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January 2009

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January 2009

*This research was funded by grant SES-0417837 from the National Science Foundation. Dan Mears, John Roman, Bill Adams, Bowen Garret, and Austin Nichols provided valuable comments on earlier drafts. The author is solely responsible for all views expressed here, and for any errors. They should not be attributed to the National Science Foundation, the Urban Institute, or its trustees and funders.

MOTIVATIONAL STRUCTURES UNDERLYING JUDICIAL DISCRETION: AN INFORMATION THEORETIC INVESTIGATION

ABSTRACT

Judicial discretion has rightly been termed a puzzle. Given the several competing concerns that can influence judges when they sanction offenders and the institutional structures that typically constrain their decisions, the task of uncovering the motivational structures underlying judicial discretion has proven very challenging for scholars. This paper develops a behavioral model of federal judges exercising discretion pursuant to the Federal Sentencing Guidelines and derives testable implications regarding the amount of prison term they impose on convicted offenders. An information theoretic approach is used to investigate these assertions. The data reveal a host of information about judicial discretion including how various factors affect sanctioning decisions, how variation in case and offender attributes heighten or reduce judicial concerns, how judges juggle various competing concerns while exercising discretion, and how compliance with the guidelines competes with other judicial concerns.

Keywords: Judicial discretion, utility maximization, information theory, limited discretionary regimes.

JEL Classification: K4, C5

1. INTRODUCTION

Decisions made by humans are often bounded, limited, guided, or constrained by institutional structures within which they exercise discretion. For example, detailed rules usually govern hiring and firing practices as well as wage and promotion decisions in most organizations. The discretion of any single actor in pronouncing decisions regarding these outcomes is typically curtailed by such rules. Although the level, degree, and rigidity of these constraints may vary from one setting to another the label "Limited Discretionary Regime" may accurately describe most public institutions or governmental organizations. Besides constraining discretion directly, such institutional structures can also have indirect effects on the exercise of discretion. They may compel individual actors to substitute their paramount concerns for subsidiary ones. For example, applicant qualification may find itself relegated to lower importance if an organization is attempting to satisfy quotas. Thus, decisions made within such regimes could have very complex mechanisms underlying them. This makes the task of empirically investigating their motivational structures extremely difficult.

Decisions made by actors at various stages within the criminal justice system are a good example of outcomes that are generated within a Limited Discretionary Regime (henceforth LDR) and where several concerns or institutional structures may influence actors. Since decisions made by these actors directly impact the lives and liberties of individuals (suspects, defendants or offenders) as well as the general welfare of society (by upholding its values or squandering resources), investigating, understanding, questioning, and scrutinizing their determinants has always interested scholars in the social science and legal communities.

Using empirical inquiry to aid in this endeavor, scholars take one of two approaches. They sometimes rely on a *direct* approach (like conducting surveys) that aims to ascer-

tain directly from actors their decision-making criteria. Unfortunately, when determinants are theorized to involve controversial factors like race, ethnicity or gender, such direct approaches can be sub-optimal. Researchers must attempt to trick the actors into providing the sought information without overtly asking for it. This is still a direct approach, albeit of a different form, that generally entails considerable costs and is often difficult to implement.

More often they rely on an *inverse* approach whereby observed outcomes from real-world processes are modeled, and their determinants inferred from these models. Observed outcomes are said to reveal the motivational structures generating them. Despite its popularity among social scientists, existing strategies for using this approach are ill-suited for understanding decisions made within the criminal justice system because (i) multiple, possibly competing, concerns may motivate actors, and (ii) institutional structures may not allow actors unfettered discretion.

This paper utilizes an information theoretic variant of the inverse approach to investigate motivations underlying federal judges' sanctioning decisions. Testable implications of a utility maximizing judge—one who is attempting to balance several (possibly competing) concerns while imposing an appropriate prison sanction—are first derived. The paper considers judicial concerns relating to desert, deterrence, incapacitation, uncertainty, consistency, and guideline compliance. The empirical framework is designed to overcome the two main drawbacks of existing strategies noted above: an inability to take into account limits to discretion that federal judges (sanctioning pursuant to the federal sentencing guidelines) typically face; and an inability to isolate, identify, and estimate implications stemming from the various concerns that potentially influence judges.

The analysis offers clearer insights into the links between various judicial concerns and observable outcomes such as whether an offender is sentenced to some prison, the amount of the prison term, and whether judges depart from guideline prescriptions. Re-

tributive and utilitarian concerns were found to motivate judges to be harsher when sanctioning offenders, while uncertainty and temporal consistency concerns had the opposite effect. The analysis also provides insights into how judicial concerns are conditioned by case and offender attributes. Increases in severity of the offense and offenders' criminal history were found to heighten retributive, utilitarian, and guideline compliance concerns while reducing uncertainty and temporal consistency concerns. Similarly, when defendants pled guilty, they reduced judges' desert, deterrence, incapacitation, and guideline compliance concerns. The analysis also suggested that desert, deterrence, and incapacitation concerns are substitutes for one another—when one rises the others fall. Importantly, the sentencing guidelines were found to interfere with sound judicial decision-making: heightened guideline compliance concerns diminished more desirable (in a normative sense) motivations such as just desert, deterrence, and incapacitation.

The rest of the paper is organized as follows: The next section reviews the relevant sentencing literature and provides an overview of the highly structured regime within which federal trial court judges exercised discretion under the mandatory FSG. Section 3 develops a behavioral model of a utility maximizing judge imposing sanctions conditional on case and offender attributes. Section 4 explains how the information theoretic approach is used for testing implications derived from this behavioral model. Section 5 presents findings from applying the framework to Fiscal Year 2003 sentencing data from the United States Sentencing Commission. Section 6 concludes the paper with a discussion of findings and their implications.

2. BACKGROUND

2.1. The Existing Literature

Scholars from a variety of disciplines including sociology, criminology, political science, law, psychology, and economics have attempted to study and explain judicial behavior. To analyze the determinants of judge's decisions, scholars rely heavily on regression analysis, usually by deriving and estimating reduced-form equations. There exists, for example, a voluminous empirical literature assessing the influence of extra-legal factors on sentencing outcomes generated under some form of sentencing guidelines and, more specifically, under the FSG. These include studies measuring the influence of a defendant's personal characteristics such as race/ethnicity (Steffensmeier and DeMuth 2000, 2001; Bushway and Piehl 2002; Spohn and Holleran 2000; Albonetti 1997; McDonald and Carlson 1993), or gender (Kempf-Leonard and Sample 2001); the judge's identity (Hofer, Blackwell, and Ruback 1999; Anderson, Kling, and Stith 1999; Payne 1997) or, more specifically, the judge's race (Steffensmeier and Britt 2001); as well as the sentencing jurisdiction (Ulmer, Kramer, and Johnson 2001; Johnson 2005, 2006) on outcomes such as departures from guidelines (Kempf-Leonard and Sample 2001; Adams 1998); the extent of such departures (Maxfield and Kramer 1998); alternatives to incarceration (Engen et al. 2003); imprisonment decisions (most studies), and the amount of prison term imposed (most studies).

The methodological limitations of this literature are well documented (Wooldredge 1998; Spohn 2000; Mears 1998). Partly in response to those criticisms, recently, the need to control for the effects of decisions made by actors prior to the sentencing judge has been recognized by researchers. For example, models involving a 'presumptive sentence' have been proposed and estimated (Engen and Gainey 2000; Ulmer 2000; Mustard 2001). That is, given case characteristics, knowledge of the sentencing regime may be used to

construct a presumptive sentence for use as an additional predictor in the model. This way inferences about the remaining predictors are not contaminated by the decision of actors prior to the judge. Their effects are said to have been 'statistically' controlled. And if one imposes parametric constraints (typically of unity) on this measure, then one is modeling the judge's discretion to *deviate* from this measure (Griswald 1987; Bushway and Piehl 2002).

Similarly, censored sample models are now routinely employed to account for the partial recording of sentencing outcomes (for example, a probation term recorded as a prison term of 0 months). Furthermore, the choice between treating the censoring process and the outcome generation process as being the same or different is itself debated in the literature. Some researchers (Peterson and Hagan 1984; Steffensmeier and DeMuth 2000, 2001) argue that these decisions are distinct and should hence be modeled sequentially using Heckman's (1979) two step method to correct for sample selection bias in the prison term model. Others (Rhodes 1991; Albonetti 1997; Bushway and Piehl 2002) have argued that decisions made by sentencing judges can be modeled more appropriately within a Tobit framework that assumes one underlying latent process generating both outcomes (Tobin 1958).

These modeling advances, although improving substantially on bivariate or multivariate regression analysis, are still inadequate for studying the motivational structures underlying sentencing decision for two reasons. First, they do not permit scholars to isolate, identify, and investigate various concerns motivating judicial decisions. Scholars typically rely on sentencing theories to motivate their investigations or to justify their findings. However, the estimated reduced-form model may be consistent with more than one theoretical claim. For example, when scholars uncover that judges, on average, sanction males more harshly than females or minorities more harshly then non-minorities (by findings statisti-

cally significant coefficients in reduced-form regression equations), what can one conclude from this finding regarding why judges may be doing so? Is it because judges feel minorities deserve harsher punishment or is it because they believe imprisoning non-minorities will result in fewer averted crimes? Unfortunately, existing empirical investigations provide very limited insights into these nuances.

Second, these advances do nothing to control for the limited realm of sentencing possibilities contemplated by the judge. The realities of LDRs, such as those described next, are typically not reflected in these models. For example, typically used models do not constrain the model predictions to lie within legitimate bounds. If a model of judicial discretion is permitted to predict sanctions above or below the limits that the regime may place on the sentencing judge, then clearly this *model* does not adequately reflect the *reality* it purports to characterize.

2.2. Limits on Judicial Discretion under the Mandatory FSG

Limits on judicial discretion are ubiquitous. Over the last three decades the sentencing environment in the United States has transitioned from a primarily unstructured system to one in which sentencing in most jurisdictions is governed by some form of structure (Tonry, 1999). In contrast to just 30 years ago, today judges do not have the wide discretion they had then in deciding the type and amount of sanction to impose (Tonry, 1996). Although these regimes vary considerably from one jurisdiction to another, the system designed to curtail the discretion of federal judges—the Federal Sentencing Guidelines (henceforth FSG)—was, undoubtedly, the most comprehensive and most rigid of existing sentencing systems (Hofer, Blackwell, and Ruback, 1999; Cabranes and Stith, 1998).

The FSG were promulgated to structure sentencing in federal courts. They have evolved considerably since their implementation in 1987, and will continue to do so. In

United States v. Booker (543 U.S. 220 [2005]), for example, the Supreme Court effectively rendered the FSG advisory. Before that, the discretion that judges exercised pursuant to the FSG was very structured. Very little discretion resided with the judge in deciding what factors were to be considered relevant. Their role was initially limited to a mechanical "minimal-pair" (present/absent) determination of each of the factors that the guidelines deemed relevant (Cabranes and Stith, 1998). In most circumstances, the guidelines also determined the precise quantitative relevance of each of the factors. This computation yielded offense severity and criminal history scores which determined where in a two-dimensional sentencing grid the specific case/defendant fell. This cell then prescribed a sentencing range, bounded by a lower and upper limit (FSG Manual, 2005). Until the recent *Booker* ruling, with few exceptions, sentencing judges were expected to exercise discretion only within these guideline-prescribed bounds or those resulting from statutory limits. The FSG did, to be sure, list some exceptions when statutory limits could be ignored. For example, effective 1994, for certain drug conspiracy cases, under §5C1.2, judges could impose a sentence without regard to any statutory minimum sentence *if* the defendant satisfied certain criteria (referred to as the Safety Valve provision). However, these criteria were fairly rigid, related to facts, and were open to little interpretation (FSG Manual, 2005).

To offer defendants an incentive to provide "substantial assistance" (SA) to the government in the prosecution of another case or a co-defendant, the FSG did allow judges to sentence below prescribed limits (U.S.S.G. §5K1.1). This type of a departure would be considered *exogenous* (out of judicial control) as the motion for a SA departure could only be filed by the prosecution on behalf of the government. Although technically judges had the authority to deny a SA motion, a "vast majority of motions were [are] granted as a matter of course" (Maxfield and Kramer, 1998, 5 n. 11). Hence, researchers also referred to them as *prosecutor controlled* departures (Steffensmeier and DeMuth, 2000, 722). With-

out such motions, judges could *not* depart from the guidelines, with one notable exception. Under 18 U.S.C. §3553(b), judges could depart from the guidelines if they determined that there were relevant factors not included in the guideline computations which, if included, would have resulted in the defendant being sentenced outside the currently prescribed range (U.S.S.G. §5K2.0). Such departures would be considered *endogenous*, or judicial, because their need was determined by the sentencing judge. However, even if the sentencing judge endogenously departed from guideline prescriptions the imposed sentence still needed to be within statutory limits, if such limits were applicable.

Having decided on a sentence, the judge was then required to decide on the proportion of that sanction that could be substituted by alternatives to incarceration (for example community confinement or home detention). Given case characteristics, however, formal rules in the FSG constrained the types and amount of the substitutions judges could consider (FSG Manual, 2005).

Finally, the choice of whether or not to imprison an offender was conditional on that option being available. The computed offense severity and criminal history scores restrict the options available to sentencing judges. These options were largely determined by the "Zones" of the sentencing grid (A, B, C or D) from where the sentence is derived. For example, when sentencing in Zones C or D of the sentencing grid, unless the judge departed from the guidelines, some prison term was *mandated*.

As should be evident, the judicial discretion regarding incarceration that, until recently, did exist in the federal sentencing system was both limited and possibly distributed over several decision points. One would expected little room for judges in such a highly structured regime to make choices, let alone rational ones. Yet, as pointed out by Posner (2006, 412), "... judicial decisions, including those of federal judges, do not appear to be random." "So, ... " Posner goes on to ask " ... what *is* their motivational structure?"

(emphasis added).

2.3. Current Focus

The aim of this paper is to advance empirical scholarship in this field by developing and utilizing an information theoretic approach for investigating the motivational structures underlying judicial discretion. In order to proceed empirically, the paper first derives testable implications of theoretical claims regarding these motivational structures.

Judicial decision-making has rightly been termed a puzzle (Baum 2000). Given the unique setting in which these decisions are made, it is hard to imagine other analogous decision-making environments and, consequently, to borrow from existing scholarship in other fields. Nonetheless, researchers studying the courts and judges usually rely on one of two perspectives from which to approach judicial discretion—the economic or the psychological perspective. The economic perspective views the judge as a rational decision maker, a rational actor in the limited sense of being purposeful and deliberative in her decisions (Higgins and Rubin 1980; Posner 1993; Cohen 1991, 1992; Shavell 2004). This perspective treats judges as making decisions like everyone else (Posner, 1995b). The psychological perspective considers judges as individuals involved in a very specialized endeavor thereby almost requiring a "psychology of judging" (Schauer 2007; Guthrie et al. 2001). This implies, among other things, that judges think and decide unlike typical individuals. This is partly due to their training as lawyers and partly because they are bestowed with the unique duty of judging other individuals. A blend of the two approaches has been suggested by many as the best means of getting clearer insights into the motivational structures underlying judges' decisions (Baum 2007). This paper follows that hybrid approach.

The economic approach to decision-making provides a theoretical as well as an analytical framework for analyzing decisions made by actor in a variety of settings (Becker,

1993). It is both a theory and a methodology. This paper, though relying only partially on economic theories of decision making, relies heavily on the utility-maximizing methodology for deriving testable implications regarding the motivational structures underlying judicial discretion. The behavioral model and its implications are derived next.

3. THE BEHAVIORAL MODEL

Consider a utility maximizing judge with multiple and possibly competing concerns. Each of these concerns potentially influence the amount of sanction this judge imposes on a particular convicted offender. Let the jth concern be denoted by S_j and let the sanction S be a function of these concerns (that is, let $S = \nu(S_1, \ldots, S_J)$). Assume that J inverse function exist that allow us to write the concerns as a function of the sanction ($S_j = \phi_j(S)$). Then a judge's utility function—dependant on these J inverse functions as well as a set of case and offender specific attributes—may be denoted by

$$U = U(\phi_1(S), \ldots, \phi_J(S); X).$$

Accordingly, conditional on the attributes X, the judge sets the sanction at a level that maximizes her utility. In order to derive testable implications from this generic problem, there are two ways to proceed.

First, one can explicitly solve this problem for an optimum sanction amount. This approach would be set up, for example, as the following constrained optimization problem:

$$\max_S \quad U(\phi_1(S), \ldots, \phi_J(S); X) \quad \text{s.t.} \quad S \in (l, u)$$

where l and u are the statutory minimum and maximum sanction the judge is restricted to sanction within. If we can make some assumptions about the shape of the judicial utility

function and these assumptions admit a unique solution, then, presumably, we can solve $\frac{\partial U}{\partial S} = 0$ and obtain a link between the optimum sanction, the attributes, and statutory limits. Let this optimum solution be denoted by $S^* = g(X, l, u)$. Here $g(\cdot)$ can be a highly non-linear function of all the behavioral quantities of interest (such as $\frac{\partial U}{\partial \phi_1}, \ldots, \frac{\partial U}{\partial \phi_J}$ and $\frac{\partial \phi_1}{\partial S}, \ldots, \frac{\partial \phi_J}{\partial S}$) in addition to the attributes (X) and the statutory limits (l, u). Unfortunately, this approach would require us to specify the shape of the utility function completely.

Alternately, we could use the implicit function theorem to solve for each of the functions individually and derive a system of equations in the various ϕ_j. A sufficient condition for $\frac{\partial U}{\partial S} = 0$ is that each $\frac{\partial U}{\partial \phi_j} = 0$ hold individually. That is, we could solve $\frac{\partial U}{\partial \phi_j} = 0 \; \forall j \in J$ individually to obtain a system of optimal solutions $\phi_j^*(S) = g_j(X, l, u) \; \forall j \in J$. Note that the optimal solutions would be for each of the J inverse functions (concerns) and not the sanction itself. Provided that the system is identified—none of the concerns are implied by another or are redundant—the approach allows one to investigate each of the processes individually.

Of course, the estimation of this system would not be trivial. Somehow, while estimating this system, one would need to ensure that the underlying S is the same across all these equations (in other words, $\phi_j^*(S) \equiv \phi_j(S^*) \; \forall j \in J$). More on that in Section 4. Before that the paper turns to deriving precise definitions of the various competing concerns judges may have when sanctioning offenders—namely, each of the inverse functions ϕ_j that enter the judicial utility function.

3.1. Components of the Judicial Utility Function

Broadly, this paper groups components of the judicial utility function under the headings of concerns regarding just deserts, deterrence, incapacitation, uncertainty reduction, temporal consistency, and guideline compliance. One may view the just desert concerns as being mo-

tivated by retributive considerations whereas the deterrence and incapacitation concerns as stemming from consequentialist considerations. That is, judges use the sentences they impose as an instrument for accomplishing some other objective. On the other hand, one may view the uncertainty reduction and temporal consistency concerns as psychological barriers that capture cognitive limitations imposed by the real world due to uncertainty about the future and judges' desire to sanction consistently. Finally, guideline compliance concerns may be viewed as the institutional pressures that judges are subject to. Note that judges may not be *required* to sanction within guideline prescribed bounds. Rather, the barrier is psychological and captures such diverse concerns as having one's decisions appealed, reviewed and/or reversed. Each of these is briefly discussed below and the corresponding ϕ_j components are derived.

3.1.1. Proportional Retribution or Just Desert

Extracting proportional retribution is, arguably, one of the central functions of a judiciary in a democratic society (Von Hirsch 1976; Moore 1987). In order to not have the citizenry extract retribution for crimes committed against persons or groups, an independent institution such as the judiciary punishes the criminal on behalf of the citizenry. With this goal in mind, and given case and offender attributes, the judge must decide on an appropriate prison term to impose.

Suppose there exists an external reference sanction that the sentencing judge believes provides an objective amount of sanction deserved by this offender for this crime. For the purpose of this reasoning, it is sufficient that judges *perceive* this reference sanction to be objective. The sentencing guidelines provide precisely such a reference point. Guideline-based computations yield an upper δ^u and a lower bound δ^l. Assume that the mid point of the rage ($\delta^* = 0.5 \times \delta^l + 0.5 \times \delta^u$) is an appropriate (just) reference sanction. This

assumption may not be too outlandish. United States Sentencing Commission researchers surveying Federal judges in a 2002 study (USSC 2003) found, for example, that more than half the surveyed judges felt that the guidelines provided just punishment more often then not (median of 4 on a scale from 1 to 6).

Clearly the computations cannot take into account all aspects of the crime, and were never intended to. Judges, therefore, probably view this recommended sanction as an imperfect (noisy) quantification of proportional retribution. Consequently, if imposing sanctions for extracting proportional retribution is a concern of the judge, she would like to sanction as close as possible to this recommended sanction. Therefore, conditional on X, l, and u, the first aspect of S that should come into U is the divergence between the sanction and this objective amount, for example $(S-\delta^*)^2$. Hence, let $\phi_1(S) = (S-\delta^*)^2$.

3.1.2. General Deterrence

Another goal of sanctioning, one of several consequentialist and forward-looking goals, that can affect the amount of prison term imposed by a sanctioning judge is general deterrence. Under this goal, the judge is attempting to deter potential offender from committing crimes by setting an example of this offender (Posner, 1995a).

For this goal to influence the judge, she must believe that potential offenders are reasoning criminals and that they make offending decisions by weighing the differential costs and benefits of committing the crime (Becker, 1968). By setting this sanction, the judge is attempting to send a signal to these potential offenders about the costs they are likely to face if apprehended.

Given the heterogeneity in the pool of potential offenders, the judge has no way of knowing exactly how may offenders she will deter (η). However, she can make some reasoned computations regarding the marginal contribution of each additional unit of sanction.

Clearly, a sanction of 0 months will not deter any potential offender. Let each additional unit of sanction after that increases the number of potential offenders deterred. However, as the sanction amount increases, let its marginal deterrent effect diminish. Since the more risk averse potential offenders will be deterred with relatively small sanctions, potential offenders who are not yet deterred will require larger and larger sanctions to deter. These features are easily captured in the following assumptions:

$$\frac{d\eta}{dz} = \frac{1}{z} \qquad \forall z > 0$$

which suggests that the number of potential offenders deterred by a total sanction of S years can be computed as

$$\eta = 1(S > 0) \int^{S} \frac{1}{z} \mathrm{d}z = 1[S > 0] \log(S)$$

Strictly speaking, $\frac{\mathrm{d}\eta}{\mathrm{d}z}$ should only be proportional to z^{-1}. Since, ultimately, a parameter will be attached to each component, the constant of proportionality can be set to 1 without loss of generality. Therefore, if general deterrence is a concern for the judge then this term must enter her utility function. Let $\phi_2(S) = 1[S > 0] \log(S)$.

3.1.3. Offender Incapacitation

It has been argued that the surest way of preventing criminals from committing crime is by putting them behind bars—incapacitating them (Zimring and Hawkins 1995). Whether individuals to be incapacitated can be identified in advance of their crime commission is a controversy that continues to be debated (Reuter and Bushway 2007). However, if a judge takes into account concerns about incapacitating the offender, then some connection between the sanction and perceived risk this offender poses to society when (s)he is free must influence judicial discretion.

Suppose the judge believes that this offender, if not incarcerated, will re-offend within the next z years. In the judge's mind, this implies an annual offending rate of z^{-1}. Consequently, the judge feels that the number of crimes averted by incarcerating this offender between (her)his current age (A) and (her)his age at release ($A+\varepsilon S$) will be

$$\int_{A}^{A+\varepsilon S} \frac{1}{z}\,\mathrm{d}z = \int^{A+\varepsilon S} \frac{1}{z}\,\mathrm{d}z - \int^{A} \frac{1}{z}\,\mathrm{d}z = \log(A+\varepsilon S) - \log(A),$$

where ε is the proportion of the prison term that an offender is required to serve (85% in the federal system). If the judge takes offender incapacitation concerns into account, her utility function must therefore include this term. Let $\phi_3(S) = \log(A+\varepsilon S) - \log(A)$.

3.1.4. Uncertainty Reduction

The judge may have sufficient information or facts about the crime. However, the public safety concerns noted above are necessarily about the future and, as such, full of uncertainty (Tonry 1987). It is therefore reasonable to expect the judge to take uncertainty about the future into account.

Suppose, as assumed before, the judge feels that the offender will, if not incarcerated, re-offend within the next z years. What the judge is not sure about is exactly *when* this event will happen. The probability that the event will happen in a small time interval within the z years can also be computed as $\pi = z^{-1}$. Using the Shannon (1948) definition of uncertainty, the expected uncertainty in the judge's mind *per interval of time* can be computed as $-\pi \log \pi = z^{-1} \log z$. Of course, for some uncertainty to exist in the judge's mind, z must be positive. Hence, over a period of S years, the total uncertainty in the judge's

mind can be computed as

$$1[S>0]\int^{S}\frac{\log z}{z}\,\mathrm{d}z = 1[S>0]\frac{1}{2}\log^2(S)$$

where $\log^2 S \equiv (\log S)^2$. If uncertainty about the risk this offender poses to the public is important to the judge, then this term must enter her utility function. Therefore, let $\phi_4(S) = 1[S>0]\log^2(S)$.

3.1.5. Temporal Consistency

Consistency considerations (Ableson, 1968) can be instrumental in motivating judges if, as is commonly perceived, the consistency of sanctioning is a ready indicator of quality and fairness of sentencing. This component of the judicial utility function can be motivated in terms of commitment to future sanction. The logic runs something like this. In addition to imposing a sanction in the current case, the judge is aware that her decision is also a commitment to sanction similar cases in the future with similar severity. The judge's thinking may evolve over time (or with age). However, for the duration of *this* sanction, in all fairness to *this* offender, she would need to impose the same amount of sanction to all similar cases.

To quantify this kind of reasoning, let's assume that the judge feels (based on available attributes) that she will see this kind of case again within the next z years. This is another way of saying that the judge feels she will be required to sanction this kind of a case z^{-1} times a year. Hence, over the life of this sanction, she will have to impose sanctions on a total of

$$\int^{S}\frac{1}{z}\,\mathrm{d}z = \log(S)$$

similar cases. If, in all fairness to the defendant currently before her, she is to impose a

sanction of S years on each of those, then she is effectively "locking" herself into sanctioning $S\log(S)$ years to similar cases over the life of this sanction. If the judge is motivated by such fairness concerns, then this "commitment" to future cases must be part of her utility function. Therefore, let $\phi_5(S) = S\log(S)$.

3.1.6. Compliance with the Guidelines

Finally, all else being the same, a judge would like to comply with the sentencing guidelines as much as possible. This may be quantified in a number of different ways. The Federal Sentencing Guidelines, in particular, are designed to guide and restrict judicial discretion by using a grid system. Hence, guideline compliance can be quantified by defining a binary indicator that flags whether or not the sanction falls within the guideline prescribed bounds. In other words, the federal judge complies with the guidelines if she does not sanction above (below) the guideline prescribed upper (lower) bound (δ^u and δ^l respectively). Therefore, let $\phi_6(S) = 1[\delta^l \leq S \leq \delta^u]$.

Each of the concerns identified above can increase or decrease the judge's utility. To ease exposition and later computations appropriate signs can be added to them as well. Since judges are presumably more satisfied when they are deterring more offenders, obtaining larger incapacitation effects, or are complying with the guidelines and are less satisfied when they are further away from the objective proportional sanction, are more uncertain about the likely future offending of the offender, or when they are locking themselves into large future commitments, the latter three concerns may be defined as the negative of the derived transformations. Table 1 summarizes the various inverse functions motivated in this section to quantify the various judicial concerns (with appropriate signs).

*** Table 1 about here ***

3.2. Model Implications

Testable implications regarding the above model can be derived quite easily in a semi-parametric information-theoretic framework. Consider defining the unknown transformation (concerns) as expectations over appropriate ranges. That is, let

$$\phi_j(S) = \int_l^u \phi_j(v)p(v)\,\mathrm{d}v \qquad \forall j = 1,\ldots,J \tag{1}$$

where $p(v)$ is assumed to be a proper density quantifying the probability that the imposed prison term will be exactly v months ($p(v) = \Pr(S \equiv v)$). For this to be a proper density one need only impose the additional requirement that $\int_l^u p(v)\,\mathrm{d}v = 1$. Note also that the integration limits ensure that predictions will fall within statutory bounds and therefore will be sensible.

Next, one can make assumptions about how various attributes X are theorized to affect the concerns. These may include offender attributes and case characteristics as well as knowledge of the context in which sanctions are imposed (as captured, for example, by jurisdiction). To introduce these attributes into the model, one can use (1) to derive moment conditions. To the extent that these attributes are truly part of the model, they should independently covary with each of the functions $\phi_j(S)$. Hence, from (1), we get the implications

$$\mathbb{E}(X\phi_j(S)) = \mathbb{E}\left(X\int_l^u \phi_j(v)p(v)\,\mathrm{d}v\right) \qquad \forall j = 1,\ldots,J \tag{2}$$

which suggests the basic identifying restriction of this modeling strategy: *So long as the functions $\phi_j(S)$ are non-linear transformations of S, one is guaranteed that each of the covariances $\mathbb{E}(X\phi_j(S))$ will solve a different piece of the puzzle.* Note, there is no restrictions that the set of attributes X be different across the equations. The same set of X will

in general produce different covariances with the $\phi_j(S)$ as long as the $\phi_j(S)$ are not linearly related. Note also that X may include non-linear transformations of the attributes, for example X^2, $\log(X)$, and the like.

Of course, these implications can only be tested empirically if the density $p(v)$ can be estimated. Moreover, since the population covariances $\mathbb{E}(X\phi_j(S))$ are not actually observed, their observed sample analogs need to be used. The next section describes how the density $p(v)$ can be recovered from a sample of imposed sanctions. It also discusses how model implications can be tested, how quantities such as the marginal effects of case and offender attributes on the sanction amount can be computed, and how important implications regarding judicial preferences—such as the elasticity of substitution among competing concerns—can be identified and recovered.

4. ESTIMATION STRATEGY

This section begins with a definition of the sample counterparts to the population equations derived in (2) and then explain how the density may be estimated using a semi-parametric, information theoretic approach. First, it should be noted that statutory bounds will not, in general, be identical across sample cases for which sanctions are observed (see Figure 1 and the surrounding text below). Hence, in this section subscripts of n are introduce to identify distinct sample observations. The sample analogs of the population equations derived above can be written as

$$\sum_n x_{kjn}\phi_j(y_n) = \sum_n x_{kjn}\int_{l_n}^{u_n} \phi_j(v)p_n(v)\,\mathrm{d}v \qquad \forall k \in K_j; j \in J \tag{3}$$

where y_n is the observed sentence in a particular case. The adding up constraints can be written as

$$1 = \int_{l_n}^{u_n} p_n(v)\,\mathrm{d}v \qquad \forall n \in N \tag{4}$$

Although the set of attributes are indexed by $k \in K_j$ and are ϕ_j specific, this is not required. The notation is used merely to derive sample analogs in full generality. Clearly, there are an infinite number of densities that are consistent with conditions (3) and (4). How does one proceed?

4.1. The Information Theoretic Approach

The sample analogs derived above can be thought of as constraints implied by our theoretical reasoning on the possible shapes the density $p(v)$ can take. Hence, we need some way to derive the density function in *as conservative a way possible* while ensuring that the density is consistent with the evidence. Zellner and Highfield (1988) in an influential paper showed how the Maximum Entropy formalism can be used very fruitfully for precisely this purpose. In that original paper, the authors derived a general class of densities using a set of arithmetic moments. Ryu (1993) and Wu (2003), among others, extended that work to a general class of transformations not just arithmetic moments. In this paper, sample analogs of the theoretical implications are *exactly* in that general form. Hence, the same strategy can be used here.

The basic mechanism underlying all information theoretic approaches, building on the works of Shannon (1948) and Jaynes (1957), is to maximize the uncertainty implied by the density subject to all consistency and adding up constraints. See Golan, Judge, and Miller (1996) for a wide array of models that can be defined and estimated using this strategy. The

problem may be formulated mathematically as:

$$\max_{\{p_n(v)\}} \quad \sum_n -\int_{l_n}^{u_n} p_n(v)\log p_n(v)\,\mathrm{d}v \tag{5}$$

subject to (3) and (4). Note that since the judge is bound by statutory limits, the researcher has no uncertainty about the sanction being outside these bounds. As such, the entropy is integrated only over the *realm of possibility* in each case.

This is a standard constrained optimization problem that can be solved by variational methods. The information theoretic solution is

$$p_n(v) = \Omega_n^{-1}\exp\left(-\sum_j \phi_j(v)\sum_k x_{kjn}\beta_{kj}\right) \qquad \forall n \in N \tag{6}$$

where β_{kj} are the lagrange multipliers associated with each of the constraints (3) and Ω_n (called the partition function) is defined as

$$\Omega_n = \int_{l_n}^{u_n} \exp\left(-\sum_j \phi_j(v)\sum_k x_{kjn}\beta_{kj}\right)\mathrm{d}v \qquad \forall n \in N. \tag{7}$$

This final solution can also be used to derive a dual (unconstrained) optimization problem in the unknown β_{kj} (Golan, Judge, and Miller 1996) and can be solved quite easily.

4.2. Diagnostics and Inference

The dual unconstrained minimization problem falls under a general class of extremum estimators, $\hat{\beta} = \arg\min_\beta \mathscr{G}(\beta, \mathbf{y}, \mathbf{X})$. The consistency and asymptotic normality of these estimators can be established under general regularity conditions (Mittelhammer, Judge, and Miller 2000, 132–139).

Assuming that standard regularity conditions are met, one way to conduct hypothesis

tests is to construct and use the Entropy Ratio Statistic ($\mathscr{E}$). Since the value of the objective function measures the amount of uncertainty implied by the probabilities, we can assess the *uncertainty reducing contribution* of each (or groups) of the constraints by comparing the values of the objective function from restricted and unrestricted models. Like the Likelihood Ratio statistic, the Entropy Ratio statistic has a limiting χ^2 distribution with degrees of freedom equal to the number of parameters with values fixed (Jaynes 1979, 67).In a similar manner, one can obtain an estimate of the asymptotic covariance matrix of the Lagrange Multipliers by computing the negative inverted Hessian of the dual objective function. This covariance matrix can then be used to assess the stability of each of the Lagrange Multipliers without needing to estimate restricted and unrestricted versions of the models.

Note that in assessing the statistical significance of the Lagrange Multipliers β we are assessing whether or not knowledge about a particular attribute is relevant to the process under study. The lagrange multipliers measure the "shadow price" of the constraint. Hence, if an offender's race is not relevant to judges' concerns regarding guideline compliance, then the corresponding Lagrange Multiplier should be close to zero. In other words, the particular constraint does not add any information about the process. Testing the significance of β_{kj} only help establish the relevance of an attribute. It says nothing, directly, about the magnitude or direction of the impact of the attribute on particular concerns or outcomes. For that, one needs to compute the marginal effects of the attribute on particular outcomes or concerns.

Given estimates of the β_{kj} that optimize the dual objective function, one can recover the density $p(v)$ using (6). Then, expectations about the jth concern can be computed as $\hat{\phi}_j = \int_l^u \phi_j(v)p(v)\,\mathrm{d}v$ and expectations about the oth outcome can be recovered as $\hat{\psi}_o = \int_l^u \psi_o(v)p(v)\,\mathrm{d}v$.Examples of outcomes include the prison term, whether or not the offender

receives some prison, or whether or not the judge sanctions below the guideline prescribed minimum. The marginal effect of the kth attribute on the jth concern may now be recovered as

$$\frac{\partial \hat{\phi}_j}{\partial x_k} = \sum_i \hat{\rho}_{ji} \hat{\beta}_{ki} \qquad \forall k, j \in K, J \tag{8}$$

where ρ_{ji} is the covariance between the jth and ith concern, and is defined as

$$\rho_{ji} = \int_l^u \phi_j(v)\phi_i(v)p(v)\,\mathrm{d}v - \int_l^u \phi_j(v)p(v)\,\mathrm{d}v \int_l^u \phi_i(v)p(v)\,\mathrm{d}v \qquad \forall j, i \tag{9}$$

The variance of a concern may, therefore, be computed as ρ_{ii}. In a similar manner, the marginal effects of attribute k on outcome o may be computed as

$$\frac{\partial \hat{\psi}_o}{\partial x_k} = \sum_i \hat{\gamma}_{oi} \hat{\beta}_{ki} \qquad \forall k, o \in K, O \tag{10}$$

where γ_{oi} is the covariance between the oth outcome and ith concern, and is defined in a manner analogous to (9). Note that (10) allows a convenient decomposition of the effect of various attributes on the oth outcome that is attributable to, or stemming from, the ith concern. This decomposition is particularly helpful in directly assessing theoretical claims about *how* and *why* attributes affect certain outcome.

Can this strategy help identify important behavioral aspects of judicial discretion? One important feature about the preference of judges is the amount of substitution among the various concerns. To see how this aspect of judicial preference *is* identified, consider, for the moment, that we are able to estimate the density $p(v)$. The marginal rate of substitution (MRS) between any two components of the judicial utility function, say $\phi_j(S)$ and $\phi_i(S)$ is derived by fully differentiating the utility function w.r.t. these components and evaluating the equation at $\mathrm{d}U = 0$. Let U_j abbreviate $\frac{\partial U}{\partial \phi_j(S)}$. Then we can derive the MRS

between component j and i, denoted τ_{ji} below, as follows:

$$\begin{aligned} \mathrm{d}U = 0 &= U_j \mathrm{d}\phi_j + U_i \mathrm{d}\phi_i \\ \tau_{ji} = U_j/U_i &= -\mathrm{d}\phi_i/\mathrm{d}\phi_j \end{aligned} \tag{11}$$

It can be shown (see the appendix), based on (9), that the quantity on the right may be computed as

$$\tau_{ji} = -\left(\frac{\rho_{ji}}{\rho_{ii}}\right) \qquad \forall j,i \tag{12}$$

and the elasticity of substitution (denoted ε_{ji} below) between j and i can also be computed as

$$\varepsilon_{ji} = -\frac{\rho_{ji}}{\rho_{ii}} \times \frac{\mathrm{abs}(\phi_i)}{\mathrm{abs}(\phi_j)} \qquad \forall j,i, \tag{13}$$

where $\mathrm{abs}(x)$ refers to the absolute value of x.

5. THE EMPIRICAL APPLICATION

This section describes the data and discusses the analysis results.

5.1. The Data

The data for this analysis were obtained from the Federal Justice Statistics Resource Center and is available to the public at http://fjsrc.urban.org. The Bureau of Justice Statistics disseminates case processing records from a variety of federal criminal justice agencies through a contract to the Urban Institute who maintains the FJSRC. The United States Sentencing Commission provides its monitoring database to be archived at the FJSRC annually. The present analysis used the criminal sentencing data for fiscal year 2003.

From the population of all cases sentenced during fiscal year 2003, cases where there

were multiple counts were excluded from the analysis as were those cases with obvious data errors. Since the programming for this analysis was done in the integrated matrix language (IML) module of SAS which has limitations on the size of matrices that can be inverted efficiently, a random sample of 25,000 observations was drawn from the final data set for analysis purpose. The random sub-sample was compared to the original sample to ensure that the two had similar average characteristics. They did.

Table 2 shows descriptive statistics for the sample used in this analysis. The main criterion variable, term of prison imposed, ranged from a maximum of 366 months to a low of 0 months. The sample used includes offenders sentenced to some prison and those sentenced to no prison. The mean prison term was 28.6 months (with a median of 18 months).

Sentencing guideline computations yield, based on the offenders criminal history score and offense severity score, a guideline prescribed maximum and minimum sanction. However, depending on the zone of the guideline grid, the judge may substitute some or all the minimum sanction by a form of punishment other than incarceration. For example, in zones A and B, the judge may substitute all of the sentence by non-incarcerative options (like probation). Similarly, in zone C, the judge may substitute only half the sentence for non-imprisonment, but in zone D the judge must impose the entire sentence as a prison term. Hence, following these rules, the guideline prescribed minimum sanctions were first converted into the effective minimum terms of imprisonment that the guidelines prescribe.

Based on applicable statutes, each case also has a statutory maximum or minimum sanction that the judge must sentence within. Moreover, when mandatory minimum sanctions are applicable, as is the case for some drug weapons related offenses, they can trump (override) existing statutory or guideline prescribed bounds. Hence, using this information, a set of statutory minimum and maximum bounds that judges must sanction within were

created.

*** Table 2 about here ***

These bounds were adjusted further based on two additional factors. First, if the prosecutor sought a departure for "substantial assistance" then the judge may ignore all statutory and guideline prescribed bounds. Hence, the statutory and mandatory minimum sanction in these cases were set to 0. Effectively, if the prosecution sought a substantial assistance departure then the judge could sanction the offender to 0 months. Similarly, under the safety valve provision the judge could ignore the mandatory minimum sanction in certain drug conspiracy cases. As such, the judge could sanction offenders to 0 months in prison if she so desired. Taking all of these considerations into account, a pair of variables capturing the statutory minimum and maximum prison terms—that *bind* the judges decision—as well as a pair of guideline prescribed minimum and maximum prison terms—that *guide* the judge's decisions—were defined.

Table 2 provides descriptive on these variables as well. The statutory and guideline prescribed minimum sanctions ranged from a low of 0 to a high of 180 and 360, respectively, whereas the guideline prescribed and statutory maximum sanction ranged from a low of 6 and 12 months, respectively, to a high of 480 months each. The mean months of statutory minimum, guideline minimum, guideline maximum, and statutory maximum were, respectively, 3, 32, 42, and 182.

Defendant age ranged from a low of 204 months (17 years) to a high of 1020 months (85 years). The average defendant was 34 years old and half the defendants were younger than 32 years. The offense severity score ranged from 1 to 43 with a mean and median of about 15. The average defendant had 4 criminal history points (median of 2) with offenders ranging from no criminal history points to one with 90.

An overwhelming majority of offenders plead guilty (98%); 85% of them were males, 31% aliens, and 73% were white. A little less than half the offenders were Hispanics (44%). Most of the cases sentenced in this sample were for drug related offenses (32%) and immigration related offenses (25%). The remaining were for property related offenses (21%), weapons related offenses (10%), public order offenses (7%) and for violent offenses (3%). Though not displayed in the Table 2, the data had sufficient number of observations per federal judicial circuit to afford an opportunity to assess the variation in concerns across sentencing contexts as well. Unfortunately, attempts to model variation in concerns across judicial districts increased model complexity considerably and convergence problems were encountered.

*** Figure 1 about here ***

To graphically demonstrate the restrictive nature of the regime within which the observed prison terms were generated, Figure 1 displays the regions within which judges are required to sentence defendant as well as the region within which they are recommended to sentence. The white area represents the guideline prescribed region that judges are expected to sanction within, unless they depart from the guidelines. The light grey region below and above the thin white region are the areas where the judge may sentence if she feels the need to depart. However, the dark gray regions are outside the bounds of what judges can sanction–statutory bound. Hence, the upper and lower edges of the light gray areas define the upper and lower bounds of integration in (3) and the upper and lower edges of the white region define δ^l and δ^u, respectively.

5.2. Unconditional Models

The next two subsection discuss the main findings of the paper. A brief discussion of the unconditional models (those without any covariates) is first presented as are the model's

implications. Findings from the conditional models are provided and discussed following that.

Table 3 presents the lagrange multiplier estimates from the unconditional models. Note that since the concerns are dimensionless, the actual size of the parameter as well as its sign do not hold much meaning. In fact, scaling the inverse functions arbitrarily produces corresponding adjustments in each of the lagrange multipliers. Hence, what is more meaningful is whether each of the constraints independently help reduce some uncertainty. They do. In fact, all of the constraint have a lagrange multiplier that is significantly different from 0. In this sample, each of the transformation of the prison term (quantifying the various judicial concerns) are relevant in explaining some aspect of the distribution of the imposed prison term.

*** Table 3 about here ***

More interesting than their statistical significance is the implication regarding how they affect measured outcomes like prison term, the in/out decision, or the decision to sanction below the guideline prescribed minimum (a downward departure). Since the concerns are dimensionless, these effects are computed and presented as elasticities in table 4.

*** Table 4 about here ***

The findings in Table 4 comport perfectly with expectations, both in terms of size and direction. As one would expect, desert, deterrence and incapacitation concerns increase the expected prison term and the probability of the defendant receiving some prison term while reducing the probability of the defendant receiving a downward departure. Similarly, concerns about uncertainty and temporal commitments decrease the prison term and the probability of the defendant receiving some prison term but increase the chances that (s)he will receive a downward departure.

Interestingly, concerns about compliance with the guidelines (trying to stay within the thin white region in Figure 1) results in larger prison terms and more chances of imprisonment but a lowered probability of a downward departure. These signs make perfect sense when one recalls that the guidelines are criticized, among other things, for being too harsh. Hence, when judges are trying to comply with the guidelines they end up sanctioning imprisonment more often, for longer periods of time, and with fewer downward departures (compared to when they are less concerned about complying with the guidelines).

In terms of the magnitudes of the effects, the decision to imprison someone seems less responsive (inelastic) to changes in the various concerns whereas there is some variation among the prison term and downward departure outcomes. For example, the amount of prison term imposed seems to be relatively inelastic to just desert, temporal consistency, and guideline compliance concerns, yet fairly elastic (responsive) to general deterrence, incapacitation and uncertainty concerns. Similarly, with the exception of desert concerns, it seems the decision to depart downward is very responsive to all the concerns with the highest elasticities stemming from general deterrence, incapacitation, and uncertainty concerns.

5.3. Conditional Models

Unconditional models, though informative, mask a fair amount of heterogeneity among cases and offenders. Next, results of the fully conditional models are presented. First, Table 5 summarizes the signs and significance levels of the lagrange multipliers (see table's legend for notational definitions).

*** Table 5 about here ***

As in the unconditional models, since these parameters reflect shadow prices of the uncertainty reducing contribution of each of the constraints, not much should be read into the signs of the parameters. However, it is interesting to note that most attributes—case, offender and context based—are important in explaining the variation in some concern or another. Moreover, some attributes are only weakly relevant. For example, the race of the defendant (white verses non-white) seems not to be related with any of the major concerns. It only helps explain some variation in guideline compliance concerns. On the other hand, the ethnicity of the defendant (Hispanic versus non-Hispanic) seems to be related to desert, deterrence and uncertainty concerns but not to incapacitation, temporal commitment or guideline compliance concerns. These findings are contrary to the position taken by scholars who argue that race is an important predictor of prison term because of perceived or actual dangerousness—judges perceive non-whites and Hispanics as being more dangerous. Apparently, race has little to do with the offender incapacitation concerns. Hence, if judges do sanction Hispanics and non-whites for longer periods of time, it is *not* because of the perceived threats these individuals pose to society. It is for other reasons.

In order to test the relevance of groups of attributes in the model, Entropy Ratio ($\mathscr{E}$) statistics were next computed to test a variety of nested models. Table 6 summarizes these results. The first row of nested models are a comparison of the completely conditional models with models that remove all conditioning attributes from each of the concerns (given in the columns) and finally from all concerns (the last column, titled 'Combined'). As should be expected, the variation among each of the concerns is individually explained by the attributes included. There are 24 parameters estimated, per concern, in the conditional model (including the intercept). Hence, the degree of freedom 23. In each of the cases the $\mathscr{E}$ statistic rejects the nested model in favor of the full model.

*** Table 6 about here ***

The next row of tests corresponds to nested models with all offender attributes removed from the model. These include the dummy variables measuring whether the defendant plead guilty, the gender of the defendant, whether the defendant is white or Hispanic, and whether the defendant is an alien. With the exception of incapacitation concerns, all other concerns seem to vary with offender attributes. Once again, this is a surprising finding given that scholars highlighting racial, ethnic, or gender disparity in sentencing practices usually put forth arguments that link judges' sentencing decisions with the perceived dangerousness of the offender. The implications of this argument is that it is incapacitation concerns that are the cause of judges' disproportionate sentencing decisions. The findings presented in Table 6 do not support that claim. Put another way, despite the fact that race, ethnicity and gender seem to be relevant to the sanctioning decision of judges, their relevance cannot be statistically linked to incapacitation concerns.

The next row of models relate to the legally relevant factors (criminal history scores and offense severity scores). The guidelines specifically state that judges may use these factors in making sanctioning decision—over and above the computations in the grid system. These attributes, as a group, are relevant to all concerns with the exception of temporal consistency. Recall that temporal consistency relates to the concern that similar cases in the future will need to be sanctioned similarly. Hence it is surprising, once again, to see an attribute like offense severity not figure prominently in this concern. It is possible that this concern varies by a more broad conceptualization of "case type"—for example, by offense type. Lending some credibility to this possibility is the fact that, as Table 5 shows, the offense type variables are all statistically significant for the temporal consistency concern.

Finally, the models tested in the last two rows of Table 6 relate to the offense type variables and the circuit dummy variables. In all cases, the concerns are found to vary significantly with these factors (as groups of variables).

Although these findings and tests were related to the parameters of the models, they are, in of themselves, less interesting than their implications regarding variation in concerns. Implications of the conditional models, with respect to their marginal effects, are discussed next.

*** Table 7 about here ***

Table 7 presents the effects of various factors in heightening or reducing specific concerns. Once again, since these concerns are dimensionless, findings are presented in terms of the percent change in the concern resulting from a unit change in the attribute. The findings largely comport with expectations, both in terms of the directions and the magnitude of effects.

Increases in the seriousness of the crime and the prior criminal activities of the offender result in heightened desert, deterrence, and incapacitation concerns, while reducing uncertainty and temporal consistency concerns. Surprisingly, though, they also heighten guideline compliance concerns. A comparison across these effect suggests that unit increases in offense seriousness and criminal history result in the largest increases in desert concerns, relative to other concerns. This seems, at least on the face of it, a very predictable finding. Since offense seriousness and criminal history are the least controversial of factors considered by judges at sentencing, they are a good proxy for what an offender 'deserves' for the particular crime. However, higher offense severity and criminal history may also require more fine-tuning of the sentence for a particular case/defendant. As such, this may lead to heightened concerns about complying with the guidelines.

On the other hand, when defendants plead guilty, judges' desert, deterrence, and incapacitation concerns are largely reduced. Instead, the judge is more concerned about future uncertainty of what the defendant may do and that the judge will need to impose simi-

lar sanctions on similarly situated offenders in the future. Moreover, compliance with the guidelines seem less of an issue to judges when defendant plead guilty.

Among males and aliens, compared to females and non-aliens, judges are more worried with desert, deterrence, incapacitation and guideline compliance and less worried about future uncertainty and temporal consistency. The same is true for Hispanic defendant.

Variations of concerns across offense types are also very revealing. Property related offenses is the reference category in these conditional models. Hence, all comparisons are relative to that category. Just Desert concerns, for example, are heightened when judges sentence cases for any offense type, compared to property offense, with the exception of drug related offenses. Similarly, compared to property related offenses, all offense types heighten judges' deterrence and incapacitation concerns. As one would expect, compared to property related offenses, judges are less concerned about future uncertainty, temporal consistency, and, in some cases, compliance with the guidelines.

The findings for violent offenses are particularly revealing. The heightening of desert, incapacitation and deterrence concerns are heightened by the largest amount (relative to property offenses) when judges sanction an offender for a violent offense. In fact, compared to property offenses, incapacitation concerns are about 13% higher for violent offenses, but only about 4% higher for the remaining offenses. Similarly, judges' uncertainty and temporal consistency concerns are the lowest when sentencing offenders for violent crimes than all other crimes.

The models also yield very interesting implications with regards to the variation in concerns by circuit. The reference circuit is the 5th circuit (including LA, MS, and TX) hence all comparisons are relative to that. Note that judges in most circuits have lower desert, deterrence, and incapacitation concerns than judges in the 5th circuit, and have higher uncertainty and consistency concerns than judges in the 5th circuit. Interestingly,

among judges from all other circuits, judges from the 9th circuit (including CA, AZ, NV, OR, ID, MT, WA, AL, HI, Guam, and the Northern Mariana Islands) seem to have the lowest desert and guideline compliance concerns when sanctioning offenders. These findings may reflect variations in sentencing philosophies across these jurisdictions. Similarly, judges in the 2nd circuit (including CT, NY, and VT) seem to have the lowest deterrence and incapacitation concerns (relative to judges from other circuits) when sanctioning offenders. Although judges from most circuits seem to have lower guideline compliance concerns than the 5th, this is not true for all. Judges from the District of Columbia circuit seem to have heightened guideline compliance concerns relative to the 5th circuit judges.

The findings so far have discussed the effects of various attributes on concerns. It would also be interesting to assess what these models imply for the traditional types of outcomes. These include prison term, whether or not an individual gets some prison (commonly termed the in/out decision), and the decision to depart downward from the guideline prescriptions. Table 8 presents findings regarding the expected percent change in particular outcomes resulting from a unit change in the attributes.

*** Table 8 about here ***

The effects of attributes on these outcome largely reflect what is found elsewhere in the literature. Both criminal history and offense severity increase the prison term by roughly 5%; males and aliens receive prison terms about 12% and 14% higher than females and non-aliens (respectively); Hispanics receive prison terms about 6% higher than non-Hispanics; and defendant who plead guilty avoid a "trial penalty" of nearly 12%. As expected, violent offenders receive the longest prison terms, followed by offenders convicted of weapons related, immigration, drug related, public order, and finally property related offenses. A similar pattern, with reversed signs is observed for the downward departure decision. Surprisingly, however, the results suggest that none of the attributes

contribute, in any meaningful way, in explaining the in/out decision. Effects on the in/out outcome, owing to unit changes in the attributes, are all less than a percent.

Although the effects of attributes on various outcomes are interesting, in that they conform to expectation, one of the benefits of pursuing a structural approach to modeling the decision-making process of federal judges was to be able to study the motivational sources of these effects. In keeping with that aim, Table 9 presents a limited set decompositions of the marginal effects of various attributes on the prison term. Here, the presentation reverts to a marginal effects in level (in months) rather then percents so that the decompositions are easier to understand.

*** Table 9 about here ***

Each unit increase in the offense severity score is associated with a 1.7 month increase in the expected prison term. Note, however, that this marginal effect masks the source of the increase. In fact, the prison term would be only 0.02 month had the judge only been concerned about general deterrence. Had the judge only been motivated by incapacitation concerns, the prison term would only have been about 0.6 months longer. On the other hand, the desert concern, on its own, would have rendered a reduction in the prison term similar to the temporal consistency concern, on its own. Therefore, the overall positive effect of increased offense severity really is an aggregation over more nuanced effects stemming from a number of concerns.

The effects of pleading guilty is another case in point. The overall effect of pleading guilty is a reduction in prison term of nearly half a year. This reduction is due, in large part, to desert, deterrence, incapacitation, and temporal consistency concerns. However, the reduction would have been higher had it not been for uncertainty concerns and about guideline compliance concerns. Clearly, pleading guilty in a particular case demonstrates

to a judge the defendants acknowledgement of his(her) wrong-doing. However, it is unclear whether the judge perceives this as indicative of permanent remorse. Therefore, the judge may still consider uncertainty about the future as a means of reducing the size of the 'break' being offered to this individual. In a similar manner, pleading guilty is, according to the guidelines, not a grounds for reducing the sanction below the guideline prescribed bounds. This is because 'accepting responsibility' for ones actions has already been built into the guideline computations. Therefore, guideline compliance concerns seem to lower the 'trial penalty' that would otherwise have been imposed on individuals going to trial.

Among the demographic factors, gender provides an interesting example. The overall 'gender penalty' (males get prison terms roughly 2.6 months longer than females) seems to stem from incapacitation and uncertainty concerns. Judges imprison males longer than females for several reasons: They feel males deserve more punishment, that punishing males will deter more potential criminals, will directly avert more crimes, and that the uncertainty about the future requires that they be incarcerated longer. On the other hand, they feel compelled to reduce males' prison terms somewhat because of the need to sanction similar offenders in the future and because of concerns about complying with the guidelines. The last of these, guideline compliance concerns, may be viewed as a penalty for females rather than a break for males. Since the guidelines are gender neutral, when sanctioning females, judges probably feel pressured to give them higher sanctions (than they would have given their other concerns) based on a desire to comply with the guidelines.

A surprising finding emerges with regard to aliens. Judges would have liked to sanction aliens out of desert concerns for much longer terms than non-aliens. However, owing to temporal consistency concerns, aliens get a break. This is a particularly strong finding that needs further exploration and analysis.

5.4. Substitution Among Concerns

The last set of implications presented and discussed here relate to the substitution among concerns. Table 10 shows the elasticities of substitution among the various concerns that are relevant to judges decision-making process. This table offers several keen insights into the motivational structures underlying judicial discretion. Once again, since the concerns are dimensionless, all numbers presented in this table are elasticities. For example, the number -4.01 in the first row under the GD heading implies that a judge is willing to give up 4% of deterrence concerns for a 1% increase in desert concerns. Similarly, the number -0.12 in the second row under JD implies that the judge is indifferent between a 1% *in*crease in deterrence concerns and a 0.12% *de*creases in desert concerns.

*** Table 10 about here ***

First, the models imply that desert, deterrence, and incapacitation concerns (one retributive and the other utilitarian) are all substitutes for one another. Hence, these concerns compete with one another when judges are making sentencing decision. When any one of these concerns rises, in a particular case, it is at the expense of the other two.

Second, the psychologically motivated concerns—regarding uncertainty about the future and temporal consistency—are also substitutes for one another. When either one of them rises it is at the expense of the other.

Third, the psychological concerns are complements to the desert, deterrence, and incapacitation concerns. That is, when retributive or utilitarian concerns rise, they heighten uncertainty and temporal consistency concerns.

Finally, guideline compliance concerns are substitutes for the retributive and utilitarian concerns whereas they are complementary to the uncertainty and temporal consistency concerns. If one considers the retributive and utilitarian motives as concerns that judges

should, in a normative sense, take into account, then the analysis suggests that being concerned about complying with the guidelines *interferes* with or *competes* with sound judicial decision making.

The analysis also highlights the sensitivity of the substitution of one concern for another. For example, judges concerns are most sensitive to changes in desert concerns. In two-way comparisons, a 1% increase in just desert concerns needs to be more than offset by other concerns for the judge to be indifferent. On the other hand, increases in most concerns render a less than proportional adjustment in the guideline compliance concerns (the last column in the table), with the exception of desert concerns. Taken together these findings suggest that guideline compliance concerns are a constant, that do not fluctuate much when most other concerns rise or fall. The exception being desert concerns. When just desert concerns rise, they can even override guideline compliance concerns.

A similar analysis suggests that when guideline compliance concerns rise they offset desert less than proportionally, but offset deterrence and incapacitation concerns disproportionately. Similarly, when guideline compliance concerns rise they heighten uncertainty and temporal consistency concerns, disproportionately.

These findings provide interesting insights into two recent episodes in the evolution of the Federal Sentencing Guidelines. The first is the pressure that the justice department was perceived as putting on federal judges in 2003 when it was learned that the then Attorney General (John Ashcroft) had instructed staff to compile lists of judges that frequently departed from the guidelines (Weintraub and Kuehne, 2003). To the extent that this was a means of heightening judges guideline compliance concerns it must have come at the expense of desert, deterrence, and incapacitation concerns. Hence, when pressured in that manner, judges are more likely to think about complying with the guidelines than about sanctioning offenders based on their blame-worthiness, culpability, and the real or per-

ceived benefits that these sanctions can have for public safety in general.

The second relates to the recent Supreme Court rulings in the *Booker* and *Fanfan* cases. These rulings have effectively rendered the Federal Sentencing Guidelines advisory and have therefore alleviated judges' guideline compliance concerns almost entirely. It can, therefore, be conjectured that judges, post-*Booker* and *Fanfan*, will be more concerned with sentencing motives such as desert, deterrence, and incapacitation, and less about such complying with the guidelines. Similarly, with a reduction in guideline compliance concerns, judges now are able to craft sentencing more thoroughly (at least they may perceive this) so that uncertainty about the future and temporal consistency may weigh relatively less on their minds.

6. DISCUSSION

This paper has used an information theoretic framework to examine the motivational structures underlying judicial discretion. The behavioral model was derived using the analytical framework of the economic approach to behavior. Judges are assumed to maximize their utility while sanctioning offenders to prison. With the assumptions that the observed sanctions imposed by judges should reveal their underlying motivational structures, a set of concerns that may influence judges while making their decisions were first derived. These concerns—including desert, deterrence, incapacitation, uncertainty, consistency, and guideline compliance—covered four categories of concerns that may motivate judges (retributive, consequentialist, psychological, and institutional).

Next, implications of the ensuing models were derived and subjected to empirical testing. A large number of interesting findings emerge from this analysis.

Unconditional models confirmed that each of the concerns were in fact part of the decision making process of federal judges sentencing convicted offenders pursuant to the

FSG during fiscal year 2003. More specifically, the retributive and utilitarian concerns typically motivated judges to pronounce harsher prison terms while psychological concerns (like uncertainty and consistency) reduced the harshness of the sanction. Concerns about complying with guidelines typically resulted in harsher sanctions as well.

Conditional models were then estimated. These models provided further clarity into the decision-making process of federal judges. Although judges' concerns varied substantially across case and offender attributes as well as the context, some concerns were less responsive to variations in attributes than other. Increases in offense severity and criminal history typically heightened retributive, utilitarian, and guideline compliance concerns while reducing uncertainty and consistency concerns. When defendant plead guilty, they reduced judges' desert, deterrence, incapacitation and guideline compliance concerns. The same concerns were heightened when judges sanction males, alien or Hispanics. Desert, deterrence, and incapacitation concerns were highest among violent offenders.

Although males were sentenced more harshly than females, the reasons for this disparity was traced to incapacitation and uncertainty concerns. Similarly, although a substantial trial penalty was found, the analysis revealed that the lions share of that penalty comes from incapacitation and temporal consistency concerns: guideline compliance concerns actually reduce the amount of trial penalty received by defendants.

Typically, desert, deterrent, and incapacitation concerns were found to be substitutes for one another as were concerns about uncertainty and temporal consistency. Heightened concerns about desert, deterrence, and incapacitation were complemented by heightened uncertainty and consistency concerns. Guideline compliance concerns seemed to interfere (or compete) with sound judicial decision-making, if by sound decision-making we imply that judges should use the traditional motivations—desert, deterrence, and incapacitation—while sentencing defendants.

The findings summarized above offer several implications for future research, practice, and policy. First, traditional linear reduced-form models offer little guidance as to 'why' judges do what they do. Hence, to understand the motivational structures underling judicial discretion, a more structured approach is required. This paper has presented and applied one such framework that seems to offer keen insights into several aspects of judicial discretion.

Second, the types of concerns included in this analysis were limited to six. Scholars interested in distinguishing more nuanced theoretical claims will need to derive their implications explicitly in order to introduce them into the framework. For example, the analysis presented in this paper did not include rehabilitation concerns largely because it is difficult to reason how those concerns will manifest themselves in the amount of prison term imposed. Similarly, scholars interested in distinguishing between general and specific deterrence concerns (that is, deterring the same individual from future offending) may need to derive more nuanced inverse functions.

Third, theoretical claims about controversial aspects of judicial discretion—such as racial, ethnic, or gender disparities—are usually very specific. For example, the literature on racial and ethnic disparity usually interprets the presence of a race or ethnicity 'effect' as confirmation of the theoretical claim that judges typically perceive minorities to be more dangerous. This suggests that judges impose harsher sanctions on these groups due to incapacitation concerns. The analysis presented in this paper refutes this line of reasoning. Although these effects were found, they are present for reasons other than the theory that is used to justify them.

Fourth, for policy and practice, the analysis presented in the paper suggests clear evidence of the consequences of implicit (if not explicit) pressures on judges. Despite the independence of the judiciary, institutional pressures stemming from one branch of gov-

ernment may interfere with sound decision-making in another. Of course, there is informal acceptance of this proposition. However, the analysis presented here provides evidence of the amount of such interference.

Finally, entities such as Sentencing Commissions, that are tasked with designing institutional structures that limit, bound, guide, or otherwise constrain the discretion of actors need to consider the larger implications of these structures *prior* to their implementation. These structures should be fine-tuned so that the rigidity of the limited discretionary regime does not interfere too much with sound decision making. An analytical framework, such as that developed here, can be an effective tool in achieving that trade-off optimally.

APPENDIX: DERIVING THE MARGINAL RATE OF SUBSTITUTION

For an unconditional model, given the estimated density

$$p(v) = \Omega^{-1} \exp\left(-\sum_j \phi_j(v)\beta_j \right) \qquad \forall v \in (l,u),$$

where Ω is the partition function, one can compute the expected value of any of the functions ϕ_j as $\phi_j = \int_l^u \phi_j(v)p(v)\,\mathrm{d}v \;\forall j \in J$. Since the only way this expectation can change is through a change in the underlying Lagrange multipliers β_j, one may pose the following question: *What change can be expected in ϕ_j and ϕ_i with respect to a unit change in β_i?* Note, the effects of a change in the *i*th Lagrange multiplier are being assessed on expectations about the *j*th as well as the *i*th concern. Given the functional forms above, it is easy to see that

$$\frac{\partial \phi_j}{\partial \beta_i} = \rho_{ji} \quad \text{and} \quad \frac{\partial \phi_i}{\partial \beta_i} = \rho_{ii}$$

so that, one can get

$$\tau_{ji} = -\left(\frac{\partial \phi_j}{\partial \beta_i}\right) \Big/ \left(\frac{\partial \phi_i}{\partial \beta_i}\right) = -\frac{\partial \phi_j}{\partial \phi_i} = -\frac{\rho_{jj'}}{\rho_{jj}}$$

This quantity is the marginal rate of substitution among concerns and the elasticity of substitution may be obtained by appropriately scaling the quantity by a ratio of the absolute values of each of the involved concerns.

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Table 1: Inverse functions linking sanctions to various concerns entering the judicial utility function.

Inverse Function	Judicial concern
$\phi_1(S) = -(S-\delta^*)^2$	Just Deserts (JD)
$\phi_2(S) = +1[S>0]\log(S)$	General Deterrence (GD)
$\phi_3(S) = +\log(A+\varepsilon S) - \log(A)$	Offender Incapacitation (OI)
$\phi_4(S) = -1[S>0]\log^2(S)$	Uncertainty Reduction (UR)
$\phi_5(S) = -S\log(S)$	Temporal Consistency (TC)
$\phi_6(S) = +1[\delta^l \leq S \leq \delta^u]$	Guideline Compliance (GC)

Table 2: Sample characteristics for convicted defendants sentenced by federal judges pursuant to the Federal Sentencing Guidelines, Fiscal Year 2003.

Variables	Mean	Median	Min	Max
Prison Term (mos)	28.6	18	0	366
Statutory Minimum (mos)	3.0	0	0	180
GL Prescribed Minimum (mos)	32.1	24	0	360
GL Prescribed Maximum (mos)	42.1	30	6	480
Statutory Maximum (mos)	182.7	120	12	480
Defendant Age (mos)	408.0	384	204	1020
Offense Severity Score (range 1-43)	15.6	15	1	43
Criminal History Points (range 0-90)	4.0	2	0	90
Defendant Plead (%)	98.3			
Male Defendant (%)	85.5			
Alien Defendant (%)	31.8			
White Defendant (%)	73.3			
Hispanic Defendant (%)	44.9			
Immigration Related Offense[a](%)	25.8			
Violence Related Offense[a](%)	3.3			
Drug Related Offense[a](%)	32.6			
Public Order Related Offense[a](%)	7.3			
Weapons Related Offense[a](%)	9.6			

[a] Most serious offense

Sample size = 25,000.

Table 3: Unconditional model lagrange multiplier point estimates, asymptotic standard errors, Wald tests, and p-values.

Concern		Parameter	a.s.e.	Wald χ^2	p-val
JD	Just Desert	0.000742	0.000016	2142.0	0.00
GD	General Deterrence	-0.413706	0.009929	1736.1	0.00
OI	Offender Incapacitation	4.689972	0.848149	30.6	0.00
UR	Uncertainty Reduction	0.040148	0.008733	21.1	0.00
TC	Temporal Consistency	0.014052	0.000375	1404.9	0.00
GC	Guideline Compliance	3.029693	0.021056	20703.1	0.00

Table 4: Median elasticity of outcome to concerns, unconditional models.

	Concerns					
Outcomes	JD	GD	OI	UR	TC	GC
Prison Term	0.132	1.215	1.014	-1.126	-0.831	0.376
Some Prison	0.006	0.042	0.022	-0.028	-0.013	0.008
Downward Departure	-0.602	-2.885	-2.328	2.638	1.900	-1.448

Table 5: Lagrange multiplier estimated signs and significance, conditional models.

Variables	JD	GD	OI	UR	TC	GC
Offense Severity Score	−−	0	++	−−	0	++
Criminal History Points	−−	++	0	−−	0	++
Defendant Plead	−−	0	0	0	++	0
Male Defendant	++	++	+	−−	+	−−
Alien Defendant	++	++	0	−−	++	++
White Defendant	0	0	0	0	0	−−
Hispanic Defendant	++	+	0	−−	0	0
Immigration Related Offense[a]	++	0	++	−−	++	−−
Violence Related Offense[a]	0	0	++	−−	++	−−
Drug Related Offense[a]	++	0	++	−−	++	−−
Public Order Related Offense[a]	−−	0	++	0	++	0
Weapons Related Offense[a]	0	−−	++	−−	++	0
Circuit00	−−	−−	0	++	0	++
Circuit01	0	−−	+	++	++	++
Circuit02	−−	−−	+	++	0	0
Circuit03	0	−−	0	++	−−	0
Circuit04	0	−−	0	0	−−	+
Circuit06	++	−−	0	0	++	−
Circuit07	0	−−	−−	0	−−	−−
Circuit08	0	−−	0	+	0	+
Circuit09	−−	−−	0	0	0	−−
Circuit10	0	−−	−	0	0	0
Circuit11	+	−−	0	0	0	0

[a] Most Serious Offense

Legend: ++ = positive $> 95\%$; + = positive $> 90\%$; – – = negative $> 95\%$; – = negative $> 90\%$; 0 = statistically insignificant with 90% confidence

All models include an intercept (not shown)

Table 6: Entropy ratio statistics and relevant degrees of freedom for testing the exclusion of groups of attributes, by judicial concerns.

	JD	GD	OI	UR	TC	GC	Combined
Null Models							
$\mathscr{E}$	1158.7	703.6	317.0	2465.7	1196.7	1417.8	15558.0
df	23	23	23	23	23	23	138
Less Offender Attributes							
$\mathscr{E}$	114.4	103.3	7.4*	129.4	77.7	27.8	1286.7
df	5	5	5	5	5	5	30
Less Case Attributes							
$\mathscr{E}$	30.5	195.2	139.1	1394.6	1.4*	688.7	6582.5
df	2	2	2	2	2	2	12
Less Offense Dummy Variables							
$\mathscr{E}$	424.2	12.2	125.5	194.8	497.2	135.7	1458.3
df	5	5	5	5	5	5	30
Less Circuit Dummy Variables							
$\mathscr{E}$	136.9	103.2	31.9	55.4	48.2	411.3	1859.7
df	11	11	11	11	11	11	66

* Cannot be rejected with 95% confidence

Table 7: Median percent change in judicial concerns for every unit change in individual attributes.

	Concerns					
Attributes	JD	GD	OI	UR	TC	GC
Offense Severity Score	22.5	3.9	5.1	-5.1	-7.0	9.2
Criminal History Points	15.3	3.9	5.2	-4.8	-7.5	5.6
Defendant Plead	-32.3	-9.5	-11.6	8.2	17.6	-13.4
Male Defendant	28.6	7.8	11.9	-10.4	-15.6	6.0
Alien Defendant	25.3	10.4	13.9	-12.9	-16.6	3.2
White Defendant	-12.4	-1.2	-2.7	1.9	3.4	-7.0
Hispanic Defendant	14.0	4.6	6.0	-6.2	-8.4	3.6
Immigration Related Offense[a]	6.3	4.3	3.8	-5.1	-3.5	-2.8
Violence Related Offense[a]	9.0	8.0	13.6	-12.8	-17.8	-2.8
Drug Related Offense[a]	-1.1	3.1	3.7	-4.6	-3.7	-3.8
Public Order Related Offense[a]	1.5	1.8	2.8	-3.3	-4.3	0.0
Weapons Related Offense[a]	3.8	1.6	4.3	-7.3	-6.7	0.0
Circuit00	-24.3	-11.9	-20.4	18.6	26.7	4.0
Circuit01	-21.0	-8.5	-12.6	10.8	15.7	0.1
Circuit02	-62.7	-16.5	-26.2	19.7	32.1	-18.7
Circuit03	-55.4	-16.0	-23.4	18.3	29.1	-17.7
Circuit04	-14.1	-6.2	-8.3	7.1	10.2	0.0
Circuit06	-39.5	-9.3	-14.1	9.5	17.8	-16.0
Circuit07	-15.8	-5.3	-7.1	3.8	8.7	-6.6
Circuit08	-28.8	-8.6	-13.1	10.3	16.1	-7.0
Circuit09	-74.2	-13.3	-16.0	11.9	23.3	-34.6
Circuit10	-36.3	-9.1	-13.9	9.9	17.8	-12.3
Circuit11	-15.1	-6.1	-8.6	6.8	10.6	-1.7

[a] Most serious offense

Table 8: Median percent change in sentencing outcomes for every unit change in individual attributes.

	Outcomes		
Variables	PT[b]	IO[c]	DD[d]
Offense Severity Score	5.2	0.1	-25.8
Criminal History Points	5.2	0.1	-16.9
Defendant Plead	-11.8	-0.1	38.4
Male Defendant	12.0	0.2	-24.6
Alien Defendant	14.0	0.3	-22.3
White Defendant	-2.8	0.0	18.9
Hispanic Defendant	6.0	0.1	-14.6
Immigration Related Offense[a]	3.7	0.3	24.5
Violence Related Offense[a]	13.7	0.3	8.2
Drug Related Offense[a]	3.6	0.2	24.2
Public Order Related Offense[a]	2.8	0.1	-4.1
Weapons Related Offense[a]	4.3	0.2	-7.9
Circuit00	-20.6	-0.4	-11.6
Circuit01	-12.7	-0.3	11.6
Circuit02	-26.6	-0.4	60.1
Circuit03	-23.6	-0.4	60.9
Circuit04	-8.3	-0.2	8.8
Circuit06	-14.3	-0.2	46.7
Circuit07	-7.2	-0.1	24.3
Circuit08	-13.3	-0.2	26.4
Circuit09	-16.4	-0.2	95.2
Circuit10	-14.1	-0.2	37.7
Circuit11	-8.7	-0.2	12.9

[a] Most serious offense

[b] Prison term imposed

[c] In-out decision

[d] Downward departure

Table 9: Decomposition of the mean marginal effects of select attributes on the months of prison term imposed by judges, stemming from various judicial concerns.

Variables	JD	GD	OI	UR	TC	GC	All[a]
Offense Severity Score	-0.09	0.02	0.59	0.97	-0.06	0.34	1.77
Criminal History Points	-0.02	0.31	-0.09	0.87	0.02	0.08	1.17
Defendant Plead	-0.79	-0.64	-2.62	1.13	-3.88	0.36	-6.44
Male Defendant	0.69	0.67	1.37	2.11	-1.36	-0.80	2.67
Alien Defendant	4.30	1.53	-1.15	3.67	-7.88	0.50	0.97
White Defendant	0.12	-0.01	0.70	-0.31	-0.89	-0.61	-1.00
Hispanic Defendant	0.67	0.34	-0.61	1.78	-1.26	0.04	0.96

[a] Sum across individual components (see (10) for derivation)

Table 10: Median elasticity of substitution among judicial concerns, conditional models.

	JD	GD	OI	UR	TC	GC
JD	...	-4.01	-2.33	2.97	1.80	-2.59
GD	-0.12	...	-0.58	0.62	0.44	-0.12
OI	-0.18	-1.42	...	1.12	0.78	-0.32
UR	0.12	1.30	0.85	...	-0.62	0.22
TC	0.20	1.69	1.27	-1.39	...	0.40
GC	-0.24	-1.70	-1.41	1.58	1.17	...

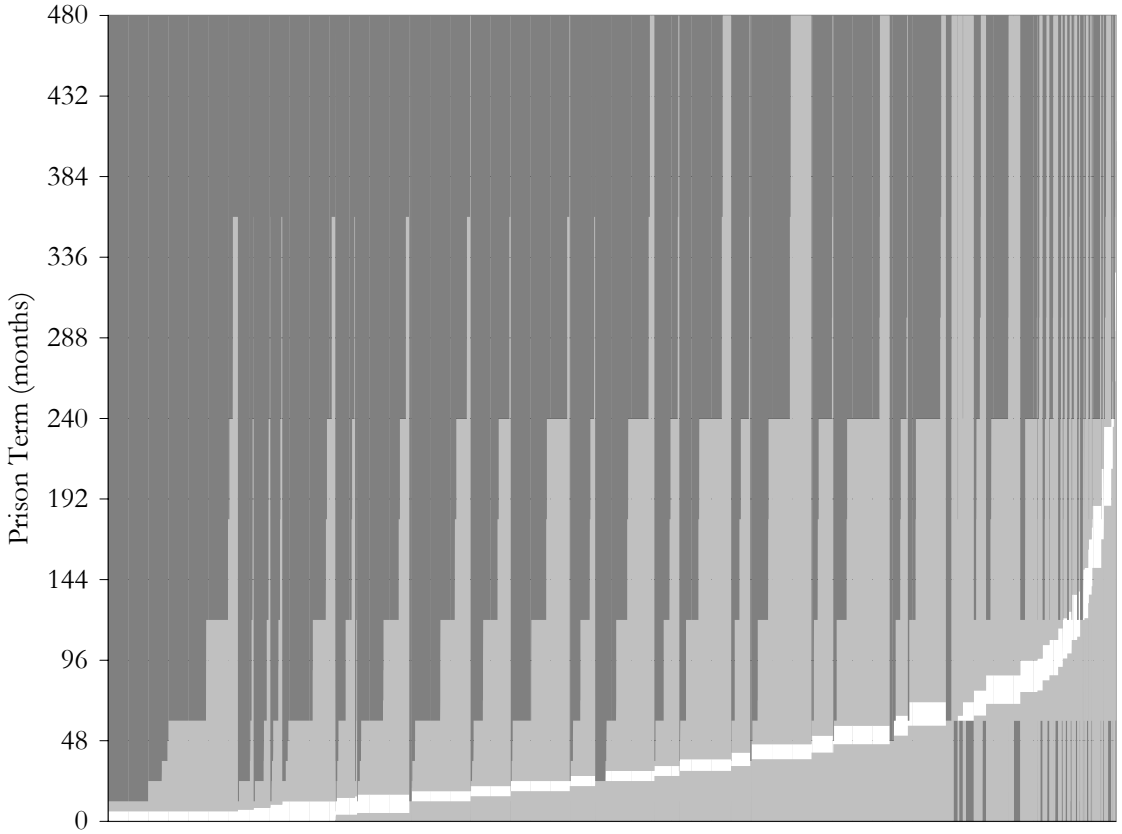

Figure 1: The Limited Discretionary Regime within which federal judges exercise discretion