual's true level of criminal behavior, for example, the quantity of illegal drugs sold. An individual knows his or her level of q, however q cannot be observed by law enforcement agents. Instead, agents observe y, a vector of "evidence" linking a particular individual to a particular crime. Evidence is an imperfect indicator of actual criminal behavior. For example, a police radar reading does not give a perfectly accurate measure of a car's speed. In general:

$$(1) \quad y = q + u$$

where u a normally distributed error term with mean zero and constant variance. Using standard results in test theory, it can be shown (Aigner and Cain, 1995) that the expected value of q conditional on observed evidence is given by:

$$E(q|y) = (1 - \gamma)\alpha + \gamma y$$

The variable α is the average value of q in the population. Agents could estimate α based on, for example, average conviction rates in the population. The variable γ is an indicator of the reliability of evidence, that is, the correlation between evidence and delinquency:

$$\gamma = \frac{\text{var}(q)}{\text{var}(q) + \text{var}(u)}$$

A Breathalyzer test would be a form of evidence with a high γ value, a lie detector test would have a lower γ value.

Now suppose that men and women, the young and the middle aged, blacks and whites, rich and poor have, on average, different levels of criminal behavior, that is, different values for α. If law enforcement agents are perfectly informed about every group's level of criminality, α^j, they can obtain a more accurate estimate of an individual's probability of committing a crime. For example, when investigating a rape case, it is sensible for agents to implicitly divide the pool of suspects into males (m) and females (f) and calculate for each suspect i:

$$E(q_i^f \| y_i^f) = (1-\gamma)\alpha^f + \gamma y_i^f$$

and

$$E(q_i^m \| y_i^m) = (1-\gamma)\alpha^m + \gamma y_i^m$$

where the superscripts m and f represent male and female respectively. If α^f is close to zero (very few women commit rape), and γ is less than one (evidence is imperfect), then possible female suspects – a Karla Homulka or Rosemary West, to name two women implicated in serial rape and murder cases – will not be investigated. However the decision of law enforcement agents to focus investigations on males does not reflect a dislike or distaste for males, it is simply a way of minimizing search costs by using 'statistical discrimination.'

In the case of pure statistical discrimination, if we control for actual levels of criminal behavior, group characteristics will have no independent effect on conviction rates. If law enforcement agents have perfect information about group criminal behavior then, for every population group j,

$$\alpha^j = \overline{q}^j$$

Police estimates of criminal behavior ($E(q|y)$) will, on average, be equal to the actual level of criminal behavior for each group, as can be seen by noting that the average police estimate is given by:

$$\frac{\sum E(q_i|y_i)}{n} = (1-\gamma)\alpha + \gamma \frac{\sum y_i}{n} \qquad (1)$$
$$= (1-\gamma)\alpha + \gamma\alpha = \alpha$$

where n is the number of individuals in the group. Recall that y = q+u where u has mean zero, hence the mean values of y and q are equal. Any two individuals exhibiting the same 'evidence' may face different probabilities of investigation because of their age, racial, or gender characteristics. However if we take groups of people -- groups of men and women, groups of blacks and whites -- police expectations of criminal behavior will, on average, be correct. Therefore if we control for actual criminal behavior, and consider large populations, characteristics such as age, race or gender should have no effect on the probability of conviction.

Expanding the Model

Pure statistical discrimination requires two assumptions. First, that police or other law enforcement agents are fully informed about the actual levels of criminal activity, α, for each population sub-group. Second, that groups are alike in all respects except levels of criminal activity, for example, the costs and benefits of searching or prosecuting criminal activity is the same across groups. In this section, we relax these two assumptions.

Imperfect Information and Hysteresis

Is there reason to believe law enforcement agents will form accurate estimates of group levels of criminal behavior? A number of authors have argued, in the context of pay differentials by race or gender, that α can be accurately determined. For example, Aigner and Cain (1995) write

> employers will not persist in believing that $\alpha^W > \alpha^B$ [average productivity of whites is greater than average productivity of blacks] if, in fact, $\alpha^W = \alpha^B$. If employers mistakenly believe $\alpha^W > \alpha^B$, then they will mistakenly overpay whites relative to blacks, and we may doubt that such mistaken behavior will persist in competitive markets (p. 177).

This argument, while arguably convincing in the context of pay differentials, is much less convincing in the case of law enforcement.

As Hayek (1945) argues, markets transmit information. Yet law enforcement does not operate in a competitive market. Law enforcement agencies have monopoly power, and their outputs are not valued in the market. Competitive forces are blunted. It is, therefore, plausible to argue that, in the context of law enforcement, history matters.

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There is hysteresis, that is, lag between changes in causes and changes in effects.

It is uncontroversial to argue that historically there has been discrimination, for example against blacks, women, or aboriginal populations, in many societies. Slavery, denial of the vote or right to hold property are incontrovertible instances. This discrimination will be reflected in historical conviction rates. Suppose agents base present investigation and enforcement efforts on past conviction rates, α_{-1}^i, where $\alpha_{-1}^i > \alpha^i$ for some population sub-group i, say, native Americans. Substituting α_{-1}^i for α^i in equation (1) above we can see that the estimated $E(q|y)$ will be higher than the actual level of criminal activity (α^i) for members of group i. Police will, therefore, spend disproportionate amounts of effort investigating and prosecuting members of group i. Membership of group i will have an independent effect on probabilities of prosecution.

Yet prior beliefs can become self-fulfilling prophecies. More enforcement efforts will result in more prosecutions, justifying the original belief that aboriginals have higher levels of criminal activity. In the absence of clear signals, as are provided by competitive markets, overcoming the effects of past discrimination may take a long time.

Enforcement Costs

Some crimes may be more costly to resolve than others. For example, tax evasion may be intrinsically more difficult to detect than shoplifting. Technology, such as photo radar, influences detection costs. Some suspects, too, are more costly to investigate and prosecute than others. It is considerably more costly to prosecute an individual who is able to afford top legal counsel than it is to prosecute a person without access to legal advice (think, for example, of the cost of anti-trust investigations into Microsoft).

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Suppose that the decision to prosecute, p, depends positively on the expected value of q and negatively the costs of investigation, c, that is,

$p=f(q,c)$.

To the extent that, say, blacks and whites, youth from single parent families versus youth from two parent families, differ in their ability to afford legal assistance, they will be prosecuted at different rates.

Differential rates of prosecution will lead eventually to differential levels of convictions -- a person will not be convicted for a crime if he or she is never prosecuted. These in turn feed-back into law enforcement agents' estimation of the value of α, average level of criminal behavior, for members of different groups. Even if law enforcement agents attempt to practice pure statistical discrimination, differential enforcement costs means conviction rates are an imperfect signal of α. Observing a given conviction rate for, say, low income individuals, a law enforcement agent will not know whether these are the result of higher criminal activity of lower prosecution costs. If law enforcement agents use actual conviction rates as a proxy for α, differential enforcement costs will mean that $E(q|y)$ is a function of group characteristics, with the $E(q|y)$ higher for those who are relatively less costly to prosecute.

Severity of Crime

A final consideration that may influence law enforcement agents' decisions to investigate and prosecute is the perceived severity of the crime. Murder is a more serious crime than bicycle theft. The prosecution function given above can be modified to include the variable s, $p=f(q,c,s)$.

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where s denotes the severity of the crime. All else being equal, we would expect law enforcement agents to be more likely to investigate and prosecute individuals suspected of serious crimes than those suspected of minor misdemeanors.

2   The Montréal Study

The database used in this paper is the Montréal Longitudinal Study, data collected by two authors of this paper, psychologists Richard Tremblay and Frank Vitaro.[2] The data base has major strengths and some limitations. The great strength of the data set is its richness. It contains information on self-reported delinquent behavior, court appearances and acquisition of an official delinquency record for a fairly large sample of young males.   Even after deleting observations with missing information, we have a sample of 639 youth for 1995. Panel data is available on the youth from ages six to 17, and information is collected on a wide variety of individual, family, and other characteristics. The sample is comprised of youth who, at age 6, lived in a low income region of Montreal. Consequently a relatively high proportion -- 9.9 percent -- of the sample made a court appearance in 1995, making it easier to identify the factors leading to delinquency.

The major drawback of the sample is that it is homogeneous in terms of race, sex and, to some extent, income, hence we are unable to test for some of the more interesting forms of statistical discrimination, for example, racial discrimination. However we do have information on other individual characteristics. As well as standard variables such

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[2]Leung (2001) contains a more extensive discussion of the database.

as schooling, employment, and family type, we have information a variety of other

characteristics that could plausibly be used by police to identify potential suspects: gang

membership, whether the individual has siblings, adult acquaintances or friends who are

delinquent, previous convictions and court appearances. We also have information about

parental characteristics such as welfare receipt and employment status.

Table 1A lists the original survey questions for 21 forms of self-reported

delinquency, ranging from drinking any alcohol, getting drunk and smoking marijuana

(the most common forms of delinquency), through to carrying a weapon, getting involved

in fist fights or gang fights, through to petty and more major types of theft. Table 1B

gives frequency distributions. Table 2 gives definitions of and frequency distributions for

the dependent variable, making a court appearance in 1995, and the individual, family,

and regional characteristics used as control variables. All the explanatory variables are

from the year 1995, except for work experience data, where we use 1994 values because

of possible endogeneity problems — making a court appearance may affect the

probability of holding down a job.

Inspection of the family characteristics data shows they are reasonably

representative of the Canadian population with respect to family characteristics -- 18.8

percent live in a single parent family, 21.1 percent in a blended family (with a biological

parent and a step parent) and 5.8 percent live with neither biological parent. Individual

characteristics, such as presence of friends who have been arrested by police, are harder to

compare to national averages because of lack of comparable data. About 70% of the

individuals in our sample reside in the economic regions of Montréal; the rest are

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concentrated in Laval, Lanaudière, Les Laurentides, and Montérégie. Data on police

enforcement expenditures was obtained by matching individual residence information to

average levels of per capita police expenditures in each region.[3]

Empirics

The empirical model tests the theory of statistical discrimination presented

in the last section. If police are equally effective at catching all criminals, young and old,

rich and poor, then the best predictor of whether or not an individual is apprehended by

police will be whether or not he convicts a crime. Assuming that individuals are honest

in reporting their own delinquency, we should be able to predict court appearances or the

acquisition of a record of juvenile delinquency from self-reports of delinquent behavior:

court appearances=f(q)

where q is a vector of self-reported delinquent behavior.

If, however, police depart from pure statistical discrimination - perhaps because of

history, perhaps because of differential enforcement costs - then individual and group

characteristics will have an independent effect on the probability of appearing in court or

obtaining a record. Formally:

court appearances=f(q,z)

where z is a vector of social characteristics. For example, if police do not investigate or

charge 'kids from good homes' we will expect the probability of appearing in court to be

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[5]The postal information is also used to match with data on per capita police expenditure
published by Statistics Canada (Statistics Canada 85F00116XPB) to obtain a measure of
police expenditure.

lower for youth who live with both biological parents, holding constant the youth's actual level of criminal behavior. If police tend to 'round up the usual suspects', we would expect court appearances to be more likely for youth who have had previous court appearances. If we find that social characteristics are significant and self-reported delinquency is not, we can make a case for differential law enforcement.

Since making a court appearance is a zero-one variable, we estimate the probability of appearing in court using a logit model derived by maximizing the log-likelihood function:

$$(5) \quad \ln L = \Sigma \left[ca_i \ln \left[\frac{\exp(\mathrm{B}X)}{1 + \exp(\mathrm{B}X)} \right] + (1 - ca_i) \ln \left[\frac{1}{1 + \exp(\mathrm{B}X)} \right] \right],$$

where

$$(6) \quad \mathrm{B}X = \beta_0 + \Sigma \beta_m q_m + \Sigma \beta_n z_n$$

where β's are the respective coefficients of the explanatory variables, q_m represents m self-reports of delinquent behavior and z_n are individual characteristics. β's in the logit model measure the marginal effects on the log-odds. For example, β_m indicates how the log-odds in favor of making a court appearance change when a_m is changed by a unit.

Tables 3A and 3B show the effects of individual and family characteristics, police expenditures, and self-reported delinquency on the probability of appearing in court, both

in terms of actual regression coefficients (Table 3A) and marginal effect analysis (Table 3B).   Model 1 shows the results when only the self-reported delinquency items are used as explanatory variables; model 2 shows the results when only the individual, family and regional characteristics are used as explanatory variables; and model 3 includes all the factors as explanatory variables.   All of the self-reported juvenile delinquency measures reported in Table 1B were included in the regression analysis (except Arson or Beat up several times or more, because of small numbers).

The model's overall goodness of fit is indicated by the count R-square in Table 3A.   Due to the differences in the number of explanatory variables used, the different R-square measures and the value of the log-likelihood functions are not directly comparable between the different model specifications.   However, the likelihood ratio tests for all model specifications give significant results.   The model has a reasonable overall goodness of fit.

(1) Self-reported delinquent behavior

Table 1B shows a number of issues that emerge when analyzing self-reported juvenile delinquency. First, the incidence of many forms of delinquency is low. For example, less than 5 percent of the sample had ever used a weapon in a fight, engaged in arson, or beaten up someone with no reason. While the rate of court appearances for some groups of frequent offenders is high (for example, 60 percent of those who often threaten to fight others make court appearances) these numbers are based on a small number of youth (as few as half a dozen youth), who often appear as frequent offenders in several categories. Small numbers and collinearity means that some of coefficient estimates change in size

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and significance across model specification.

We have chosen, therefore, to report only a select number of results. "Hemp", "Drunk" and "Any drink" are particularly interesting variables. Although smoking marijuana is clearly a criminal offense, and the numbers reporting this activity are large enough to generate reliable estimates, it is hard to find a statistically significant relationship between marijuana use and making a court appearance. Indeed, occasional use of marijuana or alcohol seems, if anything, to decrease the probability of making a court appearance, all else equal. While smoking marijuana and underage drinking are crimes, they are not sufficiently serious to warrant much police effort. This confirms our earlier hypothesis that crime severity is a factor in police search decisions.

The results for other variables, such as break-and-enter, carry a weapon, destroy family members' things, threaten to fight or steal money (from family) suggest that the youth who make court appearances are those engaged in violent, destructive crimes and property offenses. The positive and significant effect of destroying family things, consistent across a wide variety of specifications, highlights the importance of poor interpersonal relationships and bad relations with family in ending up in court.

Yet the significance of the self-reported juvenile delinquency variables is only of secondary interest in this paper. Our key focus is on socio-economic characteristics. We include self-reported juvenile delinquency as way of answering the question: Do police overuse socio-economic characteristics, discriminating against some groups of individuals? Or are police using these well to identify delinquent youth?

(2) Individual and family characteristics

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We used two criteria to decide which individual and family characteristics to include in this model. First, the criteria should be linked, in some plausible way, to the probability of committing a crime. Eye color, for example, would not be an acceptable criteria for inclusion, in that it is hard to believe, within this racially homogeneous group, eye color would affect probability of conviction. Second, the criteria should be observable by police. Grades in Math and French are inadmissible under on these grounds, as they are not readily observed by the police. Our final set of explanatory variables fall into three categories: individual characteristics, such as staying in schooling or having a job; family characteristics, including family type, parental age and income/employment status; and association with delinquents, including having friends, brothers and sisters or adult acquaintances who had been arrested by police, being a member of a gang or having a previous court appearance.

The marginal effects of individual and family characteristics in model 2 are large, significant, and consistent with the literature: being in school, having a job, and having older parents, have a negative impact on the probability of acquiring a record. Living in a single parent family or living outside a conventional family arrangement, having delinquent associates, being a gang member or having a history of court appearances increases the probability of making a court appearance.

But what is really interesting is to compare model 2 -- which looks at individual and family characteristics in isolation -- with model 3 -- which controls for actual level of delinquent behavior. Comparing the results of the two models allows us to contrast two distinct links between individual characteristics and juvenile delinquency. First, a number

of characteristics, such as being in school, are associated with lower levels of delinquent behavior. For example, the results from Table 3B show that staying in school reduces the probability of making a court appearance by 9 percent when only individual and family characteristics are considered. However, once we control for the level of self-reported delinquency, we find that being in school reduces the probability of making a court appearance by 5 percent. Youth remaining in school engage in less delinquent behavior -- when we do not control for levels of delinquency, we find that the lower probability of making a court appearance is being attributed to school, when it is in fact due to lower levels of delinquent behavior.

The second link between individual characteristics and crime arises because, *even after controlling for delinquent behavior,* schooling and other characteristics have an independent effect on the probability of making a court appearance. Schooling reduces the probability of appearing in court, controlling for level of delinquent activity. This suggests that police may be over-using an individual's student status as a signal or be more reluctant to prosecute youth in school — once we control for level of delinquency, school should not be having a strong effect (or perhaps the youth in school are smart enough not to get caught?). In the same way, police appear to be over-using single parenthood and other family status as signals of criminal behavior.

By way of contrast, the significance of gang membership and previous court appearances drops dramatically once self-reported juvenile delinquency is incorporated into the model. It may be true that, once a youth is in court once, he appears again and again. However it is largely because he is still committing criminal offenses. It is

sensible for police to target youth with previous court appearances or gang members.

Sometimes using individual characteristics can be used to reduce the costs of law

enforcement.

Alternative Explanations: Measurement Error and Human Capital

A general criticism of survey studies such as our Montréal Longitudinal Study is

that self-reports of delinquent behavior can be unreliable. Measurement error created by

inaccurate reporting decreases the precision with which the effect of self-reported

delinquency on official delinquency can be measured. Moreover, systematic bias in the

recording of self-reported behavior can also affect accuracy of the reported results. A

skeptic might argue that measurement error renders our self-reported juvenile delinquency

variables meaningless. A human capital model of crime explains the rest of our findings.

The survey method used by the Montréal Longitudinal Study has attempted to

minimize the size of potential measurement errors[4] by cross-checking the information

provided by the adolescents themselves, their parents and teachers whenever possible.

Survey participants are also assured of individual anonymity. The names of individuals

were never utilized by any researcher except for the purpose of matching records. By

following such accepted survey methods, the questionnaires can be expected to generate

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[9]For more detailed description of survey methods used in the Montréal Longitudinal
Study, see Tremblay et al. (1994).

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unbiased and reasonably reliable answers from individuals. The data-base covers answers

to 27 self-reported delinquency items collected from a questionnaire about school, family,

friends, and leisure activities. The items are not explicitly indicated as questions about

delinquent behavior and are widely spread out in the questionnaire. Despite this, some

possibility of measurement error remains. The youth were not asked about some serious

offenses, such as rape or homicide.   And the top category "frequently" may include a

range of behaviour. For Hemp, for example, it could include everything from smoking

two or three joints on the weekend to growing and trafficking.

Yet there are problems with the measurement error story. There are no incentives

for over-reporting criminal activity. We find that even frequent delinquent behavior

rarely results in apprehensions. Almost 82 percent of frequent marijuana users, 62.1

percent of youths who have bought and sold stolen goods several times or more, and 55.5

percent of youths with several or more break-and-enters, did not make a single court

appearance. Self-reported delinquency variables have limited impact simply because

most youth do not get caught for most of their delinquent behavior.

An alternative explanation of our findings is a simple human capital/economics of

crime story, as developed in Leung (2001). Youth maximize their income by allocating

time between legal work (including schooling) and criminal work to maximize their

expected income, given by:

$$w_l t_l + w_c (1-t_l) - p(1-t_l)f$$

where w_l is the return to legal work, w_c is the return to criminal activity, t_l is time spent

on legal activities, $(1-t_l)$ is time spent on criminal activities, and $p(1-t_l)f$ is the probability

of being convicted (as a function of time spent on criminal activities) times the fine if convicted. The return to legal work will be higher for those with a higher wage. Schooling and family both create human capital, and the negative coefficients on these variables in our model can be thought of as proxying the higher returns to legal work for youth who are choosing to invest in schooling and are endowed with higher levels of human capital by their family. The return to illegal work will be higher for those with more 'criminal' human capital, those schooled in how to commit crimes without being caught by delinquent peers, brothers or sisters, or older acquaintances. This explains the positive coefficients on these variables.

Our results could be interpreted as simply measurement error plus human capital, rather than as evidence of differential law enforcement. Yet as such they are still interesting, given the relative paucity of data sets available to test economic models of crime, and the reluctance of many to accept the key role of the economics discipline in explaining criminal phenomena.

3   Conclusion

This paper examines whether the factors affecting the probability of making a court appearance can differ from the frequency of actual delinquent acts committed by the same individuals. A theoretical model is constructed using the theory of statistical discrimination. Two groups of factors can affect the probability of getting caught by police and convicted by the court. The first group of factors concern the actual delinquent acts committed by individuals and referred to as self-reported delinquent behavior. The

second group of factors involve individual background characteristics that may be used by police to reduce search costs of crime investigation and the court to evaluate the likelihood of future delinquency. This second group of factors is indicators used by police and the court to practice statistical discrimination and are referred to as individual and family characteristics.

The theory suggests that if crime investigation by police is perfectly effective, then self-reported delinquent behavior would be a perfect indicator of the probability to acquire an official record. This is not the case, however, when data from the Montréal Longitudinal Study are applied empirically. The results showed that many forms of self-reported delinquency do not appear to significantly affect the probability of getting an official record.

Individual background characteristics, on the other hand, appear to have better explanatory power on official delinquent record even after controlling the level of delinquent behavior using self-reported delinquency. This suggests that various individual characteristics may be used by police to reduce search costs and the court to minimize the expenses on conviction. The results of this study show that adolescents who are students, live with both biological parents, have some work experience, and have no delinquent friends are much less likely to acquire an official delinquent record. These results imply that the police and the court use various indicators and practices statistical discrimination in crime investigation and conviction.

References

Aigner, Dennis J. and Glen G. Cain (1995), "Statistical Theories of Discrimination in Labor Market." in Jane Humphries (ed.), *Gender and Economics*. Aldershot, U.K.: Elgar Publishing, p. 416-28.

Blau, Francine D., Marianne A. Ferber, and Anne E. Winkler (1998), *The Economics of Women, Men, and Work,* 3rd ed. Upper Saddle River, New Jersey: Prentice Hall.

Canadian Centre for Justice Statistics (1998), *A Profile of Youth Justice in Canada.* Ottawa, Ontario: Statistics Canada.

Carrington, Peter (1998), http://www.sgc.gc.ca/epub/pol/e199802/e199802.htm

Corrado, Raymond R. and Alan Markwart (1996), "Canada" in Donald J. Shoemaker (ed.), *International Handbook on Juvenile Justice.* Westport, Connecticut: Greenwood Press, p. 34-56.

Chesney-Lind, Meda and Randall G. Sheldon (1998), *Girls: Delinquency and Juvenile Justice*. 2nd ed., Wadsworth Publishing Company.

Doob, Anthony N. and Lucien A. Beaulieu (1992), "Variations in the Exercise of Judicial Discretion with Young Offenders," *Canadian Journal of Criminology,* 32:35-50.

Harris, David A. (1999), "Driving While Black: Racial Profiling on our Nation's Highways," *An American Civil Liberties Union Special Report*, June 1999. (**http://www.aclu.org/profiling/report/index.html)**

Hayek (1945) "The uses of knowledge in society" *American Economic Review* 35: 519-530.

Garoupa, Nuna (2000) "The economics of organized crime and optimal law enforcement" *Economic Inquiry* 38(2): 278-288.

Jernigan, Adero S. (2000), "Driving While Black: Racial Profiling in America," *Law and Psychology Review*, 24:127-138.

Knowles, John, Nicola Persico and Petra Todd (2001) "Racial Bias in Motor Vehicle Searches: Theory and Evidence" *Journal of Political Economy* 109(1): 203-229.

Leung, Ambrose (2001) *Delinquency, Capital and Social Institutions* Doctoral thesis,

Carleton University.

Phelps (1972) "The Statistical Theory of Racism and Sexism" *American Economic Review*, 62n4:659-61.

Rowe, David C., Alexander T. Vazsonyi and Daniel J. Flannery (1995), "Sex Differences in Crime: Do Means and Within-Sex Variation have Similar Causes," *Journal of Research in Crime and Delinquency,* 32:84-100.

Shelden, R. G. and J. Horvath (1986), "Processing Offenders in a Juvenile Court: A Comparison of Male and Female Offenders," Papers Presented at the annual meeting of the Western Society of Criminology, Newport Beach, California.

Tremblay, Richard E., Frank Vitaro and Patricia L. Dobkin (1994), "Predicting Early Onset of Male Antisocial Behavior From Preschool Behavior," *Archives of General Psychiatry,* 51:732-9.

Weitzer, Ronald (1996), "Racial Discrimination in the Criminal Justice System: Findings and Problems in the Literature," *Journal of Criminal Justice,* 24:309-22.

Wordes, Madeline and Timothy S. Bynum (1995), "Policing Juveniles: Is There Bias Against Youths of Color" in Kimberly K. Leonard, Carl E. Pope and William H. Feyerherm (eds.), *Minorities in Juvenile Justice*. Thousand Oaks, California: Sage Publication Inc., 47-65.

TABLE 1A

ORIGINAL SURVEY QUESTIONS OF THE SELF-REPORTED DELINQUENT
VARIABLES

variable name	original survey question in French (English)
Hemp	Au cours des 12 derniers mois, as-tu pris de la marijuana ou du hachisch (un joint, du pot)? (Smoking marijuana)
One drink	Au cours des 12 derniers mois, as-tu pris une bouteille de bière, un verre de vin, un verre de boisson forte? (During the past 12 months, have you had a bottle of beer, a glass of wine, or a glass or hard liquor?)
Drunk	Au cours des 12 derniers mois, t'es-tu soûlé avec de la bière du vin ou d'autres boissons fortes? (During the past 12 months, you have been drunk from beer or wine or other liquor?)
Carry weapon	Au cours des 12 derniers mois, t'est-il arrivé de porter une arme (une chaîne, un couteau, fusil, etc...)? (During the past 12 months, have you carried a weapon (chain, knife, gun, etc...)?
Break and enter	Au cours des 12 derniers mois, as-tu défoncé une porte ou une fenêtre et es-tu entré prendre part pour y prendre quelque chose? (During the past 12 months, have you engaged in a 'break and enter'?)
Destroying family member's things	Au cours des 12 derniers mois, as-tu brisé ou détruit par exprès quelque chose qui appartenait à tes parents ou à un autre membre de ta famille? (During the past 12 months, have you broken or destroyed on purpose something that belongs to your parents or another member of your family?)
Threaten fight	Au cours des 12 derniers mois, as-tu menacé de battre quelqu'un pour le forcer à faire quelque chose qu'il ne voulait pas faire? (During the past 12 months, have you threatened to fight someone to force him to do something he did not want to?)
Steal money	Au cours des 12 derniers mois, as-tu pris et gardé de l'argent à maison sans la permission et sans l'intention de le rapporter? (During the past 12 months, have you taken and kept money from your house without permission and without intending to tell?)
Strongarm	Au cours des 12 derniers mois, as-tu utilise une arme en te battant? (During the past 12 months, have you fought with a weapon?)

Gang fight	Au cours des 12 derniers mois, as-tu pris part à des batailles entre groupes de jeunes (During the past 12 months, have you taken part in gang fights?)
Fist fight	Au cours des 12 derniers mois, t'es-tu battu à coups de poing avec une autre personne? (During the past 12 months, have you had fist fights?))
Beat up	Au cours des 12 derniers mois, as-tu battu quelqu'un qui ne t'avait rien fait? (During the past 12 months, have you beaten up someone with no reason?)
Use weapon	Au cours des 12 derniers mois, as-tu utilisé une arme (bâton, couteau, fusil, roches...) en te battant avec une autre personne? (During the past 12 months, have you used a weapon (stick, knife, gun, rocks...) when fighting with someone?)
Shoplift	Au cours des 12 derniers mois, as-tu pris et gardé quelque chose sans payer dans un magasin? (During the past 12 months, have you taken and kept something from a store without paying?)
Steal >$100	Au cours des 12 derniers mois, as-tu pris et gardé quelque chose de 100$ et plus qui ne t'appartenait pas? (During the past 12 months, have you taken and kept something worth $100 or more that did not belong to you?)
Steal bike	Au cours des 12 derniers mois, as-tu pris et gardé une bicyclette qui ne t'appartenait pas? (During the past 12 months, have you taken and kept a bicycle that did not belong to you?)
Enter no $	Au cours des 12 derniers mois, es-tu entré sans payer dans un endroit payant (cinéma, spectacle, événement sportif)? (During the past 12 months, have you entered somewhere without paying (movie, show, sports event)?)
Buy goods	Au cours des 12 derniers mois, as-tu acheté, utilisé ou vendu quelque chose que tu savais avoir été volé? (During the past 12 months, have you bought, used or sold something that you know has been stolen?)
Trespass	Au cours des 12 derniers mois, t'es-tu introduit quelque part où tu n'avais pas le droit (exemple: maison ou il n'y a personne, hangars, voies ferrées, maisons en construction...)? (During the past 12 months, have you entered a place where you did not have a right to be, for example, an empty house, construction site...?)
Antenna	Au cours des 12 derniers mois, as-tu détruit par exprès, une antenne, des pneus ou d'autres parties d'une automobile? (During the past 12 months, you have destroyed, on purpose, an antenna, tires, or another part of a car?)

Arson	Au cours des 12 derniers mois, as-tu mis le feu par exprès, dans un magasin ou dans d'autres endroits? (During the past 12 months, have you set a fire, on purpose, in a store or in another place?)

	Percentage of sample reporting				Percent making a court appearance, by frequency of reported behavior			
	Never	Once, twice, several times or frequently	Several times or frequently	Frequently	Never	Once, twice, several times or frequently	Several times or frequently	Frequently
Hemp	49	51	33.5	17.2	6.4	13.2	16.4	18.2
One drink	13.5	86.5	64.9	26.6	3.5	10.8	11.6	14.1
Drunk	29.7	70.3	41.5	13.1	5.3	11.8	13.6	17.9
Carry Weapon	75.4	24.6	8.8		5.8	22.3	21.4	
Break and enter	91.1	8.9	1.7		6.9	40.4	45.5	
Destroy family things	91.2	8.8	0.8		7.5	33.9	60	
Threaten fight	89.2	10.8	1.6		7.2	31.9	60	
Steal money	86.4	13.6	1.9		8.3	19.5	50	
Strongarm	91.5	8.5	0.9		7.4	37	50	
Gang fight	84.8	15.2	1.4		6.8	26.8	44.4	
Fist fight	71.5	28.5	4.5		5.3	21.4	31	
Beat up	96.7	3.3	0.2		9.1	33.3	0	
Use weapon	95.6	4.4	1.1		8.8	32.1	57.1	
Shoplift	80	20	5		7.4	19.5	28.1	
Steal >$100	93	7	1.1		8.1	33.3	57.1	
Steal bike	90.8	9.2	2.5		7.8	30.5	37.5	
Enter no $	79	21	3.1		7.5	18.7	35	
Buy goods	79.3	20.7	4.5		6.3	23.5	37.9	
Trespass	75.9	24.1	5.6		7.4	17.5	25	
Antenna	90.9	9.1	1.1		7.4	34.5	28.6	
Arson	97.5	2.5	0		9.3	31.3	0	

Table 1b
Frequency Distribution of Self-reported Delinquency Variables, 1995

TABLE 2

DEFINITIONS OF VARIABLES AND SUMMARY STATISTICS OF CONTROL VARIABLES

Variable	Percent reporting (mean value)	Definition
Court 95	9.9%	1if subject made a court appearance in 1995, 0 otherwise
school	86.7%	1 if still in school at the age of 17, 0 otherwise.
work94	27.4%	1 if subject worked for pay in 1994
friend	28.3%	1 if subject's best friend was arrested by police, 0 otherwise.
adult	45.5%	1 if subject knew any adults who are criminals, 0 otherwise.
bro/sis	14.7%	1 if subject had brother(s) and/or sister(s) who were arrested, 0 otherwise.
Gang member	12.2%	1 if subject is member of a gang in 1995
Court94	13%	1 if subject made a court appearance in 1994
Singlepar	18.8%	1 if subject lived in a single parent family
Blendd	21.1%	1 if subject lived with a biological parent and a step-parent
Other	5.8%	1 if subject lived with neither biological parent
Welfarma	20%	1 if subject's mother receives welfare income
Workdad	87%	1 if subject's father has employment income
Mombyr1 through Mombyr5	2%, 21%, 51%, 19% and 5%	Dummy variables indicating mother's age when she gave birth: 1=14-17, 2=18-21, 3=22-27, 4=28-33, 5=34-45
policeexp	184.04	per capita police expenditure of the city an individual lives in.

COEFFICIENTS AND T-STATISTICS OF FACTORS AFFECTING
PROBABILITY OF COURT APPEARANCE[5]

	Independent variables	model 1	model 2	model 3
Individual and Family Characteristics *Individual*	school	--------	-1.639*** (-5.374)	-1.918*** (-4.597)
	work	--------	-0.778** (-1.934)	-1.014** (-1.946)
Family type	Single parent family	--------	0.652* (1.644)	0.864* (1.735)
	Blended family	--------	0.0790 (0.202)	-0.198 (-.375)
	Other family	--------	1.027** (2.021)	1.426** (2.097)
	Mother receives welfare	--------	0.098 (0.258)	0.00679 (0.015)
	Father is employed	--------	-0.994*** (-2.976)	-1.124*** (-2.443)
	Mother's age when youth was born: 14-17	--------	0.0134 (0.016)	-2.11 (-1.396)
	18-21	--------	-0.189 (-0.549)	-0.248 (-0.573)
	28-33	--------	-1.568*** (-2.715)	-2.585*** (-3.231)
	34-45	--------	-0.998 (-1.247)	-1.672* (-1.732)

[5]Other regional characteristics such as unemployment rate and police expenditure are not included with the regional dummies in the same analysis since there exists multicollinearity between these variables. See Appendix 6C for a discussion of multicollinearity of the models.

Association with delinquents, history of delinquency	friend	--------	0.507 (1.57)	0.442 (0.984)
	adult	--------	0.530* (1.688)	0.222 (0.500)
	bro/sis	--------	0.250 (0.660)	0.145 (0.282)
	Gang member	--------	0.894*** (2.460)	0.454 (0.887)
	1994 court appearance	--------	0.440** (2.161)	0.351 (1.214)
Police spending	Police expenditure	--------	-0.00396** (-1.933)	-0.00361 (-1.209)
Self-reported Delinquency (selected results)	Hemp (any use)	-0.527 (-0.982)	--------	-0.700 (-1.018)
	Hemp (several or more times)	0.715 (1.237)	--------	0.830 (1.173)
	Hemp (frequent use)	-0.141 (-0.290)	--------	-0.467 (-0.764)
	One drink (any time)	-2.682*** (-6.781)	--------	0.234 (0.363)
	Drunk (any)	-0.869** (-1.961)	--------	-0.768 (-1.259)
	Drunk (several or more times	0.546 (1.087)	--------	0.320 (0.526)
	Drunk (frequent)	0.0296 (0.052)	--------	0.356 (0.519)
	Weapon (any incidents)	0.646 (1.522)	--------	0.943* (1.804)
	Break-and-enter (any incidents)	0.840 (1.523)	--------	1.34** (2.041)
	Destroying family members' things (any incidents)	1.325*** (2.755)	--------	2.154*** (3.847)
	Beatup1 (any incidents)	0.745* (1.714)	--------	0.598 (1.076)
	Stealing money (several times or more)	2.886*** (3.052)	--------	2.257* (1.821)

Value of log likelihood function	-204.49	-163.43	-127.24
LR statistics			
McFadden R-square			
Count R-square			
Observations	639	639	639

*significant at the 10% level
**significant at the 5% level
***significant at the 1% level

TABLE 3B
MARGINAL EFFECTS OF FACTORS AFFECTING
PROBABILITY OF COURT APPEARANCE

	Independent variables	model 1	model 2	model 3
Individual and Family Characteristics *Individual*	school		-0.0878	-0.0527
	work		-0.0417	-0.0279
Family type	Single parent family		0.035	0.0238
	Blended family		0.0042	-0.0054
	Other family		0.055	0.0392
	Mother receives welfare		0.0048	0.0002
	Father is employed		-0.0533	-0.0309
	Mother's age when youth was born: 14-17		0.0007	-0.0582
	18-21		-0.0102	-0.0683
	28-33		-0.084	-0.0711
	34-45		-0.0534	-0.045
Association with delinquents, history of delinquency	friend		0.0271	0.0121
	adult		0.0289	0.0061
	bro/sis		0.0134	0.004
	Gang member		0.0479	0.0125
	1994 court appearance		0.0236	0.0097
Police spending	Police expenditure		0	-0.0001

	Hemp (any use)	-0.0453		-0.0193
	Hemp (several or more times)	0.0615		0.0228
	Hemp (frequent use)	-0.0122		-0.0128
	One drink (any time)	-0.2317		0.0064
	Drunk (any)	-0.0748		-0.021
	Drunk (several or more times	0.047		0.0088
Self-reported Delinquency (selected results)	Drunk (frequent)	0.0025		0.0098
	Weapon (any incidents)	0.0556		0.0259
	Break-and-enter (any incidents)	0.0722		0.0367
	Destroying family members' things (any incidents)	0.1139		0.0592
	Beatup1 (any incidents)	0.064		0.0164
	Stealing money (several times or more)	0.2483		0.0621
Observations		639	639	639

*significant at the 10% level
**significant at the 5% level
***significant at the 1% level