Evidence Suppression by Prosecutors: Violations of the *Brady* Rule*

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Abstract

We develop a model of individual prosecutors (and teams of prosecutors) to address the incentives for the suppression of exculpatory evidence. Our model assumes that each individual prosecutor trades off a desire for career advancement (by winning a case) and a disutility for knowingly convicting an innocent defendant. We assume a population of prosecutors that is heterogeneous with respect to this disutility, and each individual's disutility rate is their own private information. A convicted defendant may later discover exculpatory information; a judge will then void the conviction and may order an investigation. Judges are also heterogeneous in their opportunity costs (which is each judge's private information) of pursuing suspected misconduct. We show that the equilibrium information configuration within the team involves concentration of authority about suppressing/disclosing evidence. We further consider the effect of angst about teammate choices, office culture, and the endogenous choice of effort to suppress evidence.

1. Introduction

In the United States, *Brady v. Maryland* (1963) requires that prosecutors disclose exculpatory evidence favorable to a defendant; not disclosing is a violation of a defendant's constitutional right to due process. The *Brady* Rule requires disclosure of evidence "material" to guilt or punishment, where evidence is material if its disclosure could change the outcome. In a series of judicial decisions this was extended to include: 1) evidence that can be used to impeach a witness; 2) evidence favorable to the defense that is in the possession of the police; and 3) undisclosed evidence that the prosecution knew, or should have known, that their case included perjured testimony (see Kozinski, 2015, and Kennan, et. al., 2011). One standard rationale for this rule is that the prosecution (i.e., the state) has considerably more power and greater access to resources (e.g., the police as an investigative tool) than the typical criminal defendant. An authority on prosecutorial misconduct[1] has observed that "... violations of *Brady* are the most recurring and pervasive of all constitutional procedural violations, with disastrous consequences ..." (Gershman, 2007, p. 533).

As an example of a collection of *Brady* violations, in 1999 John Thompson, who had been convicted, separately, of armed robbery and of murder and had been on death row in Louisiana for fourteen years, was within four weeks of his scheduled execution when a private investigator stumbled across blood evidence relevant to Thompson's defense in the armed robbery, which prosecutors in the Orleans Parish District Attorney's Office had suppressed.[2] Justice Ginsburg's

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[1] See Gershman (2015) for an extensive discussion of the different forms of prosecutorial misconduct. These include (but are not limited to) nondisclosure of evidence, misconduct in the grand jury, abuse of process, misconduct in plea bargaining, in jury selection, in the presentation of evidence, in summation, and at sentencing.

[2] Thompson was (strategically) prosecuted sequentially for these two unrelated crimes. This was done so that a conviction for the armed robbery would weaken his defense in the murder prosecution; he was convicted of both crimes. After being found innocent of murder in a retrial, Thompson sued Harry Connick, Sr. in his capacity as District Attorney for the Parish of Orleans. At trial, Thompson won $14 million dollars compensation from the Parish, but the U.S. Supreme Court in a 5-4 decision later voided the award. The description here and elsewhere in the paper is taken from a combination of the majority opinion authored by Justice Thomas and, especially, the dissenting opinion authored by Justice Ginsburg in *Connick v. Thompson*, 563 U.S. 51 (2011).

dissent in *Connick v. Thompson* details how all of the aforementioned aspects of *Brady* protection were violated in Thompson's cases.[3]   Judge Alex Kozinski, a past Chief Judge on the U.S. Ninth Circuit Court of Appeals, has argued that "There is an epidemic of *Brady* violations abroad in the land" (*United States v. Olsen*, 737 F.3d 625, 626; 9th Cir. 2013), and listed a number of federal cases involving *Brady* violations. The few studies on prosecutorial misconduct that exist have found thousands of instances of various types of prosecutorial misconduct, including many *Brady* violations (see Kennan et. al., 2011).

1.1 This Paper

Motivated by the problem of suppression of exculpatory evidence, we develop a model of individual prosecutors and prosecutorial teams. Teams are employed to share effort, to capture the benefit of diverse talents, and to train less-experienced prosecutors. We intentionally abstract from these legitimate benefits of teams, so as to focus on an illegitimate activity: the choice by prosecutors to suppress evidence in violation of a defendant's *Brady* rights, which is facilitated by the (endogenously-determined) compartmentalized receipt of exculpatory evidence.

Our model assumes that each individual prosecutor trades off a desire for career advancement (by winning a case) and a disutility for knowingly convicting an innocent defendant by suppressing exculpatory evidence. We assume a population of prosecutors that is heterogeneous with respect to this disutility, and each individual's disutility is their own private information. A convicted defendant may later discover exculpatory evidence. To simplify matters, we assume the discovered evidence is brought to a court where a judge will then void the conviction and may order

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[3] The blood evidence was artfully hidden; in the murder case, a witness's description was substantially modified to resemble Thompson and another "witness" (who better fit the original witness's description) provided perjured testimony against Thompson.

an investigation of the prosecutors from the case, depending upon her (privately known) disutility of pursuing an investigation.[4] If a prosecutor is found to have violated the defendant's *Brady* rights, the prosecutor is penalized. The anticipated game between the prosecutors and the reviewing judge is the main consideration of this paper.

1.2 Related Literature

Economists have developed an extensive literature on the incentives for agents (usually sellers in a market) to reveal information (see Dranove and Jin, 2010, for a recent survey of the literature on the disclosure of product quality). A standard result concerning the costless disclosure of information is "unraveling" wherein an informed seller cannot resist disclosing the product's true quality to avoid an adverse inference (see Grossman, 1981, and Milgrom, 1981). Complete unraveling does not occur if disclosure is costly or if there is a chance the seller is uninformed.[5]

Possibly closest to our paper is Dye (2017); in both Dye's paper and our paper, an agent may or may not possess private information but, if he has it, he has a duty to disclose it. Failure to disclose may be detected and entails a penalty. In Dye, the private information is about the future value of an asset, which is priced in the stock market. After the pricing stage, a fact-finder audits the agent with an exogenous probability; the penalty for failing to disclose is consistent with securities law. Our model differs in that our agent also has a moral cost associated with the

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[4] In reality, prosecutorial accountability is addressed via a variety of approaches in the different states; for example, in North Carolina cases referred to the State Bar (a government agency) are handled by a separate (civil) court, while in New York suits proceed via private lawsuits within the usual appeals system. We have simplified the response of the legal system to a reviewing judge ordering an investigation; for more institutional detail, see Keenan, et. al., 2011.

[5] Matthews and Postlewaite (1985) and Shavell (1994) analyze an agent who chooses whether to acquire information and whether to disclose it. They focus on voluntary versus mandatory disclosure and find that mandatory disclosure may discourage information acquisition. Garoupa and Rizzolli (2011) apply this finding to the *Brady* rule. They argue that a prosecutor may be discouraged from searching for additional evidence (which might be exculpatory) if its disclosure is mandatory, and they show that this could harm an innocent defendant.

consequences of his failure to disclose, and there is an endogenous investigation decision made by a judge. Furthermore, we extend the one-prosecutor model to consider a team of prosecutors that can organize itself in terms of the receipt and disclosure of exculpatory evidence.

Our prosecutor's payoff function includes aspects of career concerns and moral concerns about causing the conviction of a defendant he knows to be innocent. The theoretical literature on plea bargaining and trial involves several different prosecutorial payoff functions that place a varying amount of weight on these two aspects. Landes (1971) assumes the prosecutor maximizes expected sentences, whereas Grossman and Katz (1983), Reinganum (1988), Bjerk, (2007), and Baker and Mezzetti (2011) employ objectives that approximate social welfare. Daughety and Reinganum (2016) assume that a prosecutor benefits from longer expected sentences, but endures informal sanctions (such as loss of an election) from members of the community who might think the prosecutor is sometimes convicting the innocent and other times allowing the guilty to go free.

Empirical work on prosecutorial objectives finds evidence of career concerns, but also a preference for justice. Glaeser, Kessler, and Piehl (2000) find that some federal prosecutors are motivated by reducing crime while others are primarily motivated by career concerns. Boylan and Long (2005) find that higher private salaries are associated with a higher likelihood of trial by assistant U.S. attorneys (trial experience may be valuable in a subsequent private-sector job). Boylan (2005) finds that the length of prison sentences obtained is positively related to the career paths of U.S. attorneys. McCannon (2013) and Bandyopadhyay and McCannon (2014) find evidence that prosecutors up for reelection seek to increase the number of convictions at trial.

1.3 Plan of the Paper and Overview of the Results

In all versions of the model we have one reviewing judge (J, whose type is her disutility of

an investigation; this is J's private information) and one defendant (D, whose type is either guilty or innocent; this is D's private information). In Section 2 we develop a one-P model, wherein P's disutility of convicting an innocent D (P's type) is his private information. We first characterize the Bayesian Nash Equilibrium (BNE) between the prosecutor and the judge, wherein a subset of P-types will suppress evidence and a subset of J-types will conduct an investigation.

Section 3 expands the analysis to consider two Ps (each with his own private information as to type) and examines two models, one wherein only one P can observe whether exculpatory evidence exists (we will refer to this as the "21" configuration to capture that there are two Ps but only one is aware of any exculpatory evidence) and one wherein both Ps automatically learn whether such evidence exists (this is the "22" configuration). We find that the set of P-types who would prefer to suppress the evidence may be larger in the 22 configuration. However, the equilibrium probability of suppression in the 22 configuration is lower than in the 21 configuration.

In Section 4 we endogenize the choice of configuration within the team and find that (assuming J cannot observe the choice) the equilibrium configuration is 21. In Section 5 we consider the possibility that: 1) a P may suffer angst due to suppression by a teammate; 2) a P may be rewarded or punished by a teammate (or others in the office) for either disclosing or suppressing; and 3) costly effort may be expended to reduce D's likelihood of discovering exculpatory evidence. Section 6 provides a summary and a discussion of policies intended to improve information flows and to reduce prosecutorial misconduct.

2. Model Set-up, Notation, and Analysis for the Single-Prosecutor Model

In this section, we will describe the model and results for the case of one prosecutor facing one defendant and one reviewing judge. P and D have access to (different) evidence-generating

processes in the case for which P is prosecuting D. In either case, a party may observe exculpatory evidence (denoted as E) or not observe exculpatory evidence (denoted as φ). We assume that P's opportunity to observe E occurs just prior to the trial, whereas D's opportunity to observe E occurs after the trial. Note that this means that if P does observe E, but suppresses this information, then D may never become aware of E (D may only observe φ). Alternatively, if P does not observe E (i.e., P observes φ), then E may still exist and D might later observe it.

Let the prior probability of innocence be denoted λ; that is, $\lambda \equiv \Pr\{D \text{ is } I\}$, where we assume $\lambda \in (0, 1)$. The evidence-generating processes are based on D's true type, G (guilty) or I (innocent), which is D's private information. Let $\gamma \equiv \Pr\{P \text{ observes } E \mid D \text{ is } I\}$, so $1 - \gamma = \Pr\{P \text{ observes } \varphi \mid D \text{ is } I\}$. Similarly, let $\eta \equiv \Pr\{D \text{ observes } E \mid D \text{ is } I\}$, so $1 - \eta = \Pr\{D \text{ observes } \varphi \mid D \text{ is } I\}$. Both γ and η are also assumed to be positive fractions.[6] The simplest way to interpret these probabilities is that E exists whenever D is innocent, although it may not be found (observed) by either P or D.[7] Moreover, we assume that if D is G, then no exculpatory evidence exists so that neither P nor D will ever observe E; they will each observe φ with certainty. Finally, we assume that without E, D will be convicted, whereas with E, D will be found innocent. Thus, exculpatory evidence in our analysis is "perfect" in the sense that it is absolutely persuasive and clearly material.[8]

Before the trial begins, P has an opportunity to report (disclose) the receipt of exculpatory

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[6] Although we need not impose any ordering on γ and η, it is typically thought that the prosecution generally has more resources that can be brought to bear on finding evidence than does the defendant, so a typical ordering would be $\gamma > \eta$. In Section 5 we allow P to influence the size of η via suppression effort.

[7] More complex lotteries could be specified (i.e., when D is I, E may or may not exist, and may or may not be found when it does exist), but this generates additional complexities without accompanying benefits.

[8] In reality, exculpatory evidence may not be perfect, so it may only reduce the chance of conviction. Furthermore, imperfect exculpatory evidence may be observed even though D is of type G. Consideration of imperfect exculpatory evidence would considerably complicate the model (injecting a variety of additional parameters and inference conditions) and distract from our focus on the incentives for prosecutors to limit the distribution of E within a team and to suppress the evidence from D.

evidence. Let $\theta \in \{E, \varphi\}$ denote P's true evidence state (which is P's private information), and let $r \in \{E, \varphi\}$ denote P's reported evidence state. Then the pair $(r; \theta) = (E; E)$ implies that P disclosed E when he observed E, whereas $(r; \theta) = (\varphi; E)$ implies that P failed to disclose E when he observed E (because he reported having observed φ). We assume that E is "hard" evidence, so it cannot be reported when it was not observed; that is, when P observes φ, then he must report φ.

We assume that P obtains a payoff of S when D is convicted, where S reflects career concerns such as internal advancement or improved outside opportunities. However, P also suffers a loss of τ if D is falsely convicted due to P's suppression of exculpatory evidence, where τ is a random variable that is distributed according to $F(\tau)$, with density $f(\tau) > 0$, on $[0, \infty)$; that is, τ is P's type. Thus, some prosecutor types (τ-values) would prefer a false conviction to none at all, whereas others would prefer no conviction to being responsible for a false one.[9]

As stated earlier, if P does not disclose any exculpatory evidence, we assume that the evidence provided at trial is sufficient to convict D. However, following D's conviction, it is possible that D will discover exculpatory evidence (if D is truly innocent). In this case, we assume that D will go to court and have her conviction overturned by a reviewing judge and P loses the amount S associated with a conviction (independent of whether P suppressed E); we assume that P continues to incur the loss τ if he suppressed E. J also has the opportunity to investigate the prosecutor's behavior, which could have been appropriate (if P did not observe E) or inappropriate (if P observed E but reported φ). Assume that when an investigation verifies P's failure to disclose, the judge receives a payoff of V (e.g., many judges run for office or for retention and this sort of pro-

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[9] For simplicity we have confined P's private information to one aspect of his payoff (the disutility τ). Alternatively, we could view τ as commonly known and let S be P's private information. This yields equivalent results.

social behavior can elicit electoral support) and P receives a penalty of k.[10] Further, J faces a

disutility c of conducting an investigation, which might involve resource or opportunity costs due

to holding hearings, distaste for confronting colleagues in the judicial process (regardless of

outcome, J will probably work with them again), along with potential retaliation from prosecutors.

As an example of prosecutorial retaliation against a judge who attempts to enforce the *Brady*

rule, consider the following incident. In a capital-murder case in Orange County, Scott Dekraai was

convicted (in part) on the basis of testimony by a jailhouse informant. As described in Kozinski

(2015, p. xxvi), the defense challenged the informant and:

> "... Superior Court Judge Thomas Goethals ... eventually found that the Orange County
> District Attorney's office had engaged in a 'chronic failure' to disclose exculpatory evidence
> pertaining to a scheme run in conjunction with jailers to place jailhouse snitches known to
> be liars near suspects they wished to incriminate, effectively manufacturing false
> confessions. The judge then took the drastic step of disqualifying the Orange County
> District Attorney's office from further participation in the case."

Subsequently, the Orange County DA's office made use of peremptory challenges to remove Judge

Goethals from significant cases they were prosecuting. According to Saavedra (2016), "Appellate

justices ruled Monday that the Orange County District Attorney's Office can disqualify Superior

Court Judge Thomas Goethals from 46 murder cases, though the justices also said the practice is

abusive and disruptive of the court system."

J's disutility c from investigating is her private information (i.e., her type) and is distributed

according to H(c), with density h(c) > 0, on [0, ∞).[11] Thus, a judge with a sufficiently low value of

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[10] See Gershman (2015), Chapter 14 for a discussion of sanctions for prosecutorial misconduct. For example, k could include fines or jail time (California has recently passed a law in ths regard) or loss of law license, as well as reputational losses. Note that it is also straightforward to incorporate a reputational loss due simply to being investigated (i.e., even if P is not found to have suppressed evidence).

[11] As with P's type, we have confined J's private information to one aspect of her payoff (the disutility c). Alternatively, we could view c as commonly known and let V be J's private information. This yields equivalent results.

c will investigate, whereas one with a sufficiently high value of c will overturn D's conviction but will forego investigating P.[12] An investigation may fail to verify P's suppression; let μ denote the positive probability that the investigation verifies P's failure to disclose material exculpatory evidence that was in P's possession. We assume there are no "false positives;" that is, an investigation never concludes that P failed to disclose E when P actually observed φ.

2.1. Timing of Moves

The previous discussion implies the following information structure and timing of moves.

1. Nature determines whether D is G (guilty) or I (innocent), and reveals this only to D.

2. Nature determines whether P observes E or φ, and P's type τ; these are revealed only to P.

3. P reports E or φ. If P reports E, then D is exonerated and the game ends. If P reports φ, then D is convicted; P obtains S but pays τ if P had observed E.

4. If D is convicted, then Nature determines whether D observes E or φ. If D observes φ, then the game ends. If D observes E, then D provides E to J and D is exonerated; P loses the payoff S previously obtained, but if P suppressed E, then he continues to bear the disutility loss τ.

5. Nature determines J's type c; this is revealed only to J. J decides whether to investigate P. If J decides not to investigate P, then the game ends. If J investigates P, then if P is not found to have suppressed E, the game ends; if P is found to have suppressed E, then P's penalty is k, J obtains V, and the game ends.

2.2. Payoff Functions and Decisions for P and J

Using the notation and timing specification described above, we can construct payoffs and analyze decisions for P and J. First, we consider the problem facing P. Let $\pi^P(r; \theta, \tau)$ denote P's

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[12] We have assumed that J cannot credibly commit to an investigation policy. Since J's type is her private information, it would be difficult to verify whether she had adhered to any announced policy.

expected payoff from reporting r when he observed θ; this payoff is indexed by P's type, τ. We assume that P's career concerns are such that he gains S from every conviction, but loses τ only when he knows he has caused a false conviction by suppressing exculpatory evidence.[13]

Thus, $\pi^P(E; E, \tau) = 0$: when P observes and discloses E, then D is not convicted. When P observes φ, he must also report φ. However, D may subsequently observe E, in which case the conviction is reversed but, since P acted appropriately, he faces no sanction (recall, we assume there are no "false positives" when J investigates P) and since he did not create a harm by suppressing E, he bears no disutility loss τ. Thus, $\pi^P(\varphi; \varphi, \tau) = S - \Pr\{D \text{ observes } E \mid P \text{ observed } \varphi\}S$. P's posterior belief $\Pr\{D \text{ observes } E \mid P \text{ observed } \varphi\} = \eta\lambda(1 - \gamma)/[1 - \lambda + \lambda(1 - \gamma)]$.[14] Therefore,

$$\pi^P(\varphi; \varphi, \tau) = S\{1 - \eta\lambda(1 - \gamma)/[1 - \lambda + \lambda(1 - \gamma)]\}.$$

Finally, when P observes E, he knows that D is innocent. Failure to disclose E (that is, a report of φ) means that P incurs a disutility loss equal to his type τ; this disutility persists even if the conviction is eventually reversed. Moreover, even if P suppresses E, there is a chance that D will discover it herself. In this case, P will not only lose the value of the conviction and incur the disutility loss for harming D, but he will also face the risk of investigation and possible sanction. Given the timing, J decides whether to investigate only when D provides evidence E and P did not previously report E; thus, when deciding whether to suppress an observation of E, P must form a conjecture about the likelihood that J will investigate. Let $\hat{\rho}$ denote P's conjectured likelihood of investigation, when P reported φ and D provided the exculpatory evidence E. Thus $\pi^P(\varphi; E, \tau) = S -$

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[13] Some innocent Ds may be convicted due to <u>undiscovered</u> exculpatory evidence, but P can rationalize these as good (or at least untainted) convictions, as he was unaware of E and took no action to suppress it.

[14] The denominator represents the ways that P could observe φ (D is G, which happens with probability $1 - \lambda$, or D is I but P did not observe E, which happens with probability $\lambda(1 - \gamma)$). Thus $\lambda(1 - \gamma)/[1 - \lambda + \lambda(1 - \gamma)]$ represents P's posterior assessment that D is innocent, given P observed φ; η is the probability that an innocent D will discover E.

τ - Pr{D observes E | P observed E}$(S + k\mu\hat{\rho})$. Since a P that observed E knows that D is innocent,

P's posterior Pr{D observes E | P observed E} = η. Therefore $\pi^P(\varphi; E, \tau) = S(1 - \eta) - \tau - \eta k\mu\hat{\rho}$.

We can now define a strategy for P and a best response for P to his conjecture about J's

likelihood of investigation.

> **Definition 1**. A <u>strategy</u> for P is a choice of report, conditional on P's observation of θ and P's type τ; that is, $r(\theta, \tau) \in \{E, \varphi\}$. Note that in order to report (disclose) E, P must actually have observed E, so $r(\varphi, \tau) = \varphi$ is imposed; we need only consider $r(E, \tau)$. A <u>best response</u> for P to his conjecture $\hat{\rho}$ is the $r \in \{E, \varphi\}$ that maximizes $\pi^P(r; E, \tau)$.

It is clear that P will choose to suppress observed exculpatory evidence if:

$$\pi^P(\varphi; E, \tau) = S(1 - \eta) - \tau - \eta k\mu\hat{\rho} > \pi^P(E; E, \tau) = 0.$$

This occurs if and only if $\tau < t(\hat{\rho})$, where $t(\hat{\rho}) \equiv$ max $\{0, S(1 - \eta) - \eta k\mu\hat{\rho}\}$. The following lemma

characterizes the set of P-types that will suppress exculpatory evidence.[15]

> **Lemma 1**. If P observes E, P's best response is: $BR^P(\hat{\rho}; \tau) = \varphi$ if $\tau < t(\hat{\rho})$ and $BR^P(\hat{\rho}; \tau) = E$ if $\tau \geq t(\hat{\rho})$, where $t(\hat{\rho}) \equiv$ max $\{0, S(1 - \eta) - \eta k\mu\hat{\rho}\}$.

Lemma 1 states that a P of type τ who observes E and conjectures that J will investigate with

probability $\hat{\rho}$ will optimally follow a threshold rule with respect to suppression: suppress evidence

if τ is sufficiently low and otherwise disclose the evidence.

Next, consider the problem facing J. J makes a decision in this model only if P did not report

E prior to D's conviction, and D subsequently discovered E following her conviction. J will reverse

D's conviction but J can also decide whether to investigate P's behavior to ascertain whether P

suppressed evidence of D's innocence. Let d $\in \{1, 0\}$ denote this decision, where d = 1 means that

J investigates and d = 0 means that J does not investigate. To make this decision, J must construct

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[15] Our specification of P's best response assumes an indifferent P-type discloses E; since there is a continuum of types, it would not affect our results if an indifferent P-type was assumed to suppress E. However, for some parameters and conjectures, it may be that every $\tau \geq 0$ strictly prefers to disclose (i.e., suppression is strictly deterred), in which case the constraint that $t(\hat{\rho}) \geq 0$ binds and we want $\tau = t(\hat{\rho}) = 0$ to belong to the set of types that disclose.

a posterior probability that P actually had observed E but failed to disclose it. This requires J to conjecture a threshold, denoted $\hat{t}$, such that all P types with $\tau < \hat{t}$ are expected to report φ when they observe E. Since D provided J with the exculpatory evidence E, D is now known to be innocent. Thus, J's posterior assessment that P lied when he reported φ is $\gamma F(\hat{t})/[1 - \gamma + \gamma F(\hat{t})]$.[16]

Recall that: 1) J receives a value V when her investigation reveals and sanctions a P that has suppressed exculpatory evidence; 2) an investigation verifies P's suppression with probability μ; and 3) an investigation entails a disutility for J of c, which is drawn from the distribution H(c). Then a J of type c has an expected payoff of $\pi^J(d; c)$, where:

$$\pi^J(1; c) = V\mu\gamma F(\hat{t})/[1 - \gamma + \gamma F(\hat{t})] - c \text{ and } \pi^J(0; c) = 0.$$

Hence, we define parallel notions of strategy and best response for J as follows.

Definition 2. A _strategy_ for J is a decision to investigate or not (in the event that D provides E and P's prior report was φ), conditional on J's type c; that is, d(c) $\in$ {1, 0}. A _best response_ for J to her conjecture $\hat{t}$ is d(c) $\in$ {1, 0} that maximizes $\pi^J(d; c)$.

It is clear that $\pi^J(1; c) = V\mu\gamma F(\hat{t})/[1 - \gamma + \gamma F(\hat{t})] - c \geq \pi^J(0; c) = 0$ whenever $c \leq V\mu\gamma F(\hat{t})/[1 - \gamma + \gamma F(\hat{t})]$. The following lemma characterizes the set of J-types that will investigate P on suspicion of suppressing exculpatory evidence.

Lemma 2. If P reported φ and D later provided E, J's best response is: $BR^J(\hat{t}; c) = 1$ if $c \leq V\mu\gamma F(\hat{t})/[1 - \gamma + \gamma F(\hat{t})]$ and otherwise $BR^J(\hat{t}; c) = 0$.

Lemma 2 states that a J faced with a convicted D submitting exculpatory evidence, when P previously reported φ, and who conjectures that the threshold rule for P was to suppress if $\tau < \hat{t}$, will optimally follow her own threshold rule with respect to investigation: investigate if her disutility

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[16] The denominator consists of all the ways that P could have reported φ (given that we now know that D is innocent). P would have reported φ if he truly did not observe E (which happens with probability $1 - \gamma$) or if he did observe E, but his type fell below the threshold for disclosure (which happens with probability $\gamma F(\hat{t})$). Thus, the share of φ-reports that are due to evidence suppression is the ratio $\gamma F(\hat{t})/[1 - \gamma + \gamma F(\hat{t})]$.

of doing so, c, is sufficiently low and otherwise do not investigate.

2.3. Equilibrium

Lemmas 1 and 2 characterize P's and J's best response functions. However, it will be more intuitive to work with the following functions which summarize the best response behavior of, respectively, P and J (and we use a superscript BR to capture this):

$$t^{BR}(\rho) \equiv S(1 - \eta) - \eta k \mu \rho; \tag{1}$$

$$\rho^{BR}(t) \equiv H(V \mu \gamma F(t)/[1 - \gamma + \gamma F(t)]). \tag{2}$$

The function $t^{BR}(\rho)$ represents the minimum threshold level of τ consistent with disclosure, given any conjectured probability ρ of J ordering an investigation. The function $\rho^{BR}(t)$, which (from the definition of H) is always less than one, represents the probability that a randomly-drawn judge will decide to investigate, given any conjectured threshold t for disclosure.

Definition 3. A <u>Bayesian Nash Equilibrium</u> (BNE) is a pair (t^*, ρ^*), such that
$t^* = \max \{0, t^{BR}(\rho^*)\}$ and $\rho^* = \rho^{BR}(t^*)$.

Notice that equation (2) above implies that if t^* were 0 then ρ^* would be 0 as well, but then equation (1) above implies that $t^* > 0$. Therefore, it must be that $t^* > 0$. Basically, if J does not expect any P-types to suppress exculpatory evidence, then J will never investigate, but then some P-types will choose suppression. Thus, we know the equilibrium occurs along the function $t^{BR}(\rho)$.

Proposition 1. There is a unique BNE, (t^*, ρ^*), where $t^* \in (0, S(1 - \eta))$ and $\rho^* \in (0, 1)$, given by the pair of equations:

$$t^* = S(1 - \eta) - \eta k \mu \rho^*; \tag{3}$$

$$\rho^* = H(V \mu \gamma F(t^*)/[1 - \gamma + \gamma F(t^*)]). \tag{4}$$

The existence and nature of the equilibrium is most-easily seen through a graphical analysis in (t, ρ) space. In Figure 1, the functions $\rho^{BR}(t)$ and $t^{BR}(\rho)$ are graphed in (t, ρ) space. The function

$\rho^{BR}(t)$ in equation (2) starts at the origin and increases (strictly) as t increases. This function is continuous, but need not be everywhere concave nor everywhere convex; it is less than 1 for all finite values of t. The function $t^{BR}(\rho)$ from equation (1) is a linear decreasing function of ρ, which intersects the ρ-axis at $S(1 - \eta)/\eta k\mu$ and falls until it intersects the t-axis at $t = S(1 - \eta)$. These functions must cross exactly once, allowing us to assert uniqueness of the BNE in Proposition 1.

Put Figure 1 Here

2.4. Comparative Statics

In Figure 1 we illustrate the BNE (t^*, ρ^*), meaning that if P's type, τ, belongs to $[0, t^*)$, then P (if he has observed E) will choose to suppress E, while if $\tau \geq t^*$, then P will disclose E to D. Thus, the probability that P suppresses observed exculpatory evidence is $F(t^*)$. We now consider how parameters of the model affect the two equilibrium probabilities, $F(t^*)$ and ρ^*.

Three parameters (S, η, and k) affect only the function $t^{BR}(\rho)$. The function $t^{BR}(\rho)$ increases with S and decreases with η and k. Thus, an increase in S results in a higher value of both t^* and ρ^*; a higher payoff from obtaining a conviction induces more evidence suppression and this warrants more investigation. On the other hand, an increase in either η or k results in a lower value of both t^* and ρ^*; a higher risk that D will discover E or a higher sanction for suppressing evidence induces less evidence suppression and this warrants less investigation.

Two parameters (V and γ) affect only the function $\rho^{BR}(t)$. The function $\rho^{BR}(t)$ begins at $\rho^{BR}(0) = 0$, but it increases with an increase in either V or γ for all $t > 0$. Thus, since $t^{BR}(\rho)$ is downward-sloping, an increase in V or γ results in a higher ρ^* and therefore a lower t^*. That is, an increase in the value to J of apprehending a P that has suppressed evidence, or an increase in the

likelihood that P actually observed E (when he reported φ), increases J's incentive to investigate, and P's anticipation of this results in greater deterrence of evidence suppression.

Finally, the parameter μ affects both functions; an increase in μ decreases $t^{BR}(ρ)$, whereas it increases $ρ^{BR}(t)$. This implies a definite effect of μ on t^*: an increase in μ results in a decrease in t^*. That is, an increase in the effectiveness of an investigation ultimately reduces the threshold for disclosure and, hence, the extent of evidence suppression. But we are not able to determine the effect of an increase in μ on $ρ^*$; the direct effect is to increase J's incentive to investigate but this is offset to a greater or lesser extent by the increased deterrence of suppression (since $F(t^*)$ falls).

The distributions $F(τ)$ and $H(c)$ can also be perturbed in the sense of first-order stochastic dominance. $F(τ)$ strictly first-order stochastically dominates $\mathcal{F}(τ)$ if $\mathcal{F}(τ) > F(τ)$ for all $τ > 0$. Here, $\mathcal{F}$ places more weight on lower values of τ than F does. This means that $\mathcal{F}(τ)$ represents stochastically lower disutility for convicting innocent defendants. For example, such a shift could represent conditioning on D's past criminal record; thus, P might experience stochastically lower disutility from convicting a D who has engaged in previous bad behavior, but who is innocent of this crime. Analogously, $H(c)$ strictly first-order stochastic dominates $\mathcal{H}(c)$ if $\mathcal{H}(c) > H(c)$ for all $c \in (0, ∞)$. This dominance represents stochastically lower disutility of investigation under $\mathcal{H}$ than under H, since $\mathcal{H}$ places more weight on lower c-outcomes.

Only the curve $ρ^{BR}(t)$ is affected by a change in these distributions. In both cases, this curve still starts at $ρ^{BR}(0) = 0$, but it is everywhere higher under $\mathcal{F}(·)$ or $\mathcal{H}(·)$. Thus, a stochastically lower disutility for convicting innocent defendants on the part of P encourages J to investigate more often for any conjectured threshold: $ρ^*$ increases and t^* decreases. It may seem counterintuitive that $ρ^*$ increases when t^* decreases. But recall that the distribution of τ is also changing, and it is putting

more weight on lower values of τ. Let (ρ^*, t^*) be the equilibrium under F and let $(\rho^{*\prime}, t^{*\prime})$ be the equilibrium under $\mathscr{F}$. Then $\rho^* < \rho^{*\prime}$ implies that $F(t^*) < \mathscr{F}(t^{*\prime})$, despite the fact that $t^{*\prime} < t^*$. That is, there is more evidence suppression under $\mathscr{F}$ (despite the lower threshold), which justifies a higher probability of investigation. Similarly, a stochastically lower disutility of investigation results in a higher likelihood of investigation ρ^* and a lower threshold t^*.

3. Analysis for the Two-Prosecutor Model

Here we extend the base model to consider two versions of how information is handled by a team of prosecutors. For simplicity, we restrict attention to teams with two prosecutors; the versions will differ according to how knowledge of exculpatory evidence is (exogenously) distributed within the team. Throughout this section the definitions of strategies, best responses, and Bayesian Nash Equilibrium are the obvious analogues of Definitions 1-3 in Section 2; conveniently, comparative statics results for the two-prosecutor models are the same as in Section 2.

We first assume that any exculpatory evidence is received by only one prosecutor (we call this the 21, or "disjoint," information configuration); next we assume that all exculpatory evidence is known by both prosecutors (we call this the 22, or "joint," information configuration). Thus, we view the disjoint configuration as capturing compartmentalization of knowledge about the exculpatory evidence, whereas the joint configuration represents common knowledge of the possession of exculpatory evidence by the entire team.

Regardless of the information configuration, we assume that each P makes a simultaneous and non-cooperative decision regarding disclosure (or suppression) of any exculpatory evidence in his possession. The individual-decision assumption is realistic because each prosecutor has an individual affirmative duty to disclose material exculpatory evidence under *Brady*; this derives from

a line of cases which have developed *Brady* jurisprudence and is reinforced by the ABA Rules of Professional Conduct which specify an independent ethical responsibility for an individual P to disclose exculpatory evidence.[17] If a P decides that he wants to disclose E to D, it is reasonable to assume that he finds a way to accomplish this.[18]

Before proceeding to the analysis, we describe some aspects that will be common to the two versions of a team, and also indicate what aspects will be maintained consistent with the one-prosecutor model. In particular, we will assume that the parameters λ, γ, μ, η, and k continue to apply as previously-defined. Specifically, the penalty for suppressing evidence, k, is imposed on each team member that is found to have suppressed evidence; moreover, we assume that clear evidence of personal misconduct is required to impose k on that prosecutor. We assume that prosecutor i (i $\in$ {1, 2}) has a type τ_i; the types are independently and identically drawn from the distribution $F(\tau)$ and, importantly, only a prosecutor who actively suppresses exculpatory evidence suffers a disutility loss. We assume that each team member receives a payoff S_2 when D is convicted. We also modify the judge's return to investigation (formerly V) to indicate whether 1 or 2 prosecutors are found to have suppressed evidence. Thus, let V_i denote J's payoff when i $\in$ {1, 2} prosecutors are found to have suppressed evidence; we assume that $V_2 \geq V_1$. Further, we modify the distribution of J's disutility of investigation. Let $H_2(c)$ denote the distribution of c when a team of prosecutors is investigated; $H_2(c)$ will apply to both versions of the two-prosecutor model (later

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[17] Formal Opinion 09-454: "Prosecutor's Duty to Disclose Evidence and Information Favorable to the Defense," 2009. This ethical obligation does not require the evidence to be "material" (see p. 2 of the Opinion).

[18] If a P is not supposed to contact D directly, then he can disclose E to a senior teammate, or the DA, or the court if necessary. The ABA rules state that "... supervisors who directly oversee trial prosecutors must make reasonable efforts to ensure that those under their direct supervision meet their ethical obligations of disclosure, and are subject to discipline for ordering, ratifying or *knowingly failing to correct discovery violations*." [emphasis added]. In the Thompson case, one of the prosecutors confessed (when dying) his *Brady* violation to a senior colleague, who urged him to report it to the DA. He did not, but neither did the colleague, who was later sanctioned for this failure to report.

we allow this distribution to differ between configurations 21 and 22). Finally, we assume that members of the team do not reward or punish each other; we relax this assumption in Section 5.

3.1. *Exculpatory Evidence is Received by a Single Team Member*

In the first version of our two-person team of prosecutors, we assume that the exculpatory evidence (if any) is received by only one of the prosecutors, and it is random as to which one receives it; moreover, the fact that the configuration is disjoint is common knowledge to all participants (including J). Thus, if prosecutor P1 receives exculpatory evidence, then he knows that P2 did not receive it. On the other hand, if P1 does not receive exculpatory evidence, then he does not know whether P2 received exculpatory evidence (since none may have been found, either because it did not exist or it did exist but was not discovered). More formally, if D is innocent, then Nature draws E with probability γ and randomly reveals it to one of the prosecutors.

The random-allocation assumption is reasonable, including with regard to what J is likely to know should she later consider launching an investigation of the prosecutorial team. Even if legitimate tasks of case preparation are divided between Ps, the receipt of exculpatory evidence can occur within either prosecutor's bundle of tasks. For instance, if forensic evidence is managed by one team member while another deals with witnesses, then either task may uncover exculpatory evidence. A witness for the prosecution may be uncertain, or his or her credibility may be subject to impeachment. P may choose not to disclose these witness weaknesses, or may even coach the witness in how to testify, both of which are *Brady* violations. On the other hand, if a piece of physical evidence is brought to the attention of the P in charge of forensic evidence, he can choose not to have it tested, or to have it tested but then to suppress the report should it be exculpatory. In both cases, individual Ps can take such actions without the knowledge of a teammate. Further, either

P may receive information (e.g., via a phone call, or contact by a policeman or a witness) regarding exculpatory evidence, independent of their assigned tasks. Finally, as the Thompson case shows, such evidence can get "lost."[19]

Consider P1's payoff function (a parallel analysis applies to P2). It now depends on: the vector of types for P1 and P2, denoted (τ_1, τ_2); the vector of evidence states for P1 and P2, denoted (θ_1, θ_2); and the vector of reports by P1 and P2, denoted (r_1, r_2). The general form of P1's payoff is: $\pi_1^P(r_1, r_2; \theta_1, \theta_2, \tau_1, \tau_2)$. As before, any prosecutor that has observed φ must also report φ. There are several possible outcomes and associated payoffs, and these will be relevant in Section 4 when we consider endogenous information configurations. However, our immediate interest is in characterizing P1's behavior, and P1 only has a decision to make when $\theta_1 = E$. Moreover, in this case, P2 has no decision to make (he must report φ, as that is what he observed). If P1 observes E, the relevant payoff comparison for P1 is between $\pi_1^P(E, \varphi; E, \varphi, \tau_1, \tau_2)$ and $\pi_1^P(\varphi, \varphi; E, \varphi, \tau_1, \tau_2)$. The former equals zero since, once exculpatory evidence is disclosed, the case against D is dropped, while the latter equals $S_2(1 - \eta) - \tau_1 - \eta k \mu \hat{\rho}$, where $\hat{\rho}$ is now interpreted as P1's conjectured probability that J investigates when both prosecutors reported φ and D later discovered and submitted E. Notice that this comparison is the same as in the one-prosecutor discussion except that $S = S_2$, so P1 should disclose if $\tau_1 \geq t_{21}(\hat{\rho})$, where $t_{21}(\hat{\rho}) \equiv \max \{0, S_2(1 - \eta) - \eta k \mu \hat{\rho}\}$.

Now consider J's payoff. Since there is no interaction between P1 and P2 (only one makes a decision) and they are otherwise identical, the equilibrium threshold will be the same for both of

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[19] In the robbery case mentioned earlier, one of the prosecutors (Whittaker) received a lab report concerning blood evidence and claimed to have placed it on a colleague's desk (Williams), but Williams denied having ever seen it. Thomas observes that: "The report was never disclosed to Thompson's counsel." See *Connick v. Thompson*, at 55. Moreover, it appears that the prosecution chose to remain ignorant of Thompson's blood type, thereby avoiding knowing that they had material evidence (since it differed from the blood evidence type).

them. Thus, J should have a common conjectured threshold for P1 and P2, which we denote as $\hat{t}$.

When D provides E, but both P1 and P2 reported φ, J constructs a posterior belief about whether one

of the prosecutors suppressed evidence (the alternative is that both Ps actually did observe φ). More

precisely, the report pair (φ, φ) occurs if: (1) no exculpatory evidence was found, which happens

with probability $1 - \gamma$; or (2) if exculpatory evidence was found but suppressed, which happens with

probability $\gamma F(\hat{t})$. This latter expression includes the probability that it was found (γ) and it is P1

who received the evidence (with probability ½) and he suppressed it because $\tau_1 < \hat{t}$, plus the

probability that it was found (γ) and it is P2 who received the evidence (with probability ½) and he

suppressed it because $\tau_2 < \hat{t}$. Thus, J's posterior belief that evidence was suppressed is given by

$\gamma F(\hat{t})/[1 - \gamma + \gamma F(\hat{t})]$. This posterior belief is the same as in the one-prosecutor case.

Hence, J observes her disutility of investigation, which is still denoted as c but is now drawn

from the distribution $H_2(c)$, and decides whether to investigate ($d = 1$) or not ($d = 0$). J's payoff from

investigation is now $\pi^J(1; c) = V_1 \mu \gamma F(\hat{t})/[1 - \gamma + \gamma F(\hat{t})] - c$ and her payoff from not investigating is

$\pi^J(0; c) = 0$. The parameter V_1 appears here because only one P can be suppressing evidence and

thus only one P can be punished. Similar to the analysis in Section 2, it is clear that $\pi^J(1; c) =$

$V_1 \mu \gamma F(\hat{t})/[1 - \gamma + \gamma F(\hat{t})] - c \geq \pi^J(0; c) = 0$ whenever $c \leq V_1 \mu \gamma F(\hat{t})/[1 - \gamma + \gamma F(\hat{t})]$, so J investigates if

c is low enough and does not investigate otherwise. As before, it will be more intuitive to work with

the following functions which summarize best-response behavior by the Ps and J (respectively):

$$t_{21}^{BR}(\rho) \equiv S_2(1 - \eta) - \eta k \mu \rho; \tag{5}$$

$$\rho_{21}^{BR}(t) \equiv H_2(V_1 \mu \gamma F(t)/[1 - \gamma + \gamma F(t)]). \tag{6}$$

A Bayesian Nash Equilibrium for this version of the two-prosecutor team, denoted (t_{21}^*, ρ_{21}^*),

is defined analogously to the one in Section 2: both prosecutors and the judge play mutual best

responses. The function $\rho_{21}^{BR}(t)$ starts at the origin and increases (strictly) as t increases. The function $t_{21}^{BR}(\rho)$ is a linear decreasing function of t, which starts at $S_2(1 - \eta)/\eta k\mu$ on the ρ-axis and falls linearly until it reaches the horizontal axis at $t = S_2(1 - \eta)$. The functions $t_{21}^{BR}(\rho)$ and $\rho_{21}^{BR}(t)$ cross exactly once (so $t_{21}^* > 0$), which establishes the following result.

> **<u>Proposition 2</u>**. There is a unique BNE (t_{21}^*, ρ_{21}^*), where $t_{21}^* \in (0, S_2(1 - \eta))$ and $\rho_{21}^* \in (0, 1)$, given by the pair of equations:

$$t_{21}^* = S_2(1 - \eta) - \eta k\mu\rho_{21}^*; \tag{7}$$

$$\rho_{21}^* = H_2(V_1\mu\gamma F(t_{21}^*)/[1 - \gamma + \gamma F(t_{21}^*)]). \tag{8}$$

3.2. Exculpatory Evidence is Received by Both Team Members

We now consider configuration 22 wherein any exculpatory evidence is automatically received by both members of the team. That is, if either P observes E (respectively, φ), then it is common knowledge, within the team, that both know E (respectively, φ). J knows the configuration, but not whether E was observed. Now both Ps have decisions to make; we assume that they make their disclosure decisions simultaneously and noncooperatively, based only on their own private information (i.e., their disutility of causing an innocent defendant to be convicted).[20]

Consider P1's payoff; again, the general form it takes is $\pi_1^P(r_1, r_2; \theta_1, \theta_2, \tau_1, \tau_2)$. However, now it must be that $\theta_1 = \theta_2$; either both team members observe E or both observe φ (and, in this latter case, both must report φ). For convenience, we will focus on those events in which P1 has a decision to make; we will fill out the details of the payoffs for the other events later when we endogenize the information structure. If P1 observes E, then disclosing it will yield $\pi_1^P(E, r_2; E, E, \tau_1, \tau_2) = 0$ for all (r_2, τ_1, τ_2); P2 will receive the same payoff. On the other hand, if P1 reports φ (i.e.,

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[20] If utility were transferable, the team could use an incentive-compatible mechanism to elicit information about their τ-values and to recommend whether to disclose E to D. We briefly address this in footnote 22 and the Appendix.

P1 suppresses the exculpatory evidence), then if P2 discloses E, P1 will receive $\pi_1^P(\varphi, E; E, E, \tau_1, \tau_2)$ = 0 for all (τ_1, τ_2); whereas if P2 also reports φ, P1 will receive $\pi_1^P(\varphi, \varphi; E, E, \tau_1, \tau_2) = S_2(1 - \eta) - \tau_1 - \eta k\mu\hat{\rho}$, where $\hat{\rho}$ is again interpreted as P1's and P2's common conjectured probability that J investigates when both prosecutors report φ and D provides E. Note that we assume P1 only suffers the disutility τ_1 if D is actually falsely convicted; if P1 suppresses evidence but his partner discloses it, P1 does not suffer the disutility τ_1 (as his action did not cause an innocent D to be convicted).

Since P1 and P2 act simultaneously and without knowledge of each others' τ-values, P1 must have a conjecture about P2's behavior (much as J must have a conjecture about both P1's and P2's behavior). We assume that P1 and J maintain a common conjectured threshold, denoted $\hat{t}$, such that all P2 types with $\tau_2 < \hat{t}$ are expected to report φ when they observe E. Then P1's expected payoff when he observes E and reports φ is given by: $0 \cdot [1 - F(\hat{t})] + [S_2(1 - \eta) - \tau_1 - \eta k\mu\hat{\rho}]F(\hat{t})$. Thus, P1 should disclose if $\tau_1 \geq t_{22}(\hat{\rho})$, where $t_{22}(\hat{\rho}) \equiv \max \{0, S_2(1 - \eta) - \eta k\mu\hat{\rho}\}$, which is independent of the conjecture about P2's threshold. As is readily apparent, $t_{22}(\hat{\rho}) = t_{21}(\hat{\rho})$. Similarly, P2's best response (to his conjecture about the probability that J will investigate, $\hat{\rho}$) is independent of his conjecture about P1, and is the same in a team with joint information and a team with disjoint information. This again leads to the same threshold rule, now for each prosecutor.

Now consider J's payoff. Since there is no interaction between P1 and P2 and they are otherwise identical, the equilibrium threshold will be the same for both of them. Thus, J should have a common conjectured threshold, which we denote as $\hat{t}$. When D provides E, but both prosecutors reported φ, J must construct a posterior belief about whether they suppressed evidence. The report pair (φ, φ) would have occurred if: (1) no exculpatory evidence was found, which happens with probability $1 - \gamma$; or (2) if exculpatory evidence was found but both prosecutors suppressed it, which

happened with probability $\gamma(F(\hat{t}))^2$. Thus, J's posterior belief that the prosecutors suppressed evidence is $\gamma(F(\hat{t}))^2/[1 - \gamma + \gamma(F(\hat{t}))^2]$. This posterior belief is <u>not</u> the same as in the team with disjoint information (the 21 configuration); in the team with joint information, each prosecutor can serve a "whistle-blowing" role by disclosing E (thus preventing the conviction of an innocent D).

Assume that J's disutility of investigation in the case of joint information is still drawn from the distribution $H_2(c)$; that is, as discussed earlier, the disutility of investigation depends only on the number of team members. We also assume that the investigation successfully verifies suppression by both team members (with probability μ) or neither (with probability $1 - \mu$); it never verifies suppression by only one team member when both have engaged in suppression. Finally, J's payoff from an investigation that verifies suppression of evidence by both prosecutors, denoted V_2, is assumed to be at least V_1. J observes her disutility of investigation and decides whether to investigate (d = 1) or not (d = 0). J's payoff from investigation is $\pi^J(1; c) = V_2\mu\gamma(F(\hat{t}))^2/[1 - \gamma + \gamma(F(\hat{t}))^2] - c$ and her payoff from not investigating is $\pi^J(0; c) = 0$. It is clear that $\pi^J(1; c) = V_2\mu\gamma(F(\hat{t}))^2/[1 - \gamma + \gamma(F(\hat{t}))^2] - c \geq \pi^J(0; c) = 0$ whenever $c \leq V_2\mu\gamma(F(\hat{t}))^2/[1 - \gamma + \gamma(F(\hat{t}))^2]$.

Best response behavior for the Ps and J are summarized by:

$$t_{22}^{BR}(\rho) \equiv S_2(1 - \eta) - \eta k\mu\rho; \tag{9}$$

$$\rho_{22}^{BR}(t) \equiv H_2(V_2\mu\gamma(F(t))^2/[1 - \gamma + \gamma(F(t))^2]). \tag{10}$$

Clearly, $t_{22}^{BR}(\rho) = t_{21}^{BR}(\rho)$; however, $\rho_{22}^{BR}(t)$ and $\rho_{21}^{BR}(t)$ are not as easily-ordered. We first provide the characterization of the BNE for the 22 configuration and then we compare the equilibrium amounts of suppression and investigation.

A BNE for this version of the two-prosecutor team, denoted (t_{22}^*, ρ_{22}^*), is defined analogously as in Section 2: both prosecutors and the judge play mutual best responses. As in the 21 case, it is

clear that $t_{22}^* > 0$, and that the function $\rho_{22}^{BR}(t)$ starts at the origin and increases (strictly) as t increases.

The functions $t_{22}^{BR}(\rho)$ and $\rho_{22}^{BR}(t)$ cross exactly once, establishing the following result.

Proposition 3. There is a unique BNE (t_{22}^*, ρ_{22}^*) where $t_{22}^* \in (0, S_2(1 - \eta))$ and $\rho_{22}^* \in (0, 1)$, given by the pair of equations:

$$t_{22}^* = S_2(1 - \eta) - \eta k \mu \rho_{22}^*; \tag{11}$$

$$\rho_{22}^* = H_2(V_2 \mu \gamma (F(t_{22}^*))^2 / [1 - \gamma + \gamma (F(t_{22}^*))^2]). \tag{12}$$

Figure 2 depicts equilibrium in the 21 and 22 configurations, assuming that $V_2 = V_1$. Both $\rho_{22}^{BR}(t)$ and $\rho_{21}^{BR}(t)$ functions start at the origin and increase with t. Both are based on the distribution $H_2(c)$, but for any given t, their arguments are not the same. However, if V_2 was equal to V_1, then since $(F(t))^2 < F(t)$ for $t > 0$, it follows that $(F(t))^2/[1 - \gamma + \gamma(F(t))^2] < F(t)/[1 - \gamma + \gamma F(t)]$. Hence, we conclude that $\rho_{22}^{BR}(t) < \rho_{21}^{BR}(t)$ for all $t > 0$.[21] This implies that $t_{22}^* > t_{21}^*$ and $\rho_{22}^* < \rho_{21}^*$, as shown.

Put Figure 2 here

Next consider the comparison between $\rho_{22}^{BR}(t)$ and $\rho_{21}^{BR}(t)$ as we increase V_2 relative to V_1. When $V_2 = V_1$, these two functions cross at (t equals) infinity. As V_2 is increased relative to V_1, this crossing point for $\rho_{22}^{BR}(t)$ and $\rho_{21}^{BR}(t)$ moves inwards towards the origin, eventually resulting in the $\rho_{22}^{BR}(t)$ curve crossing P's best response function where $t_{22}^* < t_{21}^*$ and $\rho_{22}^* > \rho_{21}^*$. That is, as V_2 becomes sufficiently larger than V_1, the ordering of the equilibria changes. We employ this result later.

Regardless of the ordering of the equilibrium thresholds for suppressing evidence and the equilibrium likelihoods of investigation, we can order the equilibrium likelihoods of evidence suppression in the two team environments. The equilibrium likelihood of evidence suppression

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[21] One could also contemplate a mixture of the 21 and 22 configurations, wherein neither the Ps nor J know whether the configuration is 21 or 22 when they choose their strategies. This results in the same best response function for the prosecutors, but J's best response function lies between $\rho_{21}^{BR}(t)$ and $\rho_{22}^{BR}(t)$. This yields qualitatively similar results.

under joint information is $(F(t_{22}^*))^2$, since both prosecutors' τ-values must fall below t_{22}^* in order for the evidence to be suppressed. The equilibrium likelihood of evidence suppression under disjoint information is $F(t_{21}^*)$, since only the τ-value of the recipient of the exculpatory evidence must fall below t_{21}^* in order for evidence to be suppressed. The following is proved in the Appendix.

Proposition 4. There is less evidence suppression in equilibrium under joint information as compared to disjoint information. That is, $(F(t_{22}^*))^2 < F(t_{21}^*)$.

Thus, even though the joint information configuration may result in a higher threshold for evidence disclosure, the full effect will always be to reduce the likelihood of evidence suppression.[22]

Finally, one might think that the distribution of J's disutility of investigating could depend on whether the configuration is 21 or 22. For instance, in the 22 case, once one P's suppression has been verified, this P can give evidence against the other P, potentially lowering J's disutility of investigation by reducing resource costs. If J's expected disutility of investigation is stochastically lower in the 22 (as compared to the 21) configuration, this has a similar effect as increasing V_2 relative to V_1. That is, the function $\rho_{22}^{BR}(t)$ increases for every value of $t > 0$, resulting in a decrease in t_{22}^*, which reinforces the result in Proposition 4.

3.3. Prosecutor Preferences over Exogenously-Determined Configurations

In this subsection, we provide the equilibrium payoff functions under the two exogenous information configurations, and determine sufficient conditions for a P to prefer the disjoint information configuration to the joint information configuration. Let Π_{21}^* denote P1's *ex ante* expected payoff in a two-prosecutor team with configuration 21. Then:

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[22] This likelihood of suppression will increase if utility is transferable and a Groves-Clarke mechanism (see Mas-Colell, Whinston, and Green (1995), pp. 878-879) is used to coordinate the Ps' choices to suppress evidence. See the Appendix for the details on this and why, since it involves supporting and enhancing prohibited behavior, and such a mechanism requires *ex ante* commitment by both prosecutors, we do not pursue this angle further.

$$\Pi_{21}^* = (1 - \lambda)S_2 + \lambda(1 - \gamma)S_2(1 - \eta) + (\lambda\gamma/2)S_2(1 - \eta)F(t_{21}^*)$$

$$+ (\lambda\gamma/2)\int \{S_2(1 - \eta) - \eta k\mu\rho_{21}^* - \tau\}dF(\tau), \qquad (13)$$

where the integral is over $[0, t_{21}^*]$. This expression is interpreted as follows. The first term reflects the fact that with probability $1 - \lambda$, D is actually guilty, so there is no exculpatory evidence and D will therefore be convicted, yielding a payoff of S_2. The second term reflects the fact that with probability λ, D is innocent but, with probability $(1 - \gamma)$, neither P observes E; thus D is convicted, yielding a payoff of S_2, which is lost if D subsequently observes E and the conviction is vacated, which occurs with probability η. Note that P1 loses the value of the conviction, but does not suffer an internal disutility because his actions did not cause the false conviction. The third term reflects the fact that, with probability λ, D is innocent and with probability $\gamma/2$, P2 observes exculpatory evidence, which he suppresses if $\tau_2 < t_{21}^*$ (i.e., with probability $F(t_{21}^*)$). In this event, D is convicted, but the conviction is lost if D subsequently provides E, which happens with probability η. Since equation (13) is P1's expected payoff and the third term assumes that P2 suppressed, P1 does not incur τ_1 or k. Finally, the last term reflects the fact that, with probability $\lambda\gamma/2$, D is innocent and P1 observes E. If P1's type τ_1 is less than t_{21}^*, then he suppresses the exculpatory evidence, which yields the payoff $S_2(1 - \eta) - \eta k\mu\rho_{21}^* - \tau_1$; this type-specific payoff is integrated over those types that suppress the evidence. The same equation provides P2's *ex ante* expected payoff in the 21 configuration.

Next, consider the 22 configuration. Let Π_{22}^* denote P1's *ex ante* expected payoff in a two-prosecutor team with joint information. Then:

$$\Pi_{22}^* = (1 - \lambda)S_2 + \lambda(1 - \gamma)S_2(1 - \eta) + \lambda\gamma F(t_{22}^*)\int \{S_2(1 - \eta) - \eta k\mu\rho_{22}^* - \tau\}dF(\tau), \qquad (14)$$

where the integral is over $[0, t_{22}^*]$. The first two terms are the same as in the 21 model. The third term reflects the fact that, with probability $\lambda\gamma$, D is innocent and both P1 and P2 observe exculpatory

evidence, which P2 suppresses if $\tau_2 < t_{22}^*$ (i.e., with probability $F(t_{22}^*)$). If P1's type τ_1 is less than t_{22}^*, then he also suppresses the exculpatory evidence, which yields the payoff $S_2(1 - \eta) - \eta k \mu \rho_{22}^* - \tau_1$; this type-specific payoff is integrated over those P1 types that suppress the evidence.

Comparing the 21 and 22 cases, we obtain the following (see the Appendix for the proof).

Proposition 5. If $t_{22}^* \leq t_{21}^*$ (or $t_{22}^* > t_{21}^*$, but the difference is sufficiently small), then *ex ante*, a prosecutor would prefer to work in a team with disjoint information than in a team with joint information.

Thus, for example, if V_2 is sufficiently larger than V_1, then the Ps prefer there to be only one informed prosecutor (i.e., the 21 configuration), as the prospect of receiving V_1 reduces J's incentive to investigate (as compared to her receiving V_2). A second intuition for this preference is that there are circumstances under which P1 would prefer to suppress the exculpatory information (e.g., low τ_1), but his teammate is likely to disclose it if he also observes it (e.g., low t_{22}^*). The disjoint information configuration allows P1 to control the disclosure decision when he alone observes E. Finally, if P2 controls the disclosure decision, then P1 benefits when P2 suppresses.

4. Endogenous Determination of the Information Configuration

In subsection 3.1 we assume that only one team member received any exculpatory evidence (randomly, either P1 or P2). In subsection 3.2 we assume that any exculpatory evidence was commonly known by both team members. In both analyses, J knows whether the configuration is 21 or 22. In this section, we examine which configuration(s) can emerge as part of an overall BNE for the game with endogenous information configuration, assuming that J cannot observe the chosen configuration. Thus, J's decision regarding investigation will depend on her conjecture about the information configuration within the prosecutorial team.

We consider two ways of endogenizing the information configuration. One way involves

the team members coordinating *ex ante* and committing as to whether the information configuration will be joint or disjoint. The other way of endogenizing the information configuration involves a single team member randomly receiving any E and then deciding whether to share it with his teammate. That is, starting in the 21 configuration, will a P who receives exculpatory evidence convert the configuration into 22 by sharing with the other P? In this analysis the decision is made at the *interim* stage (after the types and any exculpatory evidence have been realized).

4.1. *Ex ante Choice of Information Configuration*

When J cannot observe the two-prosecutor information configuration, we have to incorporate conjectures on J's part. We then ask whether there can be an equilibrium to the overall game wherein the team of prosecutors, *ex ante*, chooses a joint information configuration. If J expects the team to choose a joint information configuration, then J will investigate with probability ρ_{22}^*. If P1 and P2 choose a joint information configuration, each can expect a payoff of Π_{22}^* as given in equation (14). What if, unobserved by J, P1 and P2 deviate to a disjoint configuration (and play in a subgame-perfect way thereafter)? Having deviated to a disjoint information configuration, they might consider changing their equilibrium thresholds but, in fact, t_{22}^* is still a best response to ρ_{22}^*. In the Appendix we show that this deviation is <u>always</u> preferred, so there cannot be an equilibrium wherein the team chooses a joint information configuration.

Next we ask whether there can be an equilibrium wherein the team chooses the disjoint configuration. If J expects the team to choose a disjoint configuration, then J will investigate with probability ρ_{21}^*. If P1 and P2 choose a disjoint configuration, each can expect a payoff of Π_{21}^* as given in equation (13). What if, unobserved by J, P1 and P2 deviate to a joint configuration (and play in a subgame-perfect way thereafter)? Although they might consider changing their

equilibrium thresholds, t_{21}^* is still a best response to ρ_{21}^*. As shown in the Appendix, this deviation is <u>never</u> preferred and hence there is an equilibrium wherein the team chooses the disjoint configuration. Thus, when P1 and P2 choose the information configuration *ex ante*, but J cannot observe their choice, then the only equilibrium involves a disjoint configuration.

4.2. Interim Choice of Information Configuration

In this case, we think of the information configuration as involving exculpatory evidence being observed by either P1 or P2 (with equal probability), but then the observing prosecutor can choose to share the information with his teammate or to suppress it (both from the teammate and the defendant). At the *interim* stage, both prosecutors know their own types.

Suppose that P1 observes exculpatory evidence. Can there be an equilibrium wherein P1 first shares this evidence with P2, and then each continues optimally (i.e., each decides simultaneously and noncooperatively whether to disclose E to D)? Suppose that J expects exculpatory evidence to be shared, and therefore investigates with probability ρ_{22}^*. If a P1 of type τ_1 shares the evidence with P2 (who does not disclose to D with probability $F(t_{22}^*)$), then P1 can expect a payoff of $F(t_{22}^*)(S_2(1 - \eta) - \eta k\mu\rho_{22}^* - \tau_1)$ if he does not disclose E to D. Thus, the threshold for P1 to disclose remains t_{22}^*. However, by deviating to not sharing the evidence with P2, P1 will obtain a payoff of $S_2(1 - \eta) - \eta k\mu\rho_{22}^* - \tau_1$ if he does not disclose E to D. Thus, when P1 has observed E and when $\tau_1 < t_{22}^*$, then P1 will defect from the putative equilibrium involving evidence sharing, so as to preempt any possibility of his teammate disclosing E to D.

Alternatively, can there be an equilibrium wherein P1 does not share exculpatory evidence with P2? Suppose that J expects exculpatory evidence not to be shared, and therefore investigates with probability ρ_{21}^*. Then if a P1 of type τ_1 does not share the evidence with P2, then P1 can expect

a payoff of $S_2(1 - \eta) - \eta k \mu \rho_{21}^* - \tau_1$ if he does not disclose E to D, so he will disclose if $\tau_1 \geq t_{21}^*$. However, by deviating to sharing the evidence with P2, P1 will obtain a lower payoff of $F(t_{21}^*)(S_2(1 - \eta) - \eta k \mu \rho_{21}^* - \tau_1)$ if he does not disclose E to D. Thus (following the deviation) the threshold for P1 to disclose to D remains t_{21}^*, but P1 will never deviate to sharing exculpatory evidence with P2 because this would only give P2 the opportunity to disclose E when P1 prefers to suppress it.

When the decision regarding whether to share exculpatory evidence with a teammate is taken at the *interim* stage, the only equilibrium involves P1 not sharing with P2 when P1 prefers to keep the evidence from D; when P1 prefers to disclose to D, he can do it directly without previously sharing it with his teammate.

The results of subsections 4.1 and 4.2 are summarized in the following proposition.

Proposition 6. Assume that J does not observe the information configuration within the team. If P1 and P2 choose the information configuration either jointly at the *ex ante* stage, or by making an individual decision about information sharing at the *interim* stage, then the overall equilibrium involves a disjoint information configuration.

5. The Effect of Angst, Office Culture, and Costly Suppression Effort

In this section we consider three extensions of the model examined in Section 3 and 4. We first consider the effect of accounting for "angst" on the part of an uninformed P concerning potential bad behavior by a teammate. We next consider "office culture" wherein colleagues and/or supervisors may reward or punish individual Ps for behavior of which they approve or disapprove. Finally, we consider the choice by Ps of costly effort to reduce the likelihood (η) that D will find exculpatory evidence that has been suppressed.

5.1. Angst

Recall that, in a 21 configuration, P1 benefits from a false conviction that P2 causes; even if D finds exculpatory evidence and the conviction is overturned, P1 does not suffer the disutility

of having caused the false conviction (since P2 caused it and P1 was unaware). What if, however, P1 suffered angst about the possibility that P2 might suppress E? Angst might arise for P1 from either: 1) the expectation of *repugnance* for a possible suppression action by P2; or 2) from anticipation of the potential *embarrassment* P1 might suffer upon revelation of a teammate's bad behavior. Let angst be modeled as a disutility for P1 of $\alpha\tau_1$, where $\alpha > 0$, whenever P2's evidence suppression caused a false conviction of which P1 was (at the time) unaware. Then the term $S_2(1 - \eta)$ in the third term in equation (13) would become $S_2(1 - \eta) - \alpha X E(\tau_1) F(t_{21}^*)$, where $X = 1$ in the repugnance case above while $X = \eta\mu\rho_{21}^*$ for the embarrassment case. Our maintained assumption is that $\alpha = 0$, but the results in Section 4.1 would continue to hold if α is sufficiently small, which we believe is most plausible (especially with respect to the embarrassment version, due to the multiple fractions entering the term). The results in Section 4.2 continue to hold for any size of α.

5.2. Office Culture

In this subsection we consider an extension in the case of a team with a 21configuration (since that is the predicted equilibrium configuration; see Section 4). We have assumed that each P's type is his own private information, and that each P makes his disclosure decision noncooperatively. Moreover, we have ruled out transferable utility, so neither P can offer or extract a payment from the other. However, it is very possible that informal incentives operate within the office. Office culture could reward or punish disclosure, so that P1's payoff from disclosing is now $\pi_1^P(E, \varphi; E, \varphi, \tau_1, \tau_2) = \beta$. If $\beta > 0$, then disclosure is rewarded, whereas if $\beta < 0$, then it is punished. For example, colleagues can be more or less cooperative and supervisors can provide better or worse future assignments. This has the predictable effect of reducing suppression and investigation if disclosure is rewarded, and increasing suppression and investigation if disclosure is punished.

A more subtle version of informal sanctions could be imposed by a teammate. For instance, suppose that P1 received exculpatory evidence and disclosed it; P2 can evaluate what his decision would have been had he (rather than P1) received the evidence. If P2 would have chosen to disclose it as well, we assume that P2 does not impose any informal sanctions on P1. But if P2 would have suppressed it, then P2 could impose an informal sanction in the amount $\sigma > 0$ on P1. This informal sanction may consist of disrespect, uncooperativeness, or sabotage in future interactions with P1. The fact that it is informal tends to limit the magnitude of σ, as overall office culture may discourage informal sanctions, or at least prefer the response be limited so as not to attract public scrutiny.

Revisiting the analysis of subsection 3.1, P1's payoff from suppressing E remains $S_2(1 - \eta) - \tau_1 - \eta k \mu \hat{\rho}$, where $\hat{\rho}$ is P1's conjectured probability that J investigates when both prosecutors report φ and D later provides E. But P1's expected payoff when he discloses is now $\pi_1^P(E, \varphi; E, \varphi, \tau_1, \tau_2) = -\sigma F(\hat{t})$, since P1 conjectures that all P2 types with $\tau_2 < \hat{t}$ would have reported φ if they had been the one that observed E. Now P1's best response is to both conjectures, $\hat{t}$ and $\hat{\rho}$: P1 should disclose if $\tau_1 \geq t_{21}(\hat{t}, \hat{\rho})$, where $t_{21}(\hat{t}, \hat{\rho}) \equiv \max \{0, S_2(1 - \eta) - \eta k \mu \hat{\rho} + \sigma F(\hat{t})\}$. P2 should follow the analogous rule if he is the one that observes E. Notice that if P1 conjectures that P2 would have used a higher threshold $\hat{t}$, then P1's best response is also to use a higher threshold.

We characterize an equilibrium in which P1 and P2 use the same threshold. J uses a common conjecture $\hat{t}$ for both P1 and P2, so her problem is unchanged from that modeled in Section 3.1. This results in the same best-response likelihood of investigation, $\rho_{21}^{BR}(\hat{t}) = H_2(V_1 \mu \gamma F(\hat{t})/[1 - \gamma + \gamma F(\hat{t})])$. Let the equilibrium threshold for P1 and P2 be denoted $t_{21}^*(\sigma)$. J's equilibrium likelihood of investigation, now also a function of σ, will be denoted $\rho_{21}^*(\sigma)$. As before, it is clear that $t_{21}^*(\sigma) = 0$ cannot be part of an equilibrium; some evidence suppression will be necessary to motivate

investigation by J. Thus, a Bayesian Nash Equilibrium $(t_{21}^*(\sigma), \rho_{21}^*(\sigma))$ is a solution to the equations:

$$t = S_2(1 - \eta) - \eta k\mu\rho + \sigma F(t); \tag{15}$$

$$\rho = H_2(V_1\mu\gamma F(t)/[1 - \gamma + \gamma F(t)]). \tag{16}$$

Note that equation (15) defines $t_{21}^*(\sigma)$ implicitly. It will be easier to visualize and understand

the BNE if we solve equation (15) for ρ in terms of t, which we will denote as $b_{21}(t; \sigma)$. The function

$\rho = b_{21}(t; \sigma) \equiv [S_2(1 - \eta) - t + \sigma F(t)]/\eta k\mu$ is increasing in σ for all $t > 0$, but begins at the same vertical

intercept, $S_2(1 - \eta)/\eta k\mu$, for all σ (and it lies above $b_{21}(t; 0)$ for all $t > 0$). When $\sigma = 0$, this is simply

the usual negatively-sloped line that crosses the horizontal axis at $S_2(1 - \eta)$. For $\sigma > 0$, we can no

longer be sure that $b_{21}(t; \sigma)$ is downward-sloping everywhere; however, it will cross the horizontal

axis when t gets sufficiently large. It is clear that there is at least one BNE, $(t_{21}^*(\sigma), \rho_{21}^*(\sigma))$, and that

$t_{21}^*(\sigma) > t_{21}^*(0)$ and $\rho_{21}^*(\sigma) > \rho_{21}^*(0)$. That is, informal sanctions result in more suppression and more

investigation. Since $b_{21}(t; \sigma)$ need not be everywhere downward-sloping, it is possible that multiple

BNE exist; however, all BNE for $\sigma > 0$ involve more evidence suppression and more investigation

than the BNE for $\sigma = 0$. The functions $b_{21}(t; \sigma)$, $b_{21}(t; 0)$, and $\rho_{21}^{BR}(t)$ are graphed in Figure 3 below;

a scenario with three BNEs is depicted. Note that since $\rho_{21}^{BR}(t)$ is increasing in t, all the equilibria are

ordered, with higher t-thresholds associated with higher likelihoods of investigation.

Proposition 7. There is at least one BNE $(t_{21}^*(\sigma), \rho_{21}^*(\sigma))$ given by equations (15)-(16). For any BNE with $\sigma > 0$, $t_{21}^*(\sigma) > t_{21}^*(0)$ and $\rho_{21}^*(\sigma) > \rho_{21}^*(0)$.

Put Figure 3 here

Finally, within the 22 configuration another type of informal sanction is possible.[23] If P1

discloses but P2 suppresses, then there is no risk of formal sanctions for P2 (because no conviction

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[23] We thank Giri Parameswaran for pointing out this scenario and the resulting full-disclosure equilibrium.

occurs), but P1 could impose an informal sanction on P2. This can also result in multiple equilibrium thresholds for the prosecutors; one type of equilibrium is similar to those described above but another equilibrium involves no suppression by either prosecutor. In particular, if P2 conjectures that P1 will always disclose (regardless of type), then it is a best response for P2 to always disclose as well (and J need not investigate). But then neither P can ever benefit from suppressing evidence. If the prosecutors can coordinate on a particular equilibrium, then they will avoid this one; moreover, if this is the anticipated equilibrium in the 22 configuration, then they will have even more reason to avoid choosing the 22 configuration.

5.3. Costly Suppression Effort

Assume that a P who has observed E and wishes to suppress it can influence the likelihood that D will subsequently discover E by engaging in suppression effort e at a cost of $e^2/2$, yielding a likelihood $\eta(e)$ that D later discovers E, where $\eta'(e) < 0$ and $\eta''(e) > 0$. We assume that this effort is expended only after P has decided to suppress E.[24] Resource costs of active suppression adds some minor complications, but again it does not affect the results in any material way.

In the 21 configuration, a P of type τ that considers suppression expects to gain $S_2(1 - \eta(e)) - \eta(e)k\mu\hat{\rho} - \tau - e^2/2$ and will choose e to maximize this expression (which is strictly concave in e, with a unique interior solution). This yields an optimal suppression effort $e^*(\hat{\rho})$ that is increasing in $\hat{\rho}$, and independent of τ. The best-response disclosure threshold for P is now $t^{BR}(\rho) = S_2(1 - \eta(e^*(\rho)) - \eta(e^*(\rho))k\mu\rho - (e^*(\rho))^2/2$ for any given ρ. Although no longer linear in ρ, $t^{BR}(\rho)$ is still a downward-sloping function in (t, ρ) space; by the envelope theorem, $t^{BR\prime}(\rho) = -\eta(e^*(\rho))k\mu$. It crosses the

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[24] If P has not observed E then let η_0 be the likelihood that D discovers E; this would replace η in the second term of equations (13) and (14), which cannot affect any of the analysis. Notice that there is no reason to assume, for example, that $\eta_0 = \eta(0)$. For example, Thompson's defense would not have found the blood evidence in the burglary case if the prosecution had not already discovered it.

horizontal axis at $t = S_2(1 - \eta(e*(0)) - (e*(0))^2/2$. J's best response function for the 21 configuration

is independent of η, and is unaffected by P's effort suppression choice. The best response functions

continue to have a unique intersection point that provides the BNE. The profit function Π_{21}^* must

be modified to reflect the effort suppression cost $(e*(\rho_{21}^*))^2/2$, which now appears in the integrand.

In addition, the endogenous value of $\eta(e*(\rho_{21}^*))$ appears in the third and fourth terms of Π_{21}^*.

In modeling suppression effort in the 22 configuration, there are many possible ways to think

about this. For instance, when is effort expended? Whose effort matters? One plausible model

assumes that this effort is (again) expended only after the outcome of the disclosure decisions is

realized. That is, first P1 and P2 decide whether or not to disclose; if both choose not to disclose,

then they each choose suppression effort simultaneously and non-cooperatively. Since they both

observed E, we assume that they both must take effort to suppress it (e.g., they must both hide or

destroy their copies of the lab report, they must both purge their emails, etc.), with a plausible

formulation being $\eta(e_1, e_2) = \eta(\min\{e_1, e_2\})$. That is, the suppression chain is only as strong as its

weakest link. If both P1 and P2 have announced an intention not to disclose, then P1 will

subsequently choose effort e_1 to maximize $S_2(1 - \eta(e_1)) - \eta(e_1)k\mu\hat{\rho} - \tau_1 - (e_1)^2/2$, subject to $e_1 \leq e_2$, as

there is no return to going beyond e_2, given the assumed functional form for $\eta(e_1, e_2)$. For a given

value of ρ, there is a continuum of equilibria wherein $e_1 = e_2$, ranging from 0 to $e*(\hat{\rho})$ as defined

above. Among these, both Ps prefer the equilibrium wherein $e_1 = e_2 = e*(\hat{\rho})$, so we select that one;

this is also the common effort level they would choose if they cooperated on the choice of effort.

Now consider P1's choice between suppressing and disclosing E. If P1 discloses, then he

will receive a payoff of 0 whereas if he suppresses, then he anticipates a payoff of $[S_2(1 - \eta(e*(\hat{\rho})) - \eta(e*(\hat{\rho}))k\mu\rho - (e*(\hat{\rho}))^2/2 - \tau_1]F(t)$, where F(t) represents P1's conjectured probability that P2 will also

choose to suppress (in which case they each exert effort $e^*(\hat{\rho})$). Thus, P1's best-response disclosure threshold is the same as in the 21 configuration above: $t^{BR}(\rho) = S_2(1 - \eta(e^*(\rho)) - \eta(e^*(\rho))k\mu\rho - (e^*(\rho))^2/2$ for any given ρ. J's best response function for the 22 configuration is independent of η, and is thus unaffected by the effort suppression choice. The best response functions continue to have a unique intersection point that provides the BNE. The profit function Π^*_{22} in equation (14) must be modified to reflect the effort suppression cost $(e^*(\rho^*_{22}))^2/2$, which now appears in the integrand. The 21 configuration remains the unique equilibrium, as before.

6. Summary and Discussion

6.1 Summary

In this paper we model a prosecutor's objective as a mixture of career concerns and moral concerns about causing innocent defendants to be convicted. Furthermore, we extend the model to a team of two prosecutors, each of whom has private information as to their individual disutility for convicting the innocent, and both of whom would benefit from a win at trial. If exculpatory evidence comes into the possession of the prosecution, it may choose to disclose or suppress it, where suppression leads to an unwarranted conviction of the defendant. Suppression of exculpatory evidence that is material to the defense is a violation of the defendant's constitutional rights under *Brady v. Maryland*, but can readily contribute to the prosecutor's career success. We focus on perfect exculpatory evidence so as to clarify the primary incentives for disclosure.

If exculpatory evidence is later discovered by the defense, the conviction is voided and a judge may order an investigation, depending upon the value of pursuing possible prosecutorial misconduct versus the judge's disutility for this pursuit. We characterize the Bayesian Nash Equilibrium in the game between the prosecution and the judge. In the team case we consider two

information configurations, one wherein only one of the two prosecutors received exculpatory evidence (the disjoint configuration) and one wherein both received it (the joint configuration). When the configuration is endogenous, the disjoint configuration is the unique equilibrium.

6.2 Discussion of Policy Implications

At present the prosecution is only required to turn over exculpatory evidence that is material, which allows for discretionary choices on the part of a prosecutor that can result in a decision that disclosure (either to D or to a prosecutorial teammate) is not required. Kozinski (2013, footnote 118, p. xxiv) observes: "Lack of materiality is the Justice Department's standard defense when it is caught committing a *Brady* violation." This is undoubtedly no less true at the state level. One direct policy change could be to reduce the strategic opportunities for prosecutors to suppress evidence by eliminating the materiality requirement. If this strategic discretionary decision could be avoided or minimized, then evidence would be more broadly-shared within the prosecution team and with the defense. There have been a number of calls for "open files," so that evidence developed by the prosecution that is relevant to the defense is promptly made available to both sides.[25]

The effect of such a change is captured in our analysis. Recall that in the model, the parameter μ was the probability that an investigation ordered by J verifies P's failure to disclose material exculpatory evidence in his possession. In Section 2.4 we indicated that an increase in μ led to an decrease in the set of types who are willing to suppress, measured by $F(t^*)$. Allowing P to use materiality strategically as a defense for evidence suppression (e.g., as noted above by Kozinski) means that the resulting value of μ is <u>lower</u> than it would otherwise be, leading to an increase in t^*,

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[25] See the discussion and references in New York State Bar Association: Report of the Task Force on Criminal Discovery, 2015. The report cites examples of broadened discovery procedures and statutes in major cities in the U.S., as well as in states such as New Jersey, North Carolina, Ohio, and Texas.

and therefore in $F(t^*)$. That is, an investigation that found that some exculpatory evidence was not included in the (otherwise) open files could provide a very clear signal of an intent to violate *Brady*.

A second policy change concerns the penalties for individual prosecutors. Since the U.S. Supreme Court's decision in *Imbler v. Pachtman* in 1976, prosecutors have enjoyed absolute immunity from civil liability for activities "intimately associated with the judicial phase of the criminal process." (*Imbler* at 430). Prosecutors are (in principle) subject to criminal prosecution but, Kozinski (2015, p. xxxix) observes that: "Despite numerous cases where prosecutors have committed willful misconduct, costing innocent defendants decades of their lives, I am aware of only two who have been criminally prosecuted for it; they spent a total of six *days* behind bars." California recently passed a law making it a felony for prosecutors to knowingly withhold or falsify evidence; the sentence can run from 16 months to three years. Notice that improving μ, as discussed above, means that the penalty k (in terms of fines or jail time) in our model is likely to be considerably more salient, possibly encouraging more judges to pursue suspected *Brady* violations.

There is a range of penalties available to policy makers, some "softer" than direct liability. Kozinski (2015, p. xxvi) suggests a "naming and shaming" strategy: "Judges who see bad behavior by those appearing before them, especially prosecutors who wield great power and have greater ethical responsibilities, must hold such misconduct up to the light of public scrutiny." One might expect that developing more common knowledge among trial judges that some of the prosecutors they engage with have developed reputations for violating *Brady* may lead those judges to more-readily refer cases for investigation.

A third policy change concerns providing incentives for prosecutorial offices to adhere to both the spirit and letter of *Brady*. We found that: 1) office culture can be a positive force for

disclosure of exculpatory evidence, or a negative force; and 2) informal sanctions by individual team members who would have chosen to suppress evidence (if they had discovered it) yields multiple equilibria, but all of those equilibria lead to yet more suppression of evidence than occurs without such informal sanctions.

While individual prosecutors enjoy absolute immunity from civil suit, municipalities can be subject to liability if plaintiffs can demonstrate deliberate indifference via a pattern of similar constitutional violations (see the majority opinion in *Connick v. Thompson* by Justice Thomas at 52). This necessitates a scheme for accumulating information on *Brady* violations. To our knowledge, while all states have judicial conduct commissions (so that complaints about the behavior of judges can be filed, documented, and investigated) no such bodies exist for receiving, documenting, and investigating complaints about prosecutorial conduct. As indicated earlier, some states handle complaints via courts while others use the state bar. Establishing prosecutorial conduct commissions in each state, with the power to document and investigate misconduct,[26] means that public databases of misconduct could be developed. This would allow patterns of behavior to be deduced, and lawsuits against municipalities to be supported by patterns of behavior. Furthermore, it would also allow documentation of egregious behavior to be used by those who desire to run for District Attorney positions in political campaigns, drawing the electorate into more-informed decision-making regarding what sort of prosecutorial office they want to have. Monetary leverage on municipalities, and political pressure on chief prosecutors, to better monitor professional staff (and modify office culture) could thus be a way to break down pernicious office culture that encourages or tolerates *Brady* violations.

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[26] This would also reduce J's costs and disutility associated with addressing suspected misconduct, thereby increasing the deterrence effect of penalties for violating *Brady*.

Appendix

<u>Proof of Proposition 4</u>. To see that $(F(t_{22}^*))^2 < F(t_{21}^*)$, we first make this argument assuming that $V_2 = V_1$. We then argue that an increase in V_2 (holding V_1 constant) reinforces the result. Recall that $\rho_{22}^{BR}(t) = H_2(V_2\mu\gamma(F(t))^2/[1 - \gamma + \gamma(F(t))^2])$ and $\rho_{21}^{BR}(t) = H_2(V_1\mu\gamma F(t)/[1 - \gamma + \gamma F(t)])$. If $V_2 = V_1$, then $\rho_{22}^{BR}(t) < \rho_{21}^{BR}(t)$ for all $t > 0$ because the expression $X/[1 - \gamma + \gamma X]$ is increasing in X and $(F(t))^2 < F(t)$. Since the function $t_{22}^{BR}(\rho) = S_2(1 - \eta) - t - \eta k\mu\rho = t_{21}^{BR}(\rho)$ is downward-sloping and the functions $\rho_{22}^{BR}(t)$ and $\rho_{21}^{BR}(t)$ are upward-sloping, the equilibrium likelihoods of investigation can be ordered: $\rho_{22}^* < \rho_{21}^*$. Since $\rho_{22}^* = H_2(V_1\mu\gamma(F(t_{22}^*))^2/[1 - \gamma + \gamma(F(t_{22}^*))^2]) < \rho_{21}^* = H_2(V_1\mu\gamma F(t_{21}^*)/[1 - \gamma + \gamma F(t_{21}^*)])$ and H_2 is increasing in its argument, it follows that $V_1\mu\gamma(F(t_{22}^*))^2/[1 - \gamma + \gamma(F(t_{22}^*))^2] < V_1\mu\gamma F(t_{21}^*)/[1 - \gamma + \gamma F(t_{21}^*)]$. This inequality holds if and only if $(F(t_{22}^*))^2 < F(t_{21}^*)$. Thus we have established the claim under the assumption that $V_2 = V_1$. Now consider the effect of increasing V_2. The expression $F(t_{21}^*)$ is unaffected because t_{21}^* is based on V_1. But an increase in V_2 increases the function $\rho_{22}^{BR}(t)$ for every $t > 0$, which results in an increase in ρ_{22}^* and a decrease in t_{22}^*. A decrease in t_{22}^* reduces the expression $(F(t_{22}^*))^2$, which reinforces the result that $(F(t_{22}^*))^2 < F(t_{21}^*)$.

<u>Proof of Proposition 5</u>. Proposition 5 claims that $\Pi_{21}^* > \Pi_{22}^*$, at least for $t_{22}^* \leq t_{21}^*$ or for $t_{22}^* > t_{21}^*$, but sufficiently close. In the 21 configuration, $t_{21}^* = S_2(1 - \eta) - \eta k\mu\rho_{21}^*$. Thus, Π_{21}^* can be re-written as:

$$\Pi_{21}^* = (1 - \lambda)S_2 + \lambda(1 - \gamma)S_2(1 - \eta) + (\lambda\gamma/2)S_2(1 - \eta)F(t_{21}^*) + (\lambda\gamma/2)\int \{t_{21}^* - \tau\}dF(\tau),$$

where the integral is over $[0, t_{21}^*]$. In the 22 configuration, $t_{22}^* = S_2(1 - \eta) - \eta k\mu\rho_{22}^*$. Thus, Π_{22}^* can be re-written as:

$$\Pi_{22}^* = (1 - \lambda)S_2 + \lambda(1 - \gamma)S_2(1 - \eta) + \lambda\gamma F(t_{22}^*)\int \{t_{22}^* - \tau\}dF(\tau),$$

where the integral is over $[0, t_{22}^*]$. Recall that there is no clear ordering between t_{22}^* and t_{21}^*. If $V_2 = V_1$, then $t_{22}^* > t_{21}^*$, but a sufficient increase in V_2 relative to V_1 could, in principle, reverse this inequality. Suppose that $t_{22}^* \leq t_{21}^*$; then we claim that $\Pi_{22}^* < \Pi_{21}^*$. This follows from three facts. First (where all integrals are over $[0, t_{21}^*]$):

$$S_2(1 - \eta)F(t_{21}^*) > \int \{S_2(1 - \eta) - \eta k\mu\rho_{21}^* - \tau\}dF(\tau) = \int \{t_{21}^* - \tau\}dF(\tau).$$

Second, $\int \{t_{21}^* - \tau\}dF(\tau)$ (where the integral is over $[0, t_{21}^*]$) $> \int \{t_{22}^* - \tau\}dF(\tau)$ (where the integral is over $[0, t_{22}^*]$). This latter result follows since the expression $\int_0^x \{x - \tau\}dF(\tau)$ is increasing in x and $t_{21}^* > t_{22}^*$ (the two terms are equal if $t_{21}^* = t_{22}^*$). Third, the expression $\int \{t_{22}^* - \tau\}dF(\tau)$ (where the integral is over $[0, t_{22}^*]$) is pre-multiplied by $F(t_{22}^*) < 1$. Combining these inequalities implies that $\Pi_{21}^* > \Pi_{22}^*$. Since this inequality is strict, it will also hold for $t_{22}^* > t_{21}^*$ (but sufficiently close).

Evidence Suppression in the 22 Configuration with Transferable Utility

  If Ps had transferable utility, then a team in a 22 configuration could use a direct mechanism that: (1) would induce them to report their τ-values truthfully (to the mechanism); and (2) would recommend the efficient decision (i.e., the one that maximizes the sum of their payoffs). To see how, let $w_i \equiv S_2(1 - \eta) - \tau_i - \eta k\mu\hat{\rho}$ denote Pi's value for suppressing evidence; this may be positive

or negative. Let W_i denote Pi's reported value of w_i. If $W_i + W_j \leq 0$, then the mechanism recommends that the evidence be disclosed; moreover, if $W_j > 0$, then Pi pays a "tax" of W_j to a third party (so as not to affect Pj's reporting). But if $W_i + W_j > 0$, then it recommends that the evidence be suppressed; moreover, if $W_j \leq 0$, then Pi pays a "tax" of $-W_j$ since Pi is changing the decision.

The taxes correspond to what would just compensate the other P for imposing an outcome he does not prefer; however, the taxes are not paid to the other P, but rather to a third party (so as not to affect the other P's reporting strategy). This mechanism induces truthful revelation of τ-values and results in the efficient (for the team) recommendation: suppress evidence when the $\underline{\text{average}}$ disutility $(\tau_1 + \tau_2)/2 < S_2(1 - \eta) - \eta k\mu\hat{\rho}$, and otherwise disclose it to D. That is, the disclosure threshold is $t_{22}(\hat{\rho}) \equiv \max\{0, S_2(1 - \eta) - \eta k\mu\hat{\rho}\}$, which is the same as without transferable utility.

Next we consider J's payoff, assuming she knows the team employs a Groves-Clarke mechanism. J conjectures that a team observing E will suppress it whenever the average disutility $(\tau_1 + \tau_2)/2$ is less than some threshold $\hat{t}$. Thus, when D provides E, but the team reported φ, J's posterior belief that the prosecutors are suppressing evidence is $\gamma F^{avg}(\hat{t})/[1 - \gamma + \gamma F^{avg}(\hat{t})]$, where $F^{avg}(\hat{t}) = \Pr\{(\tau_1 + \tau_2)/2 < \hat{t}\}$. J's expected payoff from investigation is now $V_2\mu\gamma F^{avg}(\hat{t})/[1 - \gamma + \gamma F^{avg}(\hat{t})] - c$. Thus J's best response is to investigate whenever $c \leq V_2\mu\gamma F^{avg}(\hat{t})/[1 - \gamma + \gamma F^{avg}(\hat{t})]$.

The following functions summarize the best-response behavior (the superscript "BR" denoting best response has been replaced with "TU" denoting transferable utility):

$$t_{22}^{TU}(\rho) \equiv S_2(1 - \eta) - \eta k\mu\rho; \text{ and } \rho_{22}^{TU}(t) \equiv H_2(V_2\mu\gamma F^{avg}(t)/[1 - \gamma + \gamma F^{avg}(t)]).$$

Clearly, $t_{22}^{TU}(\rho) = t_{22}^{BR}(\rho)$; the threshold value of t in terms of ρ remains the same, but now it is the average disutility $(\tau_1 + \tau_2)/2$ that must meet that threshold in order to induce disclosure. However, $\rho_{22}^{TU}(t) = H_2(V_2\mu\gamma F^{avg}(t)/[1 - \gamma + \gamma F^{avg}(t)]) > \rho_{22}^{BR}(t) = H_2(V_2\mu\gamma(F(t))^2/[1 - \gamma + \gamma(F(t))^2])$. This follows because the function $H_2(V_2\mu\gamma X/[1 - \gamma + \gamma X])$ is increasing in X and $F^{avg}(t) > (F(t))^2$ for $t > 0$. To see why this last inequality holds, note that $(F(t))^2 = \Pr\{\text{both } \tau_1 \text{ and } \tau_2 < t\}$, whereas $F^{avg}(t) = \Pr\{(\tau_1 + \tau_2)/2 < t\}$. The set of values of (τ_1, τ_2) that satisfy $(\tau_1 + \tau_2)/2 < t$ strictly contains the set of (τ_1, τ_2)-values such that both τ_1 and τ_2 are simultaneously less than t.

There is a unique BNE, denoted $(t_{22}^{TU*}, \rho_{22}^{TU*})$, which is given by:

$$t_{22}^{TU*} = S_2(1 - \eta) - \eta k\mu\rho_{22}^{TU*}; \text{ and } \rho_{22}^{TU*} = H_2(V_2\mu\gamma F^{avg}(t_{22}^{TU*})/[1 - \gamma + \gamma F^{avg}(t_{22}^{TU*})]).$$

Since $\rho_{22}^{TU}(t) > \rho_{22}^{BR}(t)$ for all $t > 0$, and $t_{22}^{TU}(\rho) = t_{22}^{BR}(\rho)$ for all ρ, the intersection of $\rho_{22}^{TU}(t)$ and $t_{22}^{TU}(\rho)$ must be to the northwest of the intersection of $\rho_{22}^{BR}(t)$ and $t_{22}^{BR}(\rho)$. That is, $\rho_{22}^{TU*} > \rho_{22}^*$ and $t_{22}^{TU*} < t_{22}^*$; under transferable utility the equilibrium likelihood of investigation will be higher and the threshold for evidence disclosure will be lower. The equilibrium probability of suppression is $F^{avg}(t_{22}^{TU*})$ under transferable utility and $(F(t_{22}^*))^2$ when utility is not transferable. Since $\rho_{22}^{TU*} > \rho_{22}^*$, it follows (by comparing equation (12) in the main text giving ρ_{22}^* with that providing ρ_{22}^{TU*} above) that $F^{avg}(t_{22}^{TU*}) > (F(t_{22}^*))^2$. That is, there is more evidence suppression in equilibrium when utility is transferable as compared to when it is not transferable.

However, the prosecutors must somehow be committed to the mechanism, because there are circumstances in which a P would want to defect from the mechanism upon learning his type and the recommendation. In particular, suppose the recommendation is to suppress the evidence; although the sum is positive, it could be that w_i is negative. Because Pi is not actually compensated, he still experiences $w_i < 0$ and therefore has an incentive to defect from the mechanism by disclosing E to D and refusing to pay the tax (thus raising his payoff to 0). There would need to be some sort of additional penalty to ensure compliance with the mechanism. Because (in our setting) we don't believe that transferable utility and enforceability of such a mechanism are compelling assumptions (as the behavior to be supported is prohibited), we do not analyze this scenario further.

Analysis of Choice Between Configurations in Subsection 4.1

Can there be an equilibrium to the overall game wherein the team of prosecutors chooses a joint information configuration? The putative equilibrium payoff is Π_{22}^*, which is given in equation (14) in the text. Since J expects configuration 22 (and cannot observe the deviation), she investigates with probability ρ_{22}^*; but then the best response for a P is t_{22}^*. So the equilibrium in the subgame is still (t_{22}^*, ρ_{22}^*) following the hypothesized deviation. Thus, the deviation payoff is:

$$\Pi_{22}^{dev} = (1 - \lambda)S_2 + \lambda(1 - \gamma)S_2(1 - \eta) + (\lambda\gamma/2)S_2(1 - \eta)F(t_{22}^*) + (\lambda\gamma/2)\int \{S_2(1 - \eta) - \eta k\mu\rho_{22}^* - \tau\}dF(\tau),$$

where the integral is over $[0, t_{22}^*]$. The deviation is preferred whenever:

$$(\lambda\gamma/2)S_2(1 - \eta)F(t_{22}^*) + (\lambda\gamma/2)\int \{S_2(1 - \eta) - \eta k\mu\rho_{22}^* - \tau\}dF(\tau)$$

$$> \lambda\gamma F(t_{22}^*)\int \{S_2(1 - \eta) - \eta k\mu\rho_{22}^* - \tau\}dF(\tau),$$

where both integrals are over $[0, t_{22}^*]$. The left-hand-side is the average of two terms, each of which is larger than the right-hand-side, so the deviation is always preferred (22 cannot be an equilibrium).

Can there be an equilibrium to the overall game wherein the team of prosecutors chooses a disjoint information configuration? The putative equilibrium payoff is Π_{21}^*, which is given in equation (13) in the text. Since J expects configuration 21 (and cannot observe the deviation), she investigates with probability ρ_{21}^*; but then the best response for a P is t_{21}^*. So the equilibrium in the subgame is still (t_{21}^*, ρ_{21}^*) following the hypothesized deviation. The deviation payoff is:

$$\Pi_{21}^{dev} = (1 - \lambda)S_2 + \lambda(1 - \gamma)S_2(1 - \eta) + \lambda\gamma F(t_{21}^*)\int \{S_2(1 - \eta) - \eta k\mu\rho_{21}^* - \tau\}dF(\tau),$$

where the integral is over $[0, t_{21}^*]$. The deviation is preferred whenever:

$$\lambda\gamma F(t_{21}^*)\int \{S_2(1 - \eta) - \eta k\mu\rho_{21}^* - \tau\}dF(\tau)$$

$$> (\lambda\gamma/2)S_2(1 - \eta)F(t_{21}^*) + (\lambda\gamma/2)\int \{S_2(1 - \eta) - \eta k\mu\rho_{21}^* - \tau\}dF(\tau),$$

where both integrals are over $[0, t_{21}^*]$. The right-hand-side is the average of two terms, each of which is larger than the left-hand-side. Thus, the deviation is never preferred (21 is an equilibrium).

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