Earnings Prospects, Matching Effects, and the Decision to Terminate a Criminal Career

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This study represents an effort to investigate the age pattern of criminal involvement from an economist's perspective. It presents a dynamic stochastic model of sequential search and match evaluation which is used to explain the reasons for, and the timing of, the decision to terminate a criminal career. The behavioral implications derived from the theoretical model are tested using individual National Longitudinal Survey of Youth data. Estimation results strongly support the prediction of a negative relation between the *option value* of retaining a criminal career and desistance decisions. More specifically, the effects of current and future expected criminal earnings are shown to be negative, substantial, and statistically significant in determining desistance probabilities. Retiring behavior is also significantly responsive to variables measuring personal costs of punishment and the availability and attractiveness of a legal income-generating activity in ways consistent with theoretical expectations.

KEY WORDS: crime desistance; rational choice; life-cycle models; matching effects; value of a criminal career.

1. INTRODUCTION

One of the most prominent and widely accepted empirical regularities in criminology is the proposition that involvement in crime diminishes with age. While the level of crime varies with its precise definition and among demographic groups, the fact that income-generating crime is both widespread among youths and, within the individual life-cycle, relatively short-lived is a fundamental pattern which has been demonstrated in several studies (Wolfgang *et al.*, 1972; Hirschi and Gottfredson, 1983; Blumstein *et al.*, 1985; Farrington, 1986; Barnett *et al.*, 1987; Tittle, 1988).

Two types of evidence have established this proposition empirically. The first consists of interviews or ethnographic observation of delinquents

in the field. Researchers commonly report that subjects abandon delinquency as they reach the end of adolescence. The second body of evidence consists of the age distribution of criminality, as measured by self-reports, arrests or convictions in a sample at a given time.

While the proposition itself has gone relatively unchallenged, explanations remain unsatisfactory. Unlike the origins of crime, the circumstances of desistance have rarely been described (Wolfgang et al., 1972, 1987; Blumstein et al., 1985; Cusson and Pinsonneault, 1986; Sampson and Laub, 1993) and the phenomenon of early retirement has received no specific theoretical attention. The sociological literature attributes the age dependence to social, psychological, or even biological factors related to the maturation process, to the offender taking the threat of punishment more seriously or establishing ties to society. Delinquency is often described as a transitory phase that passes as offenders experience some marked like events such as marriage, service in the armed forces, high-school completion, adult employment, etc. In describing the links between family background and schooling and occupational achievements, this research tradition typically views the temporal and causal ordering as unproblematic and is seldom explicit about the mechanisms that generate the observed relation between age and crime (or desistance from crime).[2]

Despite the advances that economists have made in the analyses of criminal behavior and criminal justice systems in the past few decades (Becker, 1968; Stigler, 1970; Ehrlich, 1973; Schmidt and Witte, 1989; Nerlove and Montmarquette, 1985; Shavell, 1987; Sah, 1991), the age pattern of criminal involvement has not yet been addressed in the economics of crime. The most successful vein of economic research on crime has dealt with the deterrent effect of legal sanctions, both at the aggregate and individual level analyses (Becker, 1968; Ehrlich, 1973; Cook, 1977, Witte, 1980; Schmidt and Witte, 1989). A second vein of research has examined the linkage between crime and the labor market, particularly the relationship between unemployment and crime (Sjoquist, 1973; Block and Heineke, 1975; Long and Witte, 1981; Cook and Zarkin, 1985).

Implicit in almost all economic explanations of criminal career patterns is the assumption that past criminal activity alters preferences, prices, and constraints that determine, in great part, future criminal activity (Witte, 1980; Nerlove and Montmarquette, 1985; Schmidt and Witte, 1989; Sah, 1991, Nagin and Paternoster, 1991). Two factors reportedly account for this state dependence: (i) increased experience, which alters future prospects of

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[2]The work of Sampson and Laub (1993), which develops and tests a theory of age-graded informal social control and criminal behavior using the Gluecks' data set, is one notable exception.

gains from illegal activity (learning process); and (ii) decrease or loss of legal work experience and potential change of status, which reduces expected future legal earnings. In both cases, it is believed that prior criminal experience has a genuine behavioral effect.[3]

The life cycle implied by the findings of high rates of crime concentrated in a very brief segment of the age span, however, seems to contradict the state dependence assumption of these studies. In addition to this inconsistency, one should also recognize the imbalance in the research questions posed by past studies. By focusing primarily on the relationship between crime and criminal enforcement, without any explicit consideration of the financial *rewards* from crime, the typical approach in criminological literature suffers from the lack of a comprehensive model of criminal behavior.

This paper represents an attempt to investigate the age pattern of criminal involvement. More specifically, the goal is to determine the extent to which alternative current and future earnings prospects, as distinct from background and other constraints, influence the decision to terminate a criminal career. It is argued that career profile choices and desistance decisions depend critically upon general and match-specific factors affecting the life-cycle pattern of net legal and illegal rewards. Rather than offering an explanation for *why* crime diminishes with age, the paper proposes a model designed to explain variations in the end of criminal involvement, i.e., a model designed to address the question of what makes criminals retire *when* they do.

2. CONCEPTUAL FRAMEWORK

The basic approach is to view crime participation and termination decisions as occupational choices separated in time, yet interrelated by a common set of alternatives. Occupation is defined broadly to accommodate the likely possibility of concurrent legitimate and illegitimate income-generating activities: The discrete choice being made by the individual is *not* between crime and legal employment, but between having some or none of his income generated by illegal activities.

Human capital theory applied to occupational choice tells us that an individual will chose among alternatives by comparing the utility (value) associated with each option and choosing the one that exhibits the highest discounted present value. The individual will invest in changing occupations only if returns are sufficiently large to make the particular change the most profitable use of limited resources.

[3]Such statements refer to a relatively homogeneous class of offenses, primarily property offenses, such a shoplifting, fencing, theft, robbery, and other property crimes. These also constitute the behaviors used as indicators of criminality in this study.

In the light of this theory, retirement from crime will occur when the total value of the "match" becomes less than the opportunity values associated with the transition to an exclusively legal income-generating occupation. Crime desistance decisions, then, can be adequately described by a model of sequential search involving imperfect information where the match is treated as a pure *experience good*, i.e., some characteristics of the criminal option are occupation-specific and can only be ascertained by experiencing it. As a result, the sequence of decisions, planned as of period t, can be revised as information accumulates over the life cycle so that the entire path of a criminal career is not precommitted but will change as the individual learns, through experience, about the quality of his occupational match.

2.1. Theoretical Model

The individual's criminal career is modeled as a finite horizon, discrete time, dynamic programming model with periods $t = 1 \ldots T^* \ldots T$, where T^* is the time by which all criminals will have permanently retired from crime and taken legal jobs, and T the time of death. The individual makes an occupational shift/crime retirement decision at the end of each period based on observable values of pecuniary (legal and illegal incomes) and nonpecuniary (leisure and other nonmonetary rewards) flows, as well as expectations about future pecuniary and nonpecuniary flows that are contingent on current and past decisions.

An active criminal at time t has the following options at $t + 1$: (a) Continue a criminal career, (b) retire from crime and switch to an exclusively legal occupation, or (c) retire from crime and enter a transitional state of search for an acceptable legal job. If the individual's choice is to remain a criminal for an additional period, he or she will face a similar problem at the end of the next period. If the decision is to abandon a criminal career, the individual will have foregone the *option* of being a criminal thereafter.[4]

Individuals are assumed to maximize the expected discounted value of the net returns from their actions, and may be uncertain about the sequence of returns that will be earned if the criminal option is kept. One implication

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[4]This rather unappealing assumption has been adopted in order to allow for a feasible solution to the model through backwards induction. No closed-form solution for the dynamic programming model would be available otherwise. It is important to emphasize, however, that under weak time-independency conditions, the theoretical predictions of the model hold even if retirement is *not* permanent. This is true, for example, if (a) the distribution of illegal income exhibits no cyclical time pattern and (b) the search cost of an acceptable legal job does not decrease over time (Blackwell, 1965; Kohn and Shavell, 1974). Moreover, the empirical implications of the theory do not depend on the permanent retirement assumption. Indeed, the assumption is relaxed in the empirical work in which intermittence, or gaps in a criminal career, is allowed for in the estimation of the "true" desistance probability.

of this uncertainty is that legal job offers arrive with a strictly positive but decreasing probability p, which is duration dependent in a known way, i.e., p is assumed to decrease the longer the individual's criminal history.

Let $V_{ci}(t, s, X)$ be the value at time t of being an active criminal with a criminal career that started at s. Similarly, let $V_{li}(t, s, \tilde{X})$ be the value at t of being retired from crime and undertaking only legitimate career opportunities since time s and let V_b be the value associated with the transitional state in which the individual has retired from crime but not yet taken a legal job.

Formally, then,

$$V_{ci}(t, s, X) = Yc_i(t, s, X) - C_i(t, s, Z) + \varepsilon_c(t, s) + r_i E[R_c(t+1)|\Omega_t] \quad (1)$$

$$V_{li}(t, s, \tilde{X}) = Yl_i(t, s, \tilde{X}) + \varepsilon_l(t, s) + r_i E[R_l(t+1)|\Omega_t] \quad (2)$$

$$V_{bi} = b_i(B) + \varepsilon_b + r_i E[R_b(t+1)|\Omega_t) \quad (3)$$

where Yc_i and Yl_i are the deterministic components of the criminal and legal incomes, respectively, which depend upon age t, criminal tenure $t - s$, and other exogenous variables X and $\tilde{X}$. These terms also include the deterministic part of non-wage flows of utility which are assumed to depend upon the same arguments. The term C_i measures the personal cost to the individual of remaining a criminal, which includes a set of exogenous variables Z. b_i is the deterministic component of the value associated with being in the transitional state, which is dependent on exogenous variables B such as availability of alternative sources of support. The error terms ε_c, ε_l, and ε_b are the random components of criminal income, legal income, and the value of the transitional state, while r_i is the individual's personal discount rate, which includes a time preference component.

The terms $E[R_j(t+1)|\Omega_t], j = c, l, b$, represent the expected values of the individual's best option at $t + 1$ given information set Ω_t available at t:

$$E[R_c(t+1, s, X, \tilde{X}, B)|\Omega_t]$$

$$= E \max[V_{ci}(t+1, s, X); V_{li}(t+1, t+1, \tilde{X}); V_{bi}(t+1, B)] \quad (4)$$

$$E[R_l(t+1, s, \tilde{X})|\Omega_t] = E[V_{li}(t+1, s, \tilde{X})] \quad (5)$$

$$E[R_b(t+1, B)|\Omega_t] = E[V_{bi}(t+1, B)] \quad (6)$$

For simplicity, it is assumed that if a legal offer is received, it is such that $V_{li}(t) > V_{bi}(t)$ for all individuals. While not essential, this assumption simplifies the analysis considerably.

In Eq. (1), $Yc_i - C_i + r_i E[R_c(t+1)|\Omega_t]$ is the total benefit from remaining a criminal (the sum of current net returns and the discounted value of the option). The dynamics of the problem are due to the dependence of the

functions V at $t+1$ on the choice at t and possibly before. Equation (7) describes in more detail the decision process faced by the agent at each period.

$$\max E[V_c(t+1); V_l(t+1)] \qquad \text{with probablity } p$$
$$\max E[V_c(t+1); V_b(t+1)] \qquad \text{with probability } (1-p) \tag{7}$$

The dynamic programming solution for the sequence of the value functions is obtained by starting with the terminal equation then recursively integrating the system for all $t < T^*$. At T^*, $V_{li}(T^*) > V_{bi}(T^*) > V_{ci}(T^*)$ for all individuals $i = 1 \ldots N$. By systematic induction, at $t < T^*$;

$$V_{li}(t) = Y_{li}(t) \sum_{s=t}^{T} r_i^{s-t} \sum_{s=t}^{T} (1+\rho_{li})^{s-t} \tag{8}$$

$$V_{ci}(t) = Yc_i(t) - C_i(t) + r_i E\{p \max[V_{ci}(t+1); V_{li}(t+1)]$$
$$+ (1-p) \max[V_{ci}(t+1); V_{bi}(t+1)]\} \tag{9}$$

where ρ_{li} is the individual's expected growth rate of legal income.

In order to evaluate the model's predictions about crime desistance and pursue the goal of this paper, we must first find the value that solves the equation $V_{li}(t) = V_{ci}(t)$, i.e., the value that makes the individual indifferent with regard to continuing or giving up a criminal career. The reservation value at t, $Y_i^*(t)$, is then given by

$$Y_i^*(t) \left[\sum_{s=t}^{T} r_i^{s-t} \sum_{s=t}^{T} (1+\rho_{li})^{s-t} \right] = V_{ci}(t), \tag{10}$$

The end result of the solution method is an optimal desistance strategy which arises from sequentially solving $V_{ci}(t)$ in terms of $Y^*(s)$, $T^* \geq s > t$, and can be summarized as follows.

If $Yl > Y^* \rightarrow V_l(t) > V_c(t)$, retire and take a legal job,

If $Yl < Y^*$ and $\begin{cases} b > Y^* \rightarrow V_b(t) > V_c(t), \text{ retire and search,} \\ b < Y^* \rightarrow V_b(t) < V_c(t), \text{ continue a criminal career.} \end{cases}$

A stopping rule is available at each period that pays $Yl(t)$ with probability p and $b(t)$ with probability $(1-p)$ such that it is optimal for the individual to desist from crime if and only if $b \geq Y^*$.

Note that this general solution is independent of any specific assumptions about individuals' expectations. In order for the model to generate a predicted stochastic process over the *sequence* of optimal policies, additional specification is needed. In particular, the question of how criminals form expectations in a world of uncertainty must be considered. To

complete the description of the value functions, the conditional distributions of future illegal returns and costs of remaining a criminal must be specified. Assumptions 1 and 2 provide the general properties of these functions.

Assumption 1. *Costs associated with remaining a criminal in every period are continuous in t and are nondecreasing in age (t) and criminal tenure (t − s).*

Assumption 2. *The probability that the next period's illegal returns will be greater than any given number is larger the higher are current returns. However, the probability that the next period's returns will be greater than some number, for any given value of current returns, is nonincreasing in criminal tenure.*

Assumption 1 is straightforward and motivated by the fact that, compared to other risky income-generating pursuits, crime has the distinguishing characteristic that occupational hazards, such as legal penalties, are age related: the passage from adolescence to adulthood implies stiffer penalties for the same crimes, public record of the offenses committed, and, in most states, reclassification under the Chronic Offender Statute, which significantly increases sentences for individuals convicted over three times.

The first part of Assumption 2 accounts for the existence of serial correlation in the illegal reward function due to matching effects or learning. Though the sequence of conditional distributions is not independent of past realizations and decisions, it is not necessarily stationary over time and thus requires bounding. The sufficient boundary condition is presented in the second part of Assumption 2. Factually, Assumption 2 is motivated by the possibility that criminals pursue their most promising illegal opportunities first, a possibility which is distinctly favored in other studies of criminal involvement. For example, Viscusi (1986a) observed that criminals systematically reported having several opportunities a day to "make money illegally" but acted on a selected few of such opportunities believed to be the most profitable. Also, actual yearly crime income for those who had recently engaged in crime was shown to be much lower than their reported expectation over a week converted to an annual basis (Viscusi, 1986b), indicating that criminal pursuits might offer substantial rewards over a short period since the individual can pursue only his most attractive options.

As the individual ages and his criminal career advances, there are fewer future years in which he can earn illegal returns, costs associated with being a criminal rise, and the distribution of future returns conditional on current Yc is not as favorable. The fact that both direct and opportunity costs of remaining a criminal increase with time at risk, due to the combined effect of increased potential punishment and decreased legal opportunities, while the illegal rewards become *relatively* less attractive, implies that the option

value of a criminal career decreases over time. As a consequence, the sequence of reservation values $\{Y^*(t)\}_{t=1}^{T^*}$ is decreasing in t.

In light of the theory presented, two main testable hypotheses emerge. First, there should be a negative relationship between the option value of retaining a criminal career and desistance decisions. More specifically, the higher the current criminal rewards Yc and their expected growth rate ρ_c, the lower the probability that an individual will retire from crime. Individuals will also be less likely to terminate their criminal career the lower the personal costs associated with keeping the criminal option. Second, the more attractive the alternative legal occupation, i.e., the higher current legal earnings Yl and its expected growth rate ρ_l, the higher the probability of desistance from crime.

3. THE EMPIRICAL MODEL

As modeled, the decision to retire from crime depends on factors influencing the individual's reservation value, such as current and expected future realizations of criminal and noncriminal rewards, personal costs of punishment, and the individual's discount rate. Hence,

$$I_{it} = I(Yc_{it}; Yl_{it}; \rho_{ci}; \rho_{li}; b_{it}; r_{it}; C_{it}) + \varepsilon_i \tag{11}$$

where I_{it} is the control variable, an indicator equal to 1 if retirement is chosen at time t and equal to 0 otherwise.

Note that Eq. (11) is expressed solely in terms of unobservables. To implement the model, it is assumed that the individual's personal discount rate r_i, cost of remaining a criminal C_i, and transitional value b_i are functions of vectors of variables, R_i, Z_i, and B_i, respectively, which include a set of measures related to family background, such as mother's education, number of siblings, number of dependents, the individual's criminal history, and the availability of alternative sources of support. These three variables are not estimated structurally in the context of this model.

The other unobserved variables in Eq. (11) relate to measures of current returns and expected growth rate in the respectively chosen occupations and are assumed to be of the form

$$Yc_i = X_i \beta_c + \varepsilon_{ci} \tag{12}$$

$$Yl_i = \tilde{X}_i \beta_l + \varepsilon_{li} \tag{13}$$

where X and $\tilde{X}$ are measured indicators of productivity in both activities such as schooling, age, sex, race, and other plausibly relevant variables determining legal and illegal returns. Legal and illegal earnings growth rates,

ρ_{li} and ρ_{ci}, are defined as a difference of two logarithms as follows:

$$\rho_j = \log \hat{Y}j_{t+s} - \log \hat{Y}j_t, \qquad j = l, c \qquad (14)$$

where the hats indicate preestimated imputed values for the corresponding variables, taken from auxiliary regressions.

Two important issues concerning the specification presented above are worth noting. The first relates to the measurement of desistance. Given the nature of the data used in the analysis and its truncation at age 22, the life span of the individual criminal career cannot be directly observed. To assume that an individual has terminated his criminal career simply because we do not observe him participating in crime at the time of the survey is clearly incorrect. Retrospective information on age at onset, number of offenses, age at last offense, and age at the time of survey, however, allows us to estimate the true individual probability of desistance using the method outlined by Avi-Itzhak and Shinnar (1973). The log odds of the individual's true desistance probability, which is estimated via a Poisson process, replaces the unobservable retirement indicator I_i and is the dependent variable in the structural Eq. (11).

The second issue concerns the treatment accorded to both legal and illegal wages. Because the observed legal and illegal incomes are conditioned on endogenous participation (or nonretirement) decisions, the earnings Eq. (12) and Eq. (13) cannot be estimated directly. That is, the population values of Yc_i and Yl_i are not observed; what is observed are these variables conditioned on a corresponding participation decision, i.e., Yc_i conditioned on the individual's remaining a criminal and Yl_i conditioned on his holding a legal job.

Conditional expectations of the errors in Eq. (12) and Eq. (13) are generally nonzero so that least squares applied to the conditional data would lead to biased estimates of β_c and β_l. Particularly with respect to the criminal income equation, aside from the participation issue, another important source of bias is the existence of matching effects that influence the value of occupation-specific experience and, consequently, induce particular criminal career profiles. In other words, the choice of criminal career duration, or *criminal tenure*, is not random. An individual who chose to remain longer as a criminal must have had greater than average gains from doing so, and his prospects are likely to be systematically different from those of an individual who retired after a brief period of experimentation with crime.

4. THE ESTIMATION PROCEDURE

In order to examine the empirical content of the model, a multistep procedure is necessary. In the first step, selectivity-corrected estimates of

criminal and legal earnings are obtained, respectively, via a multinomial logit-OLS and probit-OLS two-stage estimation method. The estimated coefficient vectors β_c and β_l are then used to obtain conceptually correct predictions of legal and illegal incomes and their respective expected growth rates for all individuals in the sample. Finally, in the third step, the predicted values of Yc_i, Yl_i, ρ_{ci}, and ρ_{li} are substituted in the structural Eq. (11) along with the reduced forms for r_i, C_i and b_i, yielding a linear expression of the form

$$\delta_i = \alpha_0 + \alpha_1 \hat{Y}c_i + + \alpha_2 \hat{Y}l_i + \alpha_3 \hat{\rho}_{ci} + \alpha_4 \hat{\rho}_{li} + R_i(\alpha_5 \tau_i)$$

$$+ Z_i(\alpha_6 \gamma_i) + B_i(\alpha_7 \zeta_i) + \varepsilon_i \qquad (15)$$

from which the hypotheses $\alpha_1 < 0$, $\alpha_2 > 0$, $\alpha_3 < 0$, and $\alpha_4 > 0$ can be verified. The dependent variable δ_i represents the log odds of the individual's true desistance probability, which replaces the unobservable retirement indicator I_i. A more detailed description of the procedural steps follows.

4.1. Consistent Estimation of the Earnings Equations

Our framework for obtaining consistent estimates of the parameters in the criminal earnings functions builds on standard selection analysis but accommodates a very general form of length-bias correction. In particular, it captures the duration dependence expected to arise from experience effects in the observed criminal earnings.

Consider a heterogeneous group of people with fixed escape or exit rates entering criminal careers at the same time. As long as some heterogeneity is assumed, these fixed rates will differ among individuals. As they experience criminality, individuals with relatively high exit rates will tend to leave more quickly, until eventually only the sluggish members of the original cohort remain. Hence, although each individual has a constant exit rate, the tendency for the higher exit rate faction to "sort" itself out sooner makes the average rate for the group decline.

The density of exit rates for current criminals at any time is a weighted average of the densities of exit rates for individuals with criminals careers of various durations. An implication of this difference in *composition* by exit rate between entrants and individuals with longer criminal careers is that those particular characteristics of individuals beginning a career which are not statistically independent of escape rates will be misrepresented by sampling only people whose careers are in progress at the time of the survey. Consequently, the composition by escape rate of the relevant population sampled must be taken into account when estimating the parameters of the criminal earnings equation.

In order to obtain cri... .nal income equations free of the selection bias induced by the non-random observed career duration samples, the following two-stage procedure is used:

(a) In the first stage, a closed form representation for the selection bias correction term is calculated based on a multinomial logit model of career duration choice that employs the method described by Lee (1983) and Dubin and McFadden (1984). The criminal career duration categories are defined as (*i*) participants in crime with a criminal career duration of 1 year or less, (*ii*) participants with a criminal career more than 1 but less than 3 years, and (*iii*) participants with a criminal career of more than 3 years.[5]

(b) The second stage entails the estimation of the determinants of criminal income by career length status via ordinary least squares, where the selectivity bias terms are used as additional regressors. Computationally, this procedure involves separate regressions for each duration group.

These results are important for our purposes because they give us a method of estimating the criminal income Yc_i for *all* individuals in the sample. In addition, it is possible to estimate how illegal income varies with age and criminal tenure, therefore predicting the course of potential earnings for each individual should he choose to remain a criminal. In the absence of longitudinal data on illegal income, the logarithm of $\hat{Y}c_{t+s}$ used in this study is a forecast of criminal income, assuming that the same equation estimated for time t holds 3 years later.[6]

For the estimation of $\hat{Y}_{li}$ and $\hat{p}_{li}$, conventional legal earnings equations, in which the dependent variable is the natural logarithm of the individual's annual earned income, were estimated for both period t and period $t+s$. Since legal earnings are observed solely for labor market participants, a correction for selectivity bias measuring the truncation effect associated with sample selectivity was first estimated, then appended to the set of explanatory variables in the wage equations as part of a consistent two-stage procedure (Heckman, 1979).

5. DATA AND VARIABLES

The data source is the Youth Cohort of the National Longitudinal Survey (NLSY), a survey which includes responses to more than 2,000 questions asked of 12,686 individuals between 14 and 22 years old in 1979.

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[5] The number and value of the thresholds for the crimi...l ...areer duration choice model were selected based on likelihood-ratio tests.

[6] This was achieved by applying the corresponding β_c associated with an eventual criminal tenure of 3^+ years to $X_{i,(t+s)}$ for $s = 3$ years.

Although the NLSY is a nationally representative longitudinal survey, questions related to illegal behavior were administered only in 1980 (referring to participation in 1979). Ideally, the dynamic model proposed in the paper would be best estimated by the use of fully longitudinal data. Nonetheless, although the lack of longitudinal data on illegal behavior is a serious limitation of the NLSY, the survey provides a unique opportunity to test the theoretical model. In particular, the questions provide a comprehensive account of the youth's educational and work experience, family background, sources of earned and supplemented income, and involvement with crime, including self-reported contacts with the police, courts, and correctional institutions. Most importantly, the data contain information on returns from criminal and legal activities which is not available in other data sets.[7]

The basic sampling frame includes 1,797 individuals who reported having participated in crime at some point in their lives. These are respondents aged 16 to 22 years old in 1979 with complete records on all relevant questions regarding criminal and legal income variables, criminal tenure, and other information required to estimate the "true" desistance probability. Individuals who reported being incarcerated during the reference year were excluded from the sample.

A glossary of the basic variables along with their summary statistics is presented in Table I. The set of criminal earnings predictors includes a vector of personal characteristics (gender, race), measures of general human capital (age, education), and locational and environmental variables (residence in a metropolitan area, crime in the county or residence, gang membership) assumed to influence criminal productivity. The living arrangement of the youth and his probation status were also included in the crime income equations to capture the effect of parental and official supervision on the individual's level of criminal activity. The career length equations include the same vector of regressors assumed to affect illegal earnings directly, plus variables related to family background and status such as number of dependents, number of siblings, marital status, and education of mother. The number of police stops and convictions, and the unemployment rate for the county residence—variables plausibly affecting duration decisions rather than criminal productivity—were included solely in the multinomial logit career duration choice model. The same set of variables was used across the two-stage estimation of legal earnings.

Consistent with the theoretical model, the desistance probability equations include the predicted values of criminal and legal earnings and their

[7]Difficulties may arise from the exclusive reliance upon self-reported measures of criminal involvement. Evidence from comparative studies on official and self-reported arrest data suggests the existence of a severe underreporting problem among blacks (Hindelang *et al.*, 1981).

Table I. Summary Statistics and Glossary of Variables[a]

Variable	Definition	Means	
		Active criminals	Nonparticipant criminals
AGE	Age (years)	18.08	18.68)
		(1.82)	(1.78)
EDUC	Highest grade completed	10.72	11.00
		(1.67)	(1.72)
SEX	Dummy variable = 1 if male	0.68	0.72
		—[b]	—
RACE	Racial ethnic dummy variable = 1	0.42	0.35
	if black or Hispanic	—	—
EDUM	Highest grade completed by the	10.91	10.98
	respondent's mother	(2.82)	(3.29)
LVP	Dummy variable = 1 if respondent	0.31	0.35
	lived with at least one parent	—	—
SIB	Number of siblings	3.87	3.86
		(2.50)	(2.53)
DEP	Number of dependents	0.16	0.21
		(0.58)	(0.58)
MARST	Marital status dummy variable = 1 if	0.90	0.88
	single, 0 otherwise	—	—
HALF	Dummy variable = 1 if received income	0.70	0.73
	from others for half of expenses	—	—
GANG	Gang membership dummy variables = 1	0.46	0.29
	if respondent was a gang member	—	—
ARRESTN	Number of arrests (except minor traffic	2.26	3.09
	offenses)	(7.33)	(6.90)
CONVN	Number of convictions	0.28	0.39
		(0.93)	(1.16)
PROB	Dummy variable = 1 if respondent was	0.15	0.17
	currently in probation	—	—
CRIME	Crime rate known to the police per	4628.1	5225.9
	100,000 population (county level)	(3279.7)	(3741.6)
UNEMP	Unemployment rate for labor market	2.49	2.54
	of county of residence	(0.74)	(0.74)
SMSA	Dummy variable = 1 if respondent's	0.18	0.20
	current residence in SMSA	—	—
Y_c	Income generated from illegal	840.0	0
	activities in calendar year	(1993.0)	0
Y_F	Income from wages and salary in	1247.0	3457.0
	calendar year	(243.0)	(3308.0)
JOB	Dummy variable = 1 if held a "regular"	0.43	0.79
	legal job (i.e., not "occasional")	—	—
Sample size		984	813

[a]For the purposes of this study, active criminals are individuals who reported having some or all of their total income generated from illegal activities in 1979. Nonparticipant criminals are individuals who admitted having participated in crime at some point in their lives, but reported no crime income in 1979.

[b]Standard deviations of 0–1 dummy variables were omitted since they could be calculated from their fraction in the sample.

[c]Zero responses were set as missing values and not used when calculating means.

expected growth rates as well as, once again, family background and status variables (education of the mother, living arrangements, marital status, number of siblings, number of dependents) assumed to play a role in determining personal costs of punishment and personal discount rate. Finally, a dummy variable taking the value of one if the individual was supported by a third person for half of his/her living expenses was included as a determinant of the stochastic unobservable value associated with the transitional state.

6. RESULTS

6.1. Determinants of the Criminal Career Duration Choice Model

Table II presents the estimates of the multinomial logit model of career duration choice described in Section 4.1. The two sets of equations, referred to throughout as specifications I and II, differ according to the inclusion of possibly endogenous law enforcement and gang membership variables.

Consistent with findings reported in other individual-level studies in the field (Viscusi, 1986a, b; Blumstein and Moitra, 1980), age is an important factor determining the choice of criminal career length. The significant negative coefficients for AGE in columns 1, 2, 4, and 5 in Table II indicate that the older the individual, the lower the probability that he/she is an entrant or a short career criminal. Older individuals in the sample who participated in crime during the year of the survey exhibited longer criminal tenure, as indicated by the significantly positive coefficients in columns 3 and 6.

The other two individual characteristics, sex and race/ethnicity, have strong priors in the literature. Males are more likely to participate in criminal activities in all instances of career length. While race appears insignificant in determining participation of entrants, it becomes particularly relevant in determining the duration of the criminal career. For example, blacks and Hispanics exhibit a greater likelihood of choosing a career length of over 1 year, in both specifications. When possibly endogenous variables are excluded, race is found to be a significant factor determining the participation of entrants as well, with whites being more likely to choose the shorter-term career length option.

As the principal human capital variable in the model, education, measured as highest grade completed, exhibited a negative coefficient for all but one of the career length choices, as anticipated, but proved to be insignificant for entrants and short term criminal career individuals.

The coefficients referring to marital status were insignificant, without exception. This pattern may be attributable to the lack of sufficient variability in the sample: Due to the age range considered, most respondents were unmarried.

Table II. Maximum-Likelihood Estimates for the Criminal Career Duration Choice Model (Asymptotic Standard Errors in Parentheses)[a]

Variables	Career length					
	Specification I			Specification II		
	1	2	3	1	2	3
Intercept	3.580***	2.378	−7.211***	3.626***	2.076	−5.953***
	(0.759)	(1.744)	(1.942)	(0.738)	(1.688)	(1.761)
AGE	−0.167***	−0.276**	0.294***	−0.189***	−0.223**	0.295***
	(0.048)	(0.108)	(0.101)	(0.045)	(0.102)	(0.093)
EDUC	−0.043	−0.050	−0.168*	0.002	−0.030	−0.176**
	(0.049)	(0.108)	(0.099)	(0.045)	(0.101)	(0.089)
SEX	0.243***	0.193*	0.256***	0.154**	0.202**	0.243***
	(0.068)	(0.102)	(0.072)	(0.062)	(0.101)	(0.72)
RACE	−0.075	0.460***	0.271**	−0.187***	0.424***	0.394**
	(0.063)	(0.175)	(0.134)	(0.058)	(0.170)	(0.187)
MARST	0.169	−0.475	−0.502	0.094	−0.242	−0.408
	(0.119)	(0.401)	(0.316)	(0.113)	(0.348)	(0.289)
CONVN	−0.400***	−0.272*	0.096	—	—	—
	(0.093)	(0.150)	(0.069)			
ARRESTN	−0.106***	0.008	0.023**	—	—	—
	(0.019)	(0.014)	(0.010)			
GANG	0.162***	0.241***	0.254***	—	—	—
	(0.016)	(0.035)	(0.039)			
CRIME	−0.3E−4	−0.1E−4	−0.5E−4	−0.2E−4	−9.1E−6	−0.4E−4
	(0.2E−4)	(0.4E−4)	(0.6E−4)	(0.2E−4)	(0.5E−4)	(0.5E−4)
LVP	−0.282*	−0.286	−0.342	0.009	−0.142**	−0.042
	(0.157)	(0.374)	(0.348)	(0.081)	(0.221)	(0.177)
DEP	−0.011	0.315	0.092	−0.101	0.222	0.039
	(0.117)	(0.202)	(0.228)	(0.111)	(0.202)	(0.212)
SIB	0.003	−0.023	0.087	−0.003	−0.045	0.051
	(0.025)	(0.056)	(0.055)	(0.023)	(0.053)	(0.052)
EDUM	−0.004	−0.082*	−0.087*	0.013	−0.050	−0.054
	(0.021)	(0.044)	(0.051)	(0.020)	(0.043)	(0.047)
SMSA	0.117	−0.164	0.052	0.108	−0.141	0.034
	(0.077)	(0.152)	(0.183)	(0.073)	(0.148)	(0.176)
UNEMP	−0.046	0.115	−0.046	−0.049	0.114	−0.073
	(0.076)	(0.159)	(0.197)	(0.072)	(0.153)	(0.181)
−2 log likelihood		2717.96			3044.31	

[a] Response functions contrast the log of each response probability with the log of the probability for the "nonparticipant" response category. Career length choice categories are (1) participants in crime during the year of the survey with a criminal career duration of 1 year or less, (2) participants with a criminal career longer than 1 but less than 3 years, and (3) participants with criminal career of more than 3 years.
*$P < 0.10$.
**$P < 0.05$.
***$P < 0.01$.

The significantly negative coefficients for CONVN in columns 1 and 2 and ARRESTN in column 1 in Table II indicate that an individual is less likely to be observed participating in crime as an entrant or short-term career criminal, the higher the number of police contacts and convictions accumulated. On the other hand, the coefficients for both CONVN and ARRESTN are positive for longer-career individuals (although not significant for CONVN), revealing that a greater number of law enforcement contacts is associated with increased exposure. This pattern is consistent with findings reported by Phillips and Votey (1987).

The effect of gang membership, the third possibly endogenous variable, is strongly significant at all levels of participation by career duration, as anticipated, indicating that the criminal environment is of consequence. The coefficients referring to the other crime-related background variable, the level of crime in the county of residence, were negative and insignificant in determining duration of criminal careers in both specifications. Estimates for the unemployment in the county of residence exhibited high standard errors and were found to be insignificant in determining crime participation in all levels of career duration.

Finally, with the exception of the weakly significant negative coefficients of LVP for entrants and EDUM for longer career individuals, the family background variables were found to have no significant impact in determining criminal career length choices.

6.2. Determinants of the Criminal Income by Career Length Status

Table III displays the two sets of estimated coefficients for the determinants of actual levels of criminal income adjusted for career length choices. The dependent variable is the natural logarithm of the individual's criminal income, obtained from information on total income and the individual's reported percentage of total income generated from illegal activities. This variable captures both the decision to participate in crime and the intensity of criminal behavior.[8] As before, the two sets of equations, referred to as Specifications I and II, differ according to the inclusion of possibly endogenous law enforcement and gang membership variables in both stages of the two-step estimations of the crime income variable.

As suggested in the theoretical analysis, the pure effect of aging on criminal income is of some importance in explaining why offenders retire. After controlling for criminal tenure, the parameter estimates-in Table III suggest that the effect of age *per se* on illegal income becomes insignificant for longer criminal careers. When the possibly endogenous law enforcement and gang membership variables are excluded, age is not a significant explana-

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[8]It is necessary to point out, however, some of the possible problems involved in this procedure. Because the characteristics measured here do not completely account for differences among individuals, certain individuals may have their criminal earnings underestimated, while others have theirs overestimated. Perhaps the most serious of these potential problems applies to individuals who allocate different amounts of time to illegal activities during the year.

Differences in time allocation may lead to biased estimates of the behavioral parameters if the choice of criminal labor supply is systematically correlated with the regressors in the model. Although part of this problem could, at least conceptually, be overcome by including the individual's employment and school attendance status in the illegal income equation—which would capture competing uses of time and concentrate part-time criminals—the obvious endogeneity of these decisions precludes its use in the empirical work.

Table III. Determinants of the Criminal Income by Career Length Status (Standard Errors in Parentheses)

Variables	Career length					
	Specification I			Specification II		
	1	2	3	1	2	3
Intercept	2.630***	0.095	3.631	3.229***	1.070	2.496
	(0.601)	(2.331)	(3.003)	(0.589)	(2.215)	(2.931)
AGE	0.110***	0.328***	0.192	0.007	0.261	0.186
	(0.040)	(0.157)	(0.154)	(0.041)	(0.143)	(0.159)
EDUC	0.065*	−0.081	−0.123	0.123	−0.079	−0.030
	(0.038)	(0.179)	(0.170)	(0.037)	(0.170)	(0.167)
SEX	0.284***	0.588	1.831***	0.046	0.0595	1.517**
	(0.103)	(0.535)	(0.663)	(0.104)	(0.541)	(0.684)
RACE	0.137	0.643*	0.691*	0.051	0.865**	0.673*
	(0.110)	(0.380)	(0.357)	(0.106)	(0.340)	(0.352)
PROB	−0.168	0.023	−0.065	—	—	—
	(0152)	(0.286)	(0.166)			
LVP	−0.468***	−1.147**	−0.839*	−0.154	−0.980**	−0.757
	(0.132)	(0.469)	(0.461)	(0.132)	(0.480)	(0.497)
GANG	0.057**	0.079	0.041	—	—	—
	(0.014)	(0.051)	(0.060)			
CRIME	0.4E−4***	0.9E−4	−0.1E−4	−0.2E−4	0.7E−4	−0.2E−4
	(0.1E−4)	(0.7E−4)	(0.8E−4)	(0.2E−4)	(0.7E−4)	(0.9E−4)
SMSA	0.124	0.263	0.592	0.0976	0.206	0.626
	(0.134)	(0.389)	(0.548)	(0.129)	(0.387)	(0.572)
Selectivity	−0.418***	−0.082	−0.874***	−1.637***	−0.155	−0.812***
Vrl	(0.098)	(0.231)	(0.249)	(0.185)	(0.239)	(0.314)
$\bar{R}^2$	0.1232	0.1492	0.2035	0.1649	0.1421	0.1378
N	819	89	76			
Mean of						
Y_{crim}	5.6525	5.7655	5.9539			

^aCareer length categories are (1) participants in crime during the year of the survey with a criminal career duration of 1 year or less, (2) participants with a criminal career duration of more than 1 but less than 3 years, and (3) participants with a criminal career duration of more than 3 years.
*$P < 0.10$.
**$P < 0.05$.
***$P < 0.01$.

tory variable in generating crime income. If earnings reflect marginal productivity, these results seem to indicate that age boosts productivity only for short term criminal career individuals.

Education was found to have a significant effect on criminal earnings only for entrants. The negative and statistically insignificant coefficients for the variable in the second, third, fifth, and sixth columns in Table III indicate that, in contrast to legal earnings, the skills or talents proxied by years of schooling do not enhance criminal rewards.

The coefficients referring to race/ethnicity were found to be positive in all instances and of significance in the higher levels of criminal tenure. This result is of particular consequence: Blacks and Hispanics were found to exhibit lower legal market earnings than the white youths (results not shown here), and to have a higher likelihood of choosing longer-duration careers (see Table II), providing further evidence that earnings differential is an

important determinant of criminal career length and, consequently, retire-
ment decisions. (Insufficient sample size precluded the estimation of separate
equations by race/ethnicity.)

Being on probation, contrary to initial expectations, did not have a
significant negative impact on current illegal income. On the other hand,
gang membership and crime rate in the county of residence both had a
significant positive impact on Y_c as far as entrants are concerned but were
insignificant in determining the criminal income of offenders with longer
criminal tenure.

The variable LVP exhibited a strong significant negative impact on
illegal earnings of criminals across all levels of tenure in Specification I.
Because this variable captures not only the youth's living arrangements but
also the availability of alternative sources of support, these findings are
consistent with theoretical expectations. Although consistently negative, the
coefficients for this variable in columns 4 and 6 in Table III exhibited high
standard errors and failed to achieve statistical significance when possibly
endogenous variables were excluded.

Turning to the estimated coefficients on the selectivity variables, the
empirical results point to the existence of a positive selection bias; that is, the
criminal wage distribution actually observed for participants with different
criminal tenure is higher than the distribution that would be observed for
the average individual in the sample had he/she chosen a different career
duration option. This is consistent with the notion of matching effects
influencing the value of occupation-specific experience and, consequently,
inducing particular criminal career profiles and desistance decisions.

6.3. Determinants of the Crime Desistance Decision

Table IV presents logit estimates of the legal and illegal current and
expected returns, along with the reduced form equations assumed to reveal
the individual's discount rate, personal costs of punishment, and transitional
state values on the desistance probability.

Overall, in terms of anticipated direction, the results obtained are con-
sistent with theoretical expectations. The estimated effect of criminal earn-
ings on the log-odds of retirement proved to be substantial and the most
significant in influencing retirement decisions. Individuals were also found
to be more likely to terminate their criminal careers the higher their current
legal earnings. Indeed, the effect of this variable (Yl) on the termination
decision was greater in magnitude than the effect of the primary cost of
punishment variable CONVN, indicating that the availability of an attractive

Table IV. Determinants of the Desistance Probability[a]

Variables	Specification I		Specification II	
	Coefficient	SE	Coefficient	SE
Intercept	0.565	2.986	−2.211	2.260
$\hat{Y}c$	−4.829***	0.589	−1.753***	0.404
$\hat{Y}l$	0.709***	0.249	0.636***	0.250
$\hat{\rho}_c$	−0.574**	0.286	−0.353	0.340
$\hat{\rho}_l$	0.084	0.081	0.047	0.082
CONVN	0.558**	0.253	0.606**	0.289
AGE	0.943***	0.244	0.337	0.249
MARST	−0.103	0.978	−0.248	1.008
HALF	3.589***	0.980	1.671**	0.785
SIB	−0.070	0.116	0.009	0.110
DEP	0.047	0.467	0.284	0.492
EDUM	0.048	0.101	0.008	0.109
Log likelihood	−4608.39		−4638.69	

[a]The dependent variable is given by $\ln [\delta/(1-\delta)]$, where δ is the estimated desistance probability. The reported standard errors are adjusted for heteroscedasticity and preestimation error correction.
*$P<0.10$.
**$P<0.05$.
***$P<0.01$.

alternative to illegal income-generating activities can shorten residual career length and induce retirement of young criminals.[9]

The coefficients associated with the expected growth rate of legal income, though positive as expected, are small and statistically insignificant in both specifications. Taken at face value and in conjunction with findings of a (relatively) smaller and insignificant coefficient for ρ_c in Specification II, this would appear to indicate that beliefs about future performance in both markets are not relevant in determining retirement. Although these low coefficients may be attributable to a genuine short-sighted responsiveness to opportunities, a plausible alternative explanation exists. In particular, the empirical analysis reported has considered the effects of 1979–1982 income growth on retirement decisions: 3 years may not have been a sufficient time period to control for variability in ρ_l at the age range considered. The distinction between future and immediate wage growth patterns *in both*

[9]To examine the robustness of these findings, a similar exercise was also carried out for specifications including alternative deterrence variables, such as arrests, charges and sentences. The results are not reported here because the coefficients for these variables were both small in magnitude and largely statistically insignificant, and their inclusion did not alter the reported results.

occupations may be an important consideration in determining reasons and timing of crime desistance decisions.

To test further for expected pure age effects on retirement decisions, the variable AGE was included in the final logit equation. The parameter estimates in Table IV suggest an effect of age *per se* on desistance only in the full specification (Specification I). When possibly endogenous variables are excluded from the estimation of crime income, the coefficient of the AGE variable became small and statistically insignificant: The effect of time on rates of termination seems to have operated primarily through the depressive effect of age and criminal tenure on the individual's expected criminal reward.

7. CONCLUSIONS

Youth crime has been, for the past several years, a key social policy concern. An appraisal of the causes and seriousness of youth involvement in crime should rest, in part, on an understanding of the social and economic forces giving rise to the "natural" age gradient of crime. This paper examines the life cycle of criminal involvement. It presents and estimates a comprehensive economic model of crime which is used to explain the reasons for, and timing of, the decision to terminate a criminal career.

In particular, the findings suggest that economic incentives and opportunity costs exert a powerful influence on criminal career duration and desistance choices. One immediate implication of such findings is that policy parameters operating directly through the individual's cost of engaging in crime, especially for juveniles, could be appropriately manipulated to induce changes in career duration choices and, consequently, early retirement decisions.

On the other hand, the estimated effects of the variables measuring punishment costs and the availability of an attractive legal opportunity were comparable in magnitude, indicating that the "carrot" may be just as efficient as the "stick" in shortening the length of criminal careers. Youths in general, and minority youths in particular, comprise an especially distressed segment of the labor force. The evidence provided by this study suggests that public policies oriented toward enhancing legal opportunities can potentially play an important role in determining individual behavior by increasing the opportunity costs of criminal activities.

The study departs from the existing literature in important ways. With one principal exception (Viscusi, 1986a, b), this is one of the first individual level analyses of a sample not drawn from an offender population. Another distinctive feature of this study is its explicit consideration of the financial

rewards from crime in determining criminal career profiles and crime desist-
ance decisions, whereas past studies have focused primarily on the relation-
ship between crime participation and levels of criminal enforcement.

   Finally, the main contribution of this paper is its commitment to a
broader focus. There is overwhelming evidence revealing that the probability
of a criminal career becoming a lifetime occupation is extremely low and
that the typical pattern is for an individual to pursue a brief criminal career
until eventually settling into an exclusively legal job. Understanding the
natural history of this process may yield important insights into how
anticrime policies might be improved, and the work presented in this paper
provides a useful analytic framework toward this end.

ACKNOWLEDGMENTS

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