# Cover-ups

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**Abstract**

Lengthy cover-ups are a repeated feature of the organizational landscape. This paper studies executives' optimal cover-up strategies given the penalties and the evolving beliefs of strategic outside parties who investigate malfeasance. The analysis shows that organizational self-policing and external investigation are strategic substitutes in any given period. Over time, successful cover-ups increase the incentive to cover up, and changes in the current environment, such as an increased awareness of the harmful effects of the employee's actions, can result in a reduction in cover-ups in the short term but an increase in the long term. We consider different prosecutorial regimes, with long-lived and short-lived prosecutors, prosecutors who can commit to a policy, and prosecutors who observe or not the outcome of past investigations.

Keywords: cover-ups, organizational behavior, employee malfeasance, prosecutor incentives

## 1 Introduction

Lengthy cover-ups are a continual feature of corporate and organizational landscapes. University athletic directors cover-up sexual abuse by coaches and team doctors for years.[1] Leaders of the Catholic Church hide priests' pedophilia and repeatedly reassign clergy to new parishes.[2] Automobile executives take successive steps to conceal software that beats emissions tests.[3] Why do executives persist in their cover-up efforts? This paper formally studies executive decisions to cover-up employee malfeasance over time even while facing legal or other external investigations.

The model captures the main features of cover-up scandals. In the first instance, a valuable employee commits an illegal or unethical act. The act harms third parties, but the organization derives benefits from hiding the crime and continuing to employ the perpetrator. Executives who learn of the act decide how to proceed, and outside parties, such as legal authorities or the press, who see signs of malfeasance decide whether or not to investigate. Beyond preventing further malfeasance, these outside parties have

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[1]See, e.g., Freeh (2012) for Gerald Sandusky at Penn State; Kirby (2018) and Kozlowski (2018) for Larry Nassar at Michigan State and USA Gymnastics .

[2]See, e.g., Rezendes (2002) for the Boston Archdiocese and Bonnefoy (2018) for Chile.

[3]See Leggett (2018) for details of the Volkswagen deception.

personal gains (e.g., career advancement) from uncovering the cover-up. The crime is repeated and decisions to cover up and decisions to investigate are made multiple times. In the cases cited above, the crime(s) and cover-up(s) were eventually discovered, and the organization's executives were punished.

The analysis of our model with rational *executives* and *prosecutors* sheds light on the dynamics of cover-ups and investigations. First, in any given period, organizational self-policing and external investigation are strategic substitutes; the greater the probability an executive reveals the crime, the lower is prosecutorial effort. Second, over time an executive who covers up and whose cover-up is not discovered faces less skeptical prosecutors in the future. These prosecutors investigate at a lower rate. Hence, successful cover-ups beget future cover-up incentives. Third, an increase in current public approbation for turning a blind eye to abuse (such as #MeToo) leads to greater organizational self-policing. However, this tendency is attenuated by lower rates of current and future prosecutorial investigation (since self-policing and investigation are strategic substitutes). The same intertemporal substitution applies to an increased punishment for a cover-up; the executive's greater disincentive to cover-up leads to a disincentive for both current and future investigations.

We then analyze several alternative prosecutorial regimes and the effect on the equilibrium cover-ups and investigations. These alternative regimes represent different institutional arrangements of legal authorities, for example, elected vs. appointed district attorneys. In the baseline case, short-lived prosecutors in each period act independently from one another and cannot commit to their investigation policies. We find that when these independent short-lived prosecutors each can commit to an investigation policy, they each choose a lower rate of investigation than otherwise. Without commitment, a prosecutor only weighs the current investigation costs against the likelihood of discovering a cover-up. A prosecutor who can commit to investigation strategy, such as an elected district attorney who sets policies for the office and is accountable to voters, faces a trade-off: while a higher investigation rates increase the likelihood of catching an executive, the higher rate also deters the executive from covering-up in the first place. A single long-lived prosecutor (such as appointed longer term district attorney) has similar incentives: a lower investigation rate in the beginning of the interaction raises the probability the executive will cover-up, which in turn increases the prosecutor's personal expected payoffs from discovering this cover-up in a later period.

We further consider how information about previous investigations changes prosecutors' incentives and the equilibrium cover-up path. These regimes capture the possibility that investigations occur independently, by different actors in society, or, as in the case of the Catholic Church, that perpetrators are moved to new jurisdictions. Returning to the base case—when prosecutors are short-lived and cannot commit—we find that executives can have greater incentive to cover-up when a prosecutor does not know whether a previous investigation has taken place. For the the executive, there is a possible benefit from a commonly-known failed investigation, since future would-be investigators have lower belief that the executive is covering up a crime. But this benefit does not translate into lower likelihood of future investigation when investigation costs are more likely to be high, as when, say, victims are children. In this case, executives are "effectively risk-averse," preferring ignorant future prosecutors who cannot refine their beliefs based on whether or not a previous investigation took place.

The paper contributes to the literature in law and economics in several ways. It is related to the literature on self-reporting (Kaplow and Shavell (1994) and Innes (1999)), which emphasizes the positive role of self-reporting to reduce enforcement costs and the risk of criminal behavior, in particular in environmental economics. The optimal enforcement policy involves reducing the fee for agents who self-report criminal behavior. The paper is also related to the literature on repeat offenders pioneered by Polinsky and Rubinfeld (1991) and Polinsky and Shavell (1997). A remarkable result of this literature is that, contrary to most sentencing guidelines, optimal fees need not increase with the number of offenses. The optimal fees could even be declining, as in Burnovski and Safra (1994) and Emons (2003). Rubinstein (1979) and Chu et al. (2000), Dana (2001) and Miceli (2005), among others, have proposed different mechanisms to solve the "escalating fines puzzle" and Miceli (2013) provides a survey of the literature. More recently, Buehler and Eschenbaum (2020) show that escalating fines can arise in a unified model also covering dynamic price discrimination. In almost all models in the repeat offenders literature, the enforcement probability is exogenous, and criminal opportunities are drawn independently every period. In the present paper, in contrast, the executive and prosecutors are rational and strategic; the enforcement probability is endogenous and all beliefs evolve according to Bayes' rule. After a successful cover-up, future prosecutors are less likely to investigate and, absent increasing penalties, a rational executive has greater incentive to cover-up. Increasing fines over time puts brakes on these incentives.

The stage game between the executive and the prosecutor in our model is an inspection game, and our paper is thus related to the large literature on inspection games surveyed by Avenhaus, von Stengel and Shmuel Zamir (2002). Our paper departs from the classical model of inspection games in several dimensions. First, we introduce randomness in the behavior of the inspector as well as the inspectee. Second, and more importantly, we consider an incomplete information setting, where the inspectee has a persistent type and chooses his violation at every period. This results in a dynamic evolution of beliefs and inter-temporal trade-offs that are absent from classical inspection games.

A recent paper by Dilme and Garrett (2019) analyzing reputation in dynamic inspection games is probably the paper which is most closely connected to our work. They analyze a repeated inspection games between a long-lived regulator and short-lived firms and show that, when the regulator faces a fixed cost of starting an inspection, and the inspection is not observed by the firm, the equilibrium exhibits a cycle, where firms comply after observing a conviction (the "residual deterrence") but gradually come back to a baseline level of offense (the "deterrence decay"). While the inter-temporal trade-off between prosecution and compliance in their paper is reminiscent of the one we highlight in our paper, the models are very different. Contrary to Dilme and Garrett (2019), we assume that prosecutors are short-lived while the organization is long-lived. We also suppose that the type of the perpetrator is exogenous and persistent, whereas in Dilme and Garrett (2019) the reputation of a regulator is based on his endogenous choice to commence an inspection.

Finally, our paper is more distantly related to the literature analyzing the incentives to silence whistle-blowers in organizations. For example, Muelheusser and Roider (2008) propose a model to explain why team members are reticent to denounce other team members if they observe misbehavior, and prefer to erect a "wall of silence". The literature on whistle-blowing (Friebel and Guriev (2012), Felli and Hortala-Vallve (2017), Chassang and Padro i Miquel (2019), Mechtenberg et al. (2020)) also emphasizes the retaliation power of the executive in the organization and the importance of providing legal protection to the whistle-blower.

The paper proceeds as follows: Section 2 models executive-prosecutor interaction, analyzes the equilibrium dynamics of a two-period baseline model, and studies the equilibrium effects of changes in the environment. Section 3 studies commitment by prosecutors and different prosecutorial regimes. Section 6.2.2 considers the equilibrium of a multiple-period infinite horizon game, which demonstrates the main drivers of cover-up incentives over time. (The Appendix provides a generalization of the finite period model.) The Conclusion outlines future research directions.

# 2 A Model of Cover-ups

This section builds our model of cover-ups, specifying the interaction between an executive of an organization and external investigators over time.

## 2.1 Cover-up Model

Consider an *executive* in an organization. The executive supervises an employee who is possibly a *perpetrator*, i.e., a person who commits abuse, falsifies regulatory tests, or otherwise continually harms third parties. The employee is a perpetrator with exogenous probability $\gamma_0$.[4] To focus on cover-ups, we begin with the event that the executive verifiably observes that the employee is a perpetrator.

We specify the following per-period interaction. In each period, the executive decides whether to fire the employee or to cover-up the perpetrator's crimes(s). If the employee is not fired, in each period there is a *prosecutor* (e.g., law enforcement, news reporter) who decides whether to investigate the organization. Each prosecutor's decision is based on the current realized cost of investigating and the current beliefs as to whether there is a perpetrator in the organization. If the prosecutor investigates and does not reveal a perpetrator, the interaction continues next period with the executive's next decision to fire the employee or to cover-up.

As a baseline, we consider two periods of interaction. (The Appendix contains a generalization of this model to multiple periods, and Section 6.2.2 considers interaction with an infinite horizon.) The executive's payoff is the discounted sum of the payoffs obtained in both periods with a fixed discount factor $\delta \in (0, 1)$. In any period in which the employee remains in the organization, the executive receives revenue $\widetilde{\omega}_t - \Omega_t$, where $\widetilde{\omega}_t$ is a random variable and $\Omega_t$ is a shift parameter. The random variable $\widetilde{\omega}_t$ represents the direct benefits that accrue to the executive from retaining the employee and covering up the crimes, such as the continued services of the employee. We assume that $\widetilde{\omega}_t$ is distributed over $(-\infty, +\infty)$ according to the continuously differentiable cumulative distribution $R$ which is common knowledge. The realization $\omega_t$ is the executive's private information. The parameter $\Omega_t$ captures costs that the executive bears from retaining the employee and is common knowledge. This cost could be the extent to which the executive cares about the harm to the employee's victims (capturing, say, the organization's culture or values) or the extent to which the executive is even cognizant of the harm to the victims (capturing say, the power or the voice of victims to articulate the harm).

In each period $t$, the executive sees the realization $\omega_t$ and decides whether or not cover-up the employee actions. A cover-up yields the executive $\omega_t - \Omega_t$; if the executive does not cover-up, the interaction ends, and the executive suffers a penalty $f_t^a$. The superscript $a$ denotes "amnesty," and these penalties are assumed to be smaller than those incurred if the cover-up is revealed by the period $t$ prosecutor, which we denote by $f_t$; that is, we assume that $f_t^a \leq f_t$ and the difference $f_t - f_t^a$ measures the additional penalty imposed on the executive for covering up the crime. The penalties depend on the time $t$ since $t$ corresponds to the number of acts of malfeasance of the perpetrator and the number of times the executive has covered up those crimes. We assume $f_{t-1} \leq f_t$ so that the executive faces higher overall

[4]We do not consider the employee's incentives to commit abuse. The employee either commits abuses or not, and hence the employee has a fixed type.

penalties the greater number of periods the executive has kept the employee in the organization.

We consider two short lived prosecutors, period 1 and period 2 prosecutors, who can investigate if the employee remains in the organization in their respective time period $t$. The prosecutors each base their decision to investigate on their individual costs and benefits, and they do not coordinate their actions. Each period $t$ prosecutor earns a payoff normalized to 1 if she conducts an investigation that uncovers a perpetrator and earns zero otherwise. This specification captures prosecutors who are "career-oriented" or otherwise care about their individual success rather than overall welfare or prevention of harm. The effects analyzed below would hold also for a public-minded prosecutor as long as the prosecutor earn some personal gain from uncovering a cover-up. Prosecutor $t$'s cost to investigate is a random variable $\widetilde{\kappa}_t \in [0,1]$ with continuously differentiable distribution $H$ which is common knowledge of the prosecutor and the executive. The realization $\kappa_t$ is private information of prosecutor $t$. This cost variable captures the quality of the information that the period $t$ prosecutor receives from victims or witnesses or leaks from within the organization that would help with the investigation.[5] An investigation reveals a perpetrator with probability $\sigma$.

Each prosecutor decides whether or not to investigate based on her expected payoffs, which incorporate her belief that the organization harbors a perpetrator. Prosecutors have the initial prior $\gamma_0$. If the executive does not reveal any crime, the period 1 prosecutor forms an updated belief $\gamma_1'$. In period 2, in forming her beliefs, the period 2 prosecutor might or might now know whether a previous investigation occurred in period 1. Let $\iota \in \{I, N\}$ be an indicator variable with $\iota = I$ indicating an investigation occurred in period 1 and $\iota = N$ otherwise. In the baseline case, we suppose that the period 2 prosecutor knows whether an investigation has occurred and conditions her strategy on $\iota$. Prosecutor 2 begins her tenure with belief $\gamma_1$ which is based on her prior $\gamma_0$ and the events that have occurred to date. Her updated belief upon seeing the employee remaining in the organization in period 2 is denoted $\gamma_2'$.

With this notation in hand, Figure 1 summarizes the interaction between the executive and the two prosecutors in period 1 and 2.

## 2.2 Cover-up Equilibrium

The analysis of this two period model yields the main forces of cover-up equilibria. We consider perfect Bayesian equilibria of the game; the executive's and the prosecutors' strategies are credible and all beliefs are consistent with strategies.

[5] The quality of this information is assumed to be independent of an executive's decision to cover up or not. That is, the executive cover up is simply a decision of whether or not to reveal the malfeasance to the prosecutor.

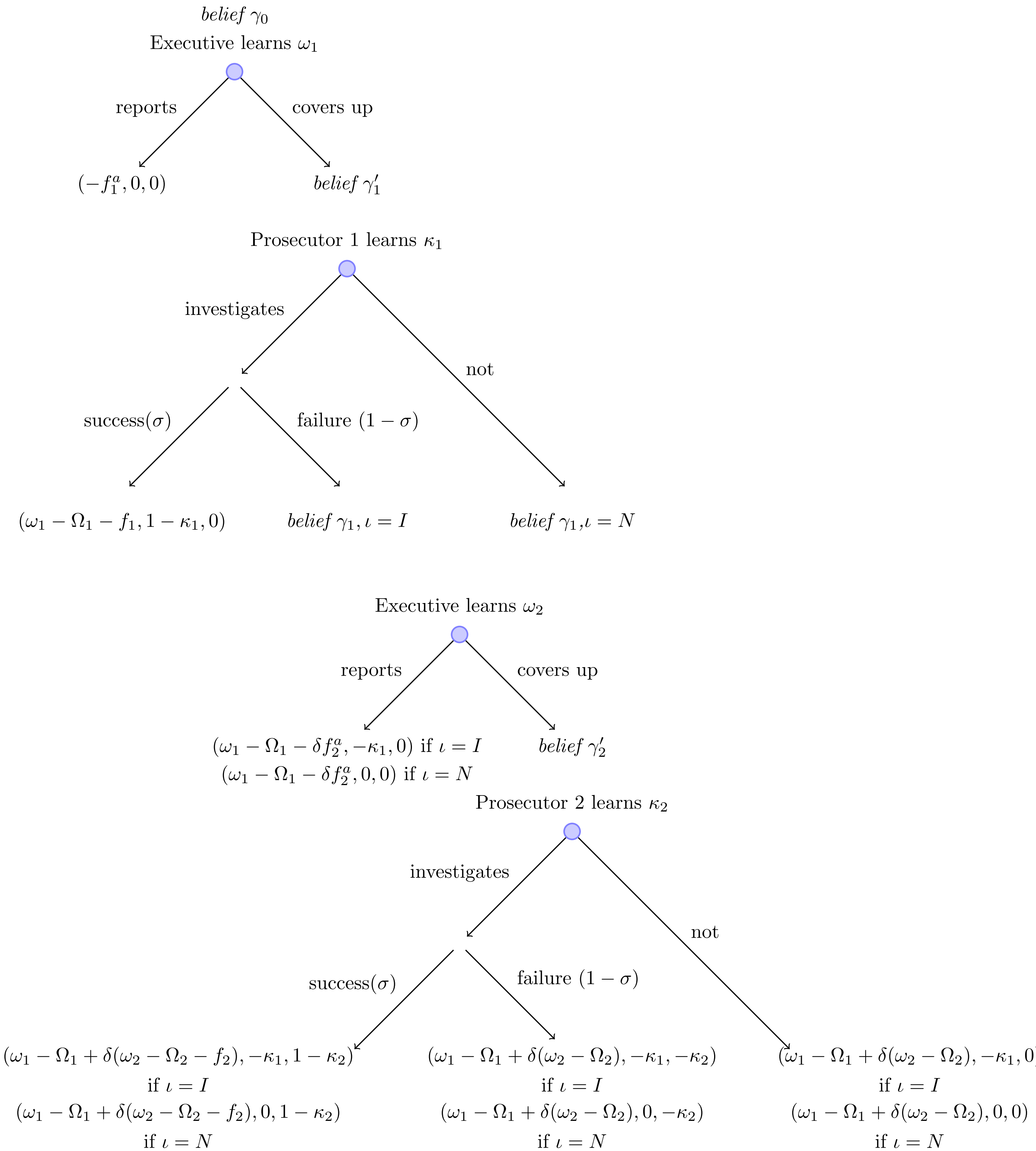


Figure 1: The Two-Period Cover-up Game

We solve by backward induction, first characterizing equilibrium behavior of the prosecutor and executive in period 2. If the executive has not fired the employee, at the end of the period prosecutor 2 makes a decision to investigate or not. Prosecutor 2 has belief $\gamma_2'$ that the employee is a perpetrator. Since an investigation succeeds with probability $\sigma$, prosecutor 2 investigates if and if $\kappa_2 \leq \sigma\gamma_2'$, resulting in the threshold value of the investigation cost:

$$k_2 \equiv \gamma_2'\sigma \tag{1}$$

below which she investigates. The probability prosecutor 2 investigates is then $H(k_2)$.

Working backwards, the executive compares the following payoffs when deciding to cover-up or not in period 2. By reporting the employee, the executive obtains a period 2 payoff of $-f_2^a$. By covering up, the executive obtains $\omega_2 - \Omega_2$ and faces an investigation with probability $H(k_2)$. Since the investigation reveals the cover-up with probability $\sigma$, in which case the executive suffers the penalty $f_2$, the executive's expected payoffs from covering up in period 2 are

$$\Pi_2^C = \omega_2 - \Omega_2 - \sigma H(k_2')f_2. \tag{2}$$

The executive will cover-up in period 2 if and only if the benefit of retaining the employee, $\omega_2$, is sufficiently high. These threshold benefits are

$$w_2 \equiv -f_2^a + \Omega_2 + \sigma H(k_2')f_2, \tag{3}$$

and the probability the executive covers up is $[1 - R(w_2)]$.

The belief of the prosecutor 2, $\gamma_2'$, must consistent with the executive's strategy. With prosecutor 2's initial belief $\gamma_1$, using Bayes' rule, we have

$$\gamma_2' = \frac{\gamma_1[1 - R(w_2)]}{1 - \gamma_1 R(w_2)}. \tag{4}$$

Using equations (1), (3), and (4), we solve for the best replies and the equilibrium values of $k_2$ and $w_2$. Substituting the consistent beliefs (4) in the prosecutor's cutoff (1), yields prosecutor 2's best reply to the executive's decision:

$$k_2(w_2) = \frac{\sigma\gamma_1[1 - R(w_2)]}{1 - \gamma_1 R(w_2)}. \tag{5}$$

This best reply gives the first strategic force in the equilibrium of this cover-up game. The cut-off $k_2$ under which the prosecutor investigates is a *decreasing* function of the cut-off $w_2$ over which the executive covers up the employee. The higher $w_2$—the more an executive reveals the perpetrator and "self-polices"—the less incentive prosecutor 2 has to investigate. For the executive's best reply, we replace $\sigma\gamma_2'$ with $k_2$ to obtain

$$w_2(k_2) = -f_2^a + \Omega_2 + \sigma H(k_2) f_2. \tag{6}$$

This best reply gives our second strategic force; the executive's cut-off $w_2$ is *increasing* in the prosecutor's cut-off $k_2$. The higher $k_2$—the more a prosecutor investigates—the lower is the executive's cover-up incentive. The executive reveals the perpetrator even at higher realizations of $\omega_2$, reducing the probability of a cover-up $[1 - R(w_2)]$.

Figure 2 illustrates the best responses of the prosecutor and the executive in the period 2 game. With continuous best replies, one increasing and one decreasing, under appropriate boundary conditions, there exists a unique equilibrium in period 2, $(w_2^*(\iota), k_2^*(\iota))$, where the events (investigation or not in the previous period are captured in the belief $\gamma_1$. We show the result formally below.

Turning to the first period, working backwards we first write the executive's continuation payoffs upon reaching the end of period 1. These continuation payoffs, denoted $V_1$, are given by the unique equilibrium in period 2 and depend on $\gamma_1$, the belief at the end of period 1 that the employee is a perpetrator:

$$V_1(\gamma_1) = \int_{-\infty}^{w_2^*(\gamma_1)} -f_2^a dR(\omega) + \int_{w_2^*(\gamma_1)}^{\infty} [\omega - \Omega_2 - H(k_2^*(\gamma_1))\sigma f_2] dR(\omega). \tag{7}$$

The beliefs $\gamma_1$ depend on whether or not an investigation took place in period 1. If no investigation took place ($\iota = N$), $\gamma_1 = \gamma_1'$. If an investigation did take place ($\iota = I$), using Bayes' rule:

$$\gamma_1 = \frac{\gamma_1'(1-\sigma)}{1-\sigma\gamma_1'}. \tag{8}$$

Turning to the last decision in period 1: The period 1 prosecutor investigates if and only if the investigation cost $\kappa_1$ is below the expected gains from investigating given his belief $\gamma_1'$. Hence, the investigation cut-off cut is

$$k_1 \equiv \gamma_1'\sigma, \tag{9}$$

and the probability of an investigation in period 1 is $H(k_1)$. Since an investigation succeeds with proba-

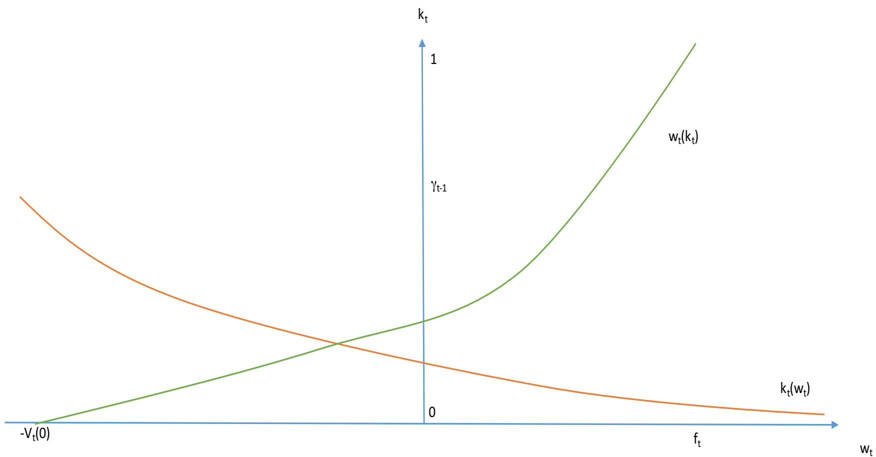


Figure 2: Best Replies in Period 2

bility $\sigma$, the executive's period 1 payoffs from covering up are

$$\Pi_1^C = \omega_1 - \Omega_1 - \sigma H(k_1) f_1 + (1 - H(k_1))\delta V_1(\gamma_1') + (1-\sigma)H(k_1)\delta V_1 \left( \frac{\gamma_1'(1-\sigma)}{1-\sigma\gamma_1'} \right). \tag{10}$$

We assume that the fine $f_1$ is sufficiently high so that the executive prefers not to be investigated by the prosecutor, and the expected payoff of the executive is decreasing in $H(k_1)$,[6]

$$\sigma f_1 + (1-\sigma)\delta V_1 \left( \frac{\gamma_1'(1-\sigma)}{1-\sigma\gamma_1'} \right) \geq \delta V_1(\gamma_1'). \tag{11}$$

We rewrite the executive's cutoff as

[6]This inequality is ultimately a condition on the primitives of the model. Constructing the equilibrium assuming this condition is met, there is always a first period fine $f_1$ that is sufficiently high so that condition is met. If this condition were not met, the best response of the executive to the prosecutor's decision would be non-monotonic, raising the possibility of multiple equilibria..

$$w_1 \equiv -f_1^a + \Omega_1 + \sigma H(k_1) f_1 - (1 - H(k_1))\delta V_1(\gamma_1') - (1-\sigma)H(k_1)\delta V_1\left(\frac{\gamma_1'(1-\sigma)}{1-\sigma\gamma_1'}\right). \tag{12}$$

The prosecutor's belief $\gamma_1'$ must be consistent with the executive's strategy in period 1. By Bayes' rule

$$\gamma_1' = \frac{\gamma_0[1-R(w_1)]}{1-\gamma_0 R(w_1)}. \tag{13}$$

Following the same steps as in the analysis of period 2, we solve for the period 1 best replies. For prosecutor 1, we have

$$k_1(w_1) = \frac{\sigma\gamma_0[1-R(w_1)]}{1-\gamma_0 R(w_1)}, \tag{14}$$

and for the executive in period 1 we have

$$w_1(k_1) = -f_1^a + \Omega_1 + \sigma H(k_1) f_1 - (1-H(k_1))\delta V_1\left(\frac{k_1}{\sigma}\right) - (1-\sigma)H(k_1)\delta V_1\left(\frac{k_1(1-\sigma)}{\sigma(1-k_1)}\right). \tag{15}$$

Since $V_1(\gamma_1)$ is decreasing (which we show formally in the Appendix) so that the executive is worse off in the future when the prosecutor believes more strongly a perpetrator is in the organization, and inequality (11) holds, these best replies exhibit the same pattern as those in period 2. The best reply of prosecutor 1 is always decreasing, the best reply of the executive is always increasing, and the unique period 1 equilibrium $(w_1^*, k_1^*)$ lies at the intersection. Within period 1, we see the same forces as within period 2: (a) the more the executive self-policies, the lower the likelihood of an investigation, and (b) the more the prosecutor investigates, the lower the likelihood of a cover-up.

Our first result formally shows the existence of a unique equilibrium in the two-period game. @@I moved the proof to the Appendix. I don't think any more intuition needs to be provided?@@

**Theorem 1** *For $f_1$ sufficiently high so that $\sigma f_1 + \delta V_1(\gamma_1) \geq (1-\sigma)\delta V_1(\gamma_1 \frac{1-\sigma}{1-\sigma\gamma_1})$ for all $\gamma_1 \in [0, \gamma_0]$, there exists a unique equilibrium of the two-period cover-up game.*

**Proof of Theorem 1**. All proofs are provided in the Appendix.

Theorem 1 shows that, under a natural condition on the parameters guaranteeing that the executive prefers not to be investigated, the two-period game has a unique equilibrium, which we denote $(k_1^*, k_2^*(\iota), w_1^*, w_2^*(\iota))$. Note that the second period play depends on whether or not an investigation took place in period 1; no investigation in period 1 or a failed investigation leads to different beliefs at the end of period, $\gamma_1$, which feed into the optimal strategies of the executive and the period 2 prosecutor.

The unique two period equilibrium shows the inter-temporal dynamics of the cover-up path. First, the probability of an investigation declines over time. Prosecutor 2 knows that the executive did not fire the employee and any investigation conducted by prosecutor 1 failed. The prosecutor's belief that the organization harbors a perpetrator is then falling, $\gamma_1 < \gamma_0$, and $\gamma_2' < \gamma_1'$, which are directly follow from equations (8) and (13) respectively, implying $k_2^*(\iota) = \sigma\gamma_2' < \sigma\gamma_1' = k_1^*$.

Second, there are two opposing forces on the executive's cover-up period 2 decision relative to the period 1 decision. Prosecutor 2's lower likelihood to investigate leads to higher cover-up incentives for the executive in the second period relative to the first period. That is, a successful cover-up in the first period leads to stronger cover-up incentives in the second period. However, pulling in the opposite direction, in the second period the executive no longer enjoys a continuation value of keeping the perpetrator in the organization. The second period fine could also be much larger than the first period fine. Hence, it is not possible to sign the difference between $w_1^*$ and $w_2^*(\iota)$. However, in a stationary setting where $\Omega_t = \Omega$, $f_t = f$,$f_t^a = f^a$ for all $t$, and absent such a deadline effect, as in an infinite horizon setting shown below, the executive has higher incentives to cover up in each subsequent period and probabilities of cover-ups are continually increasing over time.

We next study how the equilibrium differs for different environmental factors, such as shifts in $\Omega_t$ and the prior $\gamma_0$ and for higher or lower penalties $f^a$ and $f$.

## 2.3 Equilibrium Effects of Costs, Penalties, and Initial Beliefs

This section considers comparative statics of the cover-up equilibrium. Changes in the costs and penalties in period $t$ directly affect equilibrium cover-up and investigation rates in period $t$, and they affect the previous (or following) cover-up and investigation through the changes in beliefs. We first consider the effect of a change in the initial belief of the prosecutor, $\gamma_0$, which directly impacts the best-response of the prosecutor in period 1. We then analyze changes in the other parameters of the model—the cost of cover-ups $\Omega_t$ and the fees $f_a^t$ and $f_t$—which directly impact the best-response of the executive in period $t$.

Consider the effect of an increase in $\gamma_0$ from, say, a leak from someone else (unmodeled) in the organization. This shock shifts up prosecutor 1's best reply (14) but does not affect the executive's best reply. Hence, in period 1, the prosecutor is more likely to investigate and the executive less likely to cover-up. Prosecutor 2 will also be more suspicious and investigate more often, prompting the executive to also cover-up less in the future.

**Proposition 1** *An increase in $\gamma_0$ increases $k_1^*, k_2^*(\iota), w_1^*,$ and $w_2^*(\iota)$.*

Next consider changes in the environment that affect only the executive's best reply in period 1, such as an increase in $\Omega_1$ representing, for example, the #MeToo movement which diminishes an organization's current reputation or profits from harboring a perpetrator (irrespective of the direct profits generated from employing the perpetrator). This increase shifts down the executive's best reply (15) with no change in the prosecutor's best reply, resulting in an increase in $w_1^*$ and a decrease in $k_1^*$. The change to $\Omega_1$ further affects the cover-up path through the belief $\gamma_1$. With a decrease in $k_1$, $\gamma_1$ falls, resulting in decrease in $\gamma_2'$, leading to a decrease in $k_2^*(\iota)$ and $w_2^*(\iota)$.

Hence, there is an intertemporal substitution in the executive's cover-up decision. The increase in $\Omega_1$ decreases cover-up incentives in period 1, but increases cover-up incentives in period 2. Since the executive covers up less in period 1, prosecutor 2's rational beliefs that the employee is a perpetrator falls. Prosecutor 2 is then less likely to investigate than otherwise, giving the executive a relatively higher incentive to cover-up in period 2.

**Proposition 2** *An increase in $\Omega_1$ results in a decrease in $k_1^*$, an increase in $w_1^*$, a decrease in $k_2^*(\iota)$ and a decrease in $w_2^*(\iota)$.*

The effects of changes in the amnesty fee and the penalty fee in the first period $f_1^a$ and $f_1$ can be analyzed in the same way as the $\Omega_1$ comparative statics. By the executive's best reply (15), an increase in the penalty fee $f_1$ has the same effect as an increase in $\Omega_1$, and an increase in the amnesty fee $f_1^a$ has the same effect as a decrease in $\Omega_1$. Therefore, an increase in $\Omega_1$, an increase $f_1$, or a decrease in $f_1^a$, lead to an increase in the executive's incentive to report in period 1, but if the executive reaches the second period, his incentive to report falls.

The effect of changes in the environment in period 2 are harder to analyze, since there are feedback effects to period 1 decisions. For example, an increase in $\Omega_2$ directly affects the incentives in period 2 and affects the decision of the executive in the first period through the continuation value $V_1$. A simple computation shows that

$$\frac{\partial V_1}{\partial \Omega_2} = -R(w_2^*) - R'(w_2^*)\frac{\partial w_2^*}{\partial \Omega_2}[f_2^a - (w_2^* - \Omega_2 - H(k_2^*)\sigma f_2)] - H'(k_2^*)\sigma f_2 \frac{\partial k_2^*}{\partial \Omega_2}[1 - R(w_2^*)],$$

yielding

$$\frac{\partial V_1}{\partial \Omega_2} = -R(w_2^*) - H'(k_2^*)\sigma f_2 \frac{dk_2^*}{d\Omega_2}[1 - R(w_2^*)].$$

While the first term is always negative, the sign of the second term depends on the sign of $\frac{\partial k_2^*}{\partial \Omega_2}$, which is not easy to compute; an increase in $\Omega_2$ affects the decisions of the prosecutor and executive in period 2 both directly and indirectly through the change in $\gamma_1$ due to the change in the executive's action in period 1. While the direct effect is clearly negative (an increase in $\Omega_2$ increases the executive's incentive to report and hence lowers the prosecutor's incentive to investigate), the sign of the indirect effect cannot be ascertained. Hence the effect of a change in $\Omega_2$ on the equilibrium values cannot be established.

The only second-period parameter for which clear comparative statics can be established is the amnesty fee $f_2^a$, because an increase in $f_2^a$ simultaneously reduces the executive's payoff in period 2 and increases the incentive to cover-up.[7] As shown in the next Proposition, a reduction in $f_2^a$ unambiguously reduces the continuation value $V_1$, so that the comparative static effects of the period 2 amnesty payoff on the equilibrium values can partially be signed. In particular, an increase in the amnesty penalty in period 2 increases cover-ups in period 2, but decreases cover-ups in period 1. The period 1 probability of investigation therefore also falls.

**Proposition 3** *An increase in $f_2^a$ results in a decrease in $k_1^*$, an increase in $w_1^*$ and a decrease in $w_2^*$.*

Proposition 3 gives a partial result on the effect of changes in the second period parameters on the equilibrium values in the second period of the game. In particular, a change in $f_2^a$ affects the equilibrium values $k_2^*$ and $w_2^*$ through two channels: a direct effect, linked to a decrease in the incentive to report in the second period, and an indirect effect linked to a change in the belief $\gamma_1$. The direct effect leads the executive to report less often, and hence the prosecutor to investigate more often. But, as the continuation value $V_1$ is reduced, the executive is also more likely to report in the first period, so that the prosecutor's belief at the beginning of the second period is reduced. The indirect effect thus leads the prosecutor to investigate less often and the executive to report less often. The direct and indirect effects thus work in the same direction on the executive's incentives (an increase in $f_2^a$ lowers the executive's incentives to report), but in opposite directions on prosecutor 2's incentive to investigate.

## 2.4 Amnesty fees, penalties and welfare

We next study, through a numerical simulation, how amnesty fees and penalties in the two periods, $f_1^a, f_2^a, f_1$ and $f_2$ affect welfare. In our model, the only two players are the executive and the prosecutor who have very specific objectives. There is no unequivocal definition of social welfare because we do not explicitly take into account the harm to the victim nor the cost to society of the activity of the

[7] By contrast, an increase in $\Omega_2$ or in the fee $f_2$ result in a decrease in the payoff in the second period and a decrease in the incentive to cover-up, two effects with opposite directions on the continuation value $V_1$.

perpetrator.[8] As a shorthand for the social welfare objective, we consider two measures: the probability that the perpetrator is stopped at the end of the first period (either because the executive reports on the perpetrator or because the prosecutor's investigation successfully reveals the perpetrator), $Pr_1$, and the probability that the perpetrator is stopped at the end of the second period, $Pr_{12}$. Formally,

$$\begin{aligned} Pr_1 &= R(w_1^*) + (1 - R(w_1^*))H(k_1^*)\sigma, \\ Pr_{12} &= Pr_1 + (1 - R(w_1^*[(1 - H(k_1^*)[R(w_2^*(N)) + (1 - R(w_2^*(N))H(k_2^*(N))\sigma] \\ &\quad + H(k_1^*)(1-\sigma)[R(w_2^*(I)) + (1 - R(w_2^*(I))H(k_2^*(I))\sigma], \end{aligned}$$

where $w_2^*(N)$ and $k_2^*(N)$ are the second period equilibrium values when no investigation has occurred in period 1 and $w_2^*(I)$ and $k_2^*(I)$ the equilibrium values when and investigation has occurred in period 1.

In the simulation, we suppose that the executive's benefits $\tilde{\omega}$ are uniformly distributed over $[-\frac{1}{2}, \frac{1}{2}]$, that the prosecutor's investigation costs $\tilde{\kappa}$ are uniformly distributed over $[0, 1]$, and fix $\delta = 0.9, \sigma = 0.9, \gamma_0 = 0.7$. In the baseline, we fix $f_1^a = 0, f_2^a = 0.09, f_1 = 0.5, f_2 = 0.5$.

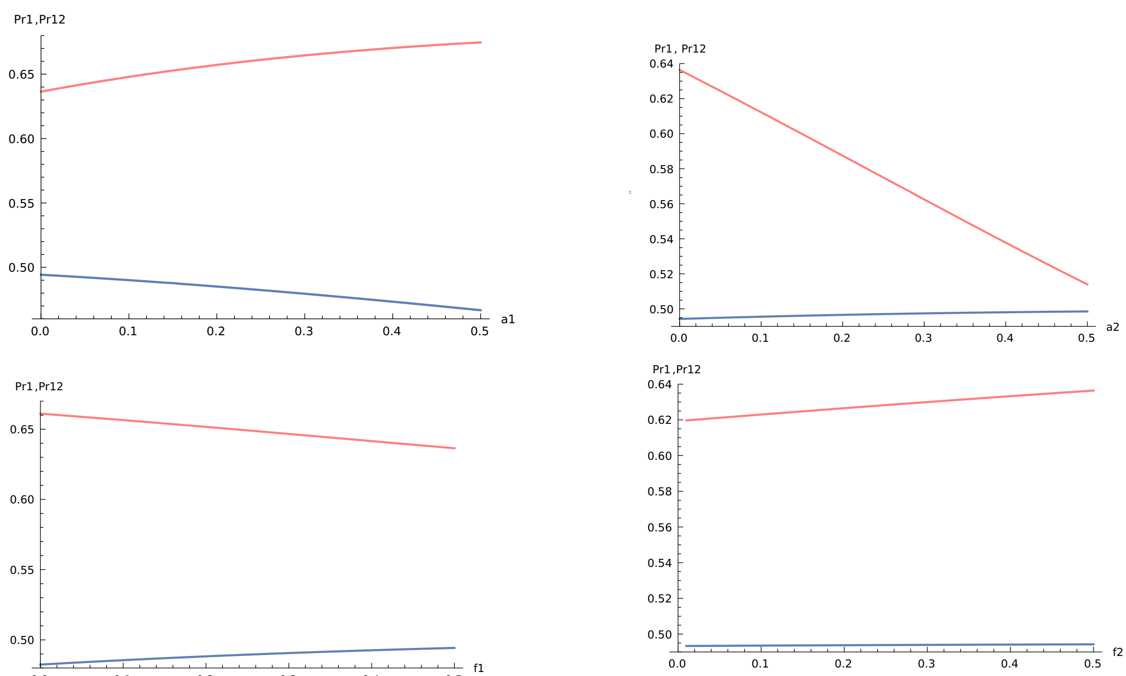


Figure 3: Probabilities of stopping the prosecutor at the end of period 1 (in blue), at the end of period 2 (in red) as a function of $f_1^a$ (top left), $f_2^a$(top right), $f_1$ (bottom left) and $f_2$ (bottom right) : $\delta = 0.9, \sigma = 0.9, \gamma_0 = 0.7,\ f_1^a = 0, f_2^a = 0.09, f_1 = 0.5, f_2 = 0.5$.

As illustrated in Figure 3, an increase in the amnesty fee in period 1, by reducing the executive's

[8] We also do not explicitly model the utility of the perpetrator

incentive to report the perpetrator, lowers the probability of stopping the perpetrator in period 1. However, by the inter-temporal substitution of the prosecutor's decision, an increase in the amnesty fee in period 1 results in an increase in the probability of stopping the perpetrator in the second period, which outweighs the reduction in the first period probability. A similar effect emerges for an increase in the amnesty fee in period 2. This increase results in a reduction of the probability of stopping the executive in the second period, hence increases the continuation value of the executive in the first period, and by inter-temporal substitution of the prosecutor's decision, increases the probability of capture in the first period. As expected, an increase in the penalty in the first period has an opposite effect to an increase in the amnesty fee: it increases the probability of stopping the perpetrator in the first period, but reduces the probability of stopping him in the second period, resulting finally in a lower probability of stopping him over the two periods. By contrast, an increase in the penalty in the second period increases the probability of stopping the perpetrator in both periods.

The optimal amnesty and penalty fee structure would thus depend on the importance of stopping the perpetrator early. If the harm to the victims is so large that the objective of the social planner is to stop the perpetrator as early as possible, she should select a low amnesty fee $f_1^a$, a large amnesty fee $f_2^a$ (implying an escalation of amnesty fees), and large penalties $f_1$ and $f_2$. If, instead, the objective of the social planner is to maximize the probability of catching the perpetrator over all periods, she should set a high first-period amnesty fee $f_a^1$, a low amnesty fee $f_a^2$ (implying a decrease over time of amnesty fees), a low penalty $f_1$ and a high penalty $f_2$ (implying an escalation of penalty fees).

# 3 Prosecutorial Regimes

In this section we consider how different institutional structures would shape prosecutors' incentives and, thereby, the cover-up equilibrium. The base case above considers two short-lived independent prosecutors and prosecutor 2 knows whether or not an investigation took place in period 1.

We first study commitment on the part of these period 1 and period 2 prosecutors. This commitment would represent, for example, elected district attorneys who institute guidelines to pursue investigations whenever complaints are sufficiently precise and credible. Such an officer would be accountable to voters and face possible loss in future elections for non-adherence to announced standards. In the model this commitment would be a particular cut-off investigation cost below which the prosecutor conducts an investigation.

We then study a long-lived prosecutor, which would represent legal authorities who have a longer tenure (e.g., appointed district attorneys with renewable terms) or who internalize the effects of their actions on their successors. We consider a long-lived prosecutor, who, for full contrast with the base case, does not have ability to commit to investigation guidelines.

Our main insight from studying commitment is that individual prosecutors who are career-minded (as we model them), would prefer to commit to lower probabilities of investigation. This lower investigation rate gives the executive a higher incentive to cover-up in that period, which gives the prosecutor an increased likelihood of conducting a successful investigation. On balance, the committed investigation rates are not too high as to deter the executive and not too low as to obviate the investigations which yield the prosecutor payoffs.

A long-lived prosecutor similarly manipulates the investigation rate to increase the likelihood of a successful investigation. When the probability that the employee is perpetrator is low, the prosecutor lowers his investigation rate in the first period, which induces more cover-up. The prosecutor sets this investigation rate anticipating a further opportunity to catch the executive in the second period.

We then study how the information structure can alter the equilibrium outcome. We compare the base case to the situation where the period-2 prosecutor does not know whether an investigation took place in period 1. This new information structure represents, for example, the perpetrator moving to a new location as part of the cover-up or a wider understanding of "prosecutors" who could be independent of one another other. In the case of cover-ups of sexual abuse in the Catholic Church, the offending priests were often moved to different parishes, where the community did not know about previous allegations or attempts to prosecute the priest (see e.g. Boston Globe Spotlight (2002), Farragher (2012), John Jay College of Criminal Justice (2014)). In university sexual abuse cases, different entities, such as social workers and association review boards investigated cases over time, possibly without knowledge or prior complaints (Freeh Sporkin & Sullivan, LLP. (2012), Baylor University Board of Regents (2016)).

The two information structures present different, related gambles to the executive, since the beliefs of an ignorant prosecutor in period 2 are a convex combination of those of an informed period 2 prosecutor. We find an executive who is effectively "risk averse" prefers to face an ignorant investigator. An executive would have this preference when investigation costs are likely to be high. This latter case then captures, for example, the abuse of children which is hard to uncover, and the strategy of the Catholic Church to relocate offenders.

### 3.1 Short-Lived Prosecutors with Commitment

We first study commitment on the part of two short-lived prosecutors. In the game without commitment, the equilibrium within each period is given by the solution to the following system of equations, suppressing the time period notation. These two equations are the best response of the executive and the best response of that period's prosecutor, respectively.

$$w = \Omega + \sigma f H(k) - f^a \tag{16}$$

$$k = \frac{\sigma\gamma(1 - R(w))}{1 - \gamma R(w)} \tag{17}$$

Suppose that a prosecutor can commit to a cut-off level $k^C$. Formally, the prosecutor chooses $k^C$ at the beginning of the period, the executive observes $k^C$ and chooses whether or not cover-up. The prosecutor then investigates or not depending on whether the cost realization is below $k^C$. The prosecutor determines the optimal commitment level anticipating how the executive would respond choosing $w(k)$ as in equation (16). The payoffs of the prosecutor are then given by:

$$\Pi = \int_0^k \frac{\sigma\gamma[1 - R(w(k))]}{1 - \gamma R(w(k))} - \kappa h(\kappa) d\kappa. \tag{18}$$

]

We compare the optimal commitment cut off costs, denoted $k_1^C$ and $k_2^C$ and the executive's equilibrium responses denoted $w_1^C$ and $w_2^C$ with the equilibrium in the game without commitment. We find that each prosecutor commits to investigate at a lower rate than otherwise in order to inflate the cover-up in their period. For period 1, there then more cover-ups and less investigation than in the case without commitment. In period 2, however, there are two forces at work. Prosecutor 2 has an incentive to commit to a lower level of investigation. But, due to the depressed investigation rate in period 1, prosecutor 2 also has a higher belief that the employee is a perpetrator. Hence, overall the period 2 comparison to the non-commitment case is ambiguous.[9]

**Proposition 4** *Short-lived prosecutors who can commit to their investigation strategies at the beginning of each period would choose lower investigation rates than prosecutors who cannot commit. As a*

[9] Another comparison is between a career-minded prosecutor and a benevolent prosecutor, who obtains a payoff of 1 regardless of whether the perpetrator is revealed by the investigation or turned in by the executive. The benevolent prosecutor chooses a higher threshold $k$, investigating more often. The executive then covers up less when facing a benevolent prosecutor than a career-minded prosecutor.

*consequence, in period 1* $k_1^C < k_1^*$ *and* $w_1^C < w_1^*$.

As discussed above, the result follows from the prosecutor's additional consideration of how their initial investigation strategies affect the probability a subsequent successful investigation. This additional feature of the optimal cut-off investigation cost is easily seen in the prosecutor's best response. Differentiating the prosecutor's payoffs (18) with respect to $k$ gives the optimal cut off investigation cost:

$$h(k)\left(\frac{\sigma\gamma[1-R(w(k))]}{1-\gamma R(w(k))}-k\right)-H(k)R'(w(k))w'(k)\frac{\sigma\gamma(1-\gamma)}{(1-\gamma R(w(k))^2}=0. \tag{19}$$

where the ability to commit adds the second term.

## 3.2 Long-Lived Prosecutor

Now, instead of two short-lived prosecutors, suppose there is a single prosecutor who interacts with the executive in both periods. This prosecutor has a discount factor of $\delta$ and earns a payoff of 1 for a successful investigation in either period 1 or period 2. We suppose the prosecutor cannot commit to cut off investigation costs in any given period. However, the prosecutor does anticipate how his investigatory strategy in period 1 sets the stage for period 2.

We solve backwards for the perfect Bayesian equilibrium. In the second period, without the ability to commit, the long-lived prosecutor in period 2 has the same best reply to the executive as the short-lived prosecutor 2, which we write in this case as

$$k_2^{LL}(w_2)=\frac{\sigma\gamma_1[1-R(w_2)]}{1-\gamma_1 R(w_2)}. \tag{20}$$

.

In the first period, the long-lived prosecutor who observes $\kappa_1$ compares what is obtained by investigating,

$$\Pi^I=-\kappa_1+\gamma_1'\sigma+(1-\gamma_1'\sigma)\delta\Pi_1\left(\frac{\gamma_1'(1-\sigma)}{1-\gamma_1'\sigma}\right), \tag{21}$$

with his payoffs if he does not investigate,

$$\Pi^N=\delta\Pi_1(\gamma_1'), \tag{22}$$

where $\Pi_1$, the continuation value of the prosecutor, is given by

$$\Pi_1(\gamma_1) = \int_0^{k_2^{LL}} \gamma_1 \frac{1 - R(w_2)}{1 - \gamma_1 R(w_2)} - \kappa h(\kappa) d\kappa. \tag{23}$$

The long lived prosecutor's cut off $k_1^{LL}$ is then

$$k_1^{LL} \equiv \gamma_1' \sigma + (1 - \gamma_1' \sigma) \delta \Pi_1 \left( \frac{\gamma_1'(1-\sigma)}{1 - \gamma_1' \sigma} \right) - \delta \Pi_1(\gamma_1'). \tag{24}$$

Whether the cut off $k_1^{LL}$ is higher or lower then the cut off $k_1 \equiv \gamma_1' \sigma$ then depends on whether $\Pi_1$ is increasing or decreasing in $\gamma_1$, which in turn depends on the elasticity of the executive's cover-up strategy in period 2.[10] The distribution of the executive's benefits can be such that executive does not change its cover-up decision much in response to the prosecutor's beliefs. In this case, the prosecutor sets a lower cut-off cost, investigating less, often, in order to increase the probability of successful investigation in the subsequent period.

**Proposition 5** *The continuation value of the long-lived prosecutor, $\Pi_1$, is decreasing in $\gamma_1$ when the elasticity of executive's cover-up strategy is sufficiently small. Hence, in this case, a long-lived prosecutor chooses to investigate less in period 1 than a short-lived prosecutor.*

### 3.3 Knowledge of Previous Investigation

Returning to the case of two short-lived prosecutors, we ask how the equilibrium changes when prosecutor 2 is ignorant of past investigations. In the baseline model, prosecutor 2 has beliefs $\gamma_1^N = \gamma_1'$ if no investigation occurred and $\gamma_1^I = \gamma_1' \frac{1-\sigma}{1-\sigma\gamma_1'}$ if an unsuccessful investigation occurred. Adding notation to the equilibrium derived above, for each realization of $\iota$ let $w_2^*(N)$ and $w_2^*(I)$ denote the respective cover-up levels. In the case that prosecutor 2 is uninformed, prosecutor 2 holds the belief, denoted $\tilde{\gamma}_1$, which is a convex combination of $\gamma_1^N$ and $\gamma_1^I$,

$$\tilde{\gamma}_1 = \frac{1 - H(k_1)}{1 - \sigma H(k_1)} \gamma_1^N + \frac{(1-\sigma) H(k_1)}{1 - \sigma H(k_I)} \gamma_1^1.$$

The equilibrium in period 2 is then the simultaneous solution to the best replies (16) and (17), when the prosecutor 2 holds this belief. The equilibrium cover-up level in period 2 is then between $w_2^*(N)$ and $w_2^*(I)$, since the prosecutor 2's investigation rate is based a belief which falls between $\gamma_1^N$ and $\gamma_1^I$. The executive in period 2 responds optimally to the prosecutor in either case.

[10] The elasticity of the strategy is, of course, an equilibrium measurement, and the condition ultimately depends on the primitives, here the shape of the distribution function of the executive's benefits, $R$, as seen in the proof below.

Turning to period 1, does the executive prefer to face an uninformed or an informed prosecutor in period 2? When prosecutor 2 is informed, the executive's best outcome from period 1 is an unsuccessful investigation. Prosecutor 2's beliefs are then the lowest possible at $\gamma_1^1$. If these beliefs do not lead to sufficiently lower probability of an investigation in $t = 2$, however, the executive could be better off with an ignorant prosecutor 2. The trade-off is expressed in the continuation value function $V_1(\gamma_1)$. If $V_1(\gamma_1)$ is convex (concave), the executive prefers that prosecutor 2 be informed (uninformed).

The shape of $V_1(\gamma_1)$ in turn depends on the shape of the distribution of investigation costs $H$. One interpretation of the shape of $H$ is witness credibility, which reduces investigation costs. If most witnesses or victims cannot credibly relay their experiences, as in the case of children, the probabilities of low investigation costs are low and $H$ is convex. An executive then prefers the prosecutor to not know of previous investigations ($V_1$ is concave). On the other hand, if most victims are credible, so the probability of low investigation costs is high, the executive prefers investigators know about previous investigations. In the event the period 1 investigation is not successful so that prosecutor 2's beliefs fall, the prosecutor is unlikely to face low enough costs to launch an investigation. The executive is then willing to "bet" on this outcome by covering up more in period 1.

**Proposition 6** *Suppose $H$ is convex in $\kappa$ and in equilibrium $1 - 2\gamma_1 + \gamma_1 R(w_2) < 0$. Then the executive prefers a prosecutor who is ignorant of past investigations.*

# 4 Conclusion

This paper builds a model of cover-ups where a rational executive decides—in the face of possible investigation—whether or not to retain a malfeasant employee. The analysis indicates that successful cover-ups lead to greater incentives for future cover-ups. The longer the employee malfeasance is not revealed or discovered, the less a future investigator believes that malfeasance has occurred. Thus, an executive is rationally "optimistic" after evading detection and covers up more and more as time passes.

The two-period model affords the study of different prosecutorial regimes and the study of environmental changes, such as current heightened social condemnation of those who hide abuse and strengthened penalties for cover-ups. The analysis indicates intertemporal effects that can lessen the impact of such shifts. When an organization covers up less often, the investigator is also less likely to investigate in that period and investigate less in future periods due to rational updating of beliefs.

The institutional structure of outside investigators is critical to the rate of cover-ups and investigations. When prosecutors personally gain from catching malfeasance (as modeled), they will depress the investigation rate when they can commit to a investigation strategy or when they internalize the effect of their strategy on subsequent prosecutors. Cover-ups then ironically occur more often when prosecutors have commitment power. Cover-up incentives also differ when prosecutors do or do not have knowledge of past investigation. When investigation costs are more likely to be high than low, executives can prefer an ignorant prosecutor, since they are less likely overall on average to face an investigation.

This paper is a jumping off point for further study of strategic cover-ups. For example, we have assumed that the perpetrator cannot control his behavior, in order to focus attention on the strategic interaction between the executive and the prosecutor. We could extend the model by allowing the employee to choose whether or not to misbehave, giving the executive the role of an intermediary who can discipline the employee and report to the prosecutor. Future research could also consider the possibility that an overarching institution could commit to internal investigations of member organizations. The Pope, for example, proposed recently that the Church do more "self-policing" (Horowitz (2019)) (even as though it is not clear how this new effort would be enforced). With commitment, the umbrella institution becomes a first mover, and, as such, take into account the subsequent rational replies of executives of individual member organizations and of outside prosecutors. Other avenues for future study further involve multiple organizations that share a similar "culture" or governing bodies, such as universities or sports leagues. Prosecutors would then also consider the rules set by these bodies and update the probability of malfeasance by observing outcomes of investigations of any one member. Executives' actions then have externalities on other members which could prompt governing bodies to adopt internally enforced rules or codes of ethics to coordinate behavior. Such organizations, or public law enforcement, could also optimally set the fines as a possible complement or substitute to prosecutorial investigations.

# 5 References

**Avenhaus, Rudolf, Bernhard Von Stengel, and Shmuel Zamir. 2002.** "Inspection games." *Handbook of game theory with economic applications* Volume 3 : 1947-1987.

Baylor University Board of Regents. 2016. "Findings of Fact."

**Bonnefoy, Pascale. 2018.** "Catholic Church Faces Reckoning in Chile as Sex Abuse Scandal Widens," *The New York Times*, July 31.https://www.nytimes.com/2018/07/31/world/americas/chile-pope-francis-catholic-church-sexual-abuse.html.

Boston Globe Spotlight, 2002. " Scores of priests involved in sex abuse cases: Settlements kept scope of issue out of public eye," January 31, 2002. http://archive.boston.com/globe/spotlight/abuse/archive/print/013102_priests.htm

**Buehler, Stefan and Nicolas Eschenbaum. 2020** "Explaining escalating prices and fines: A unified approach, " *Journal of Economic Behavior and Organization*, 153-164.

**Burnovski, Moshe, and Zvi Safra. 1994.** "Deterrence effects of sequential punishment policies: Should repeat offenders be more severely punished?". *International Review of Law and Economics* : 14, 341-350.

**Chassang, Sylvain and Gerard Padro i Miquel . 2019.** "Crime, intimidation, and whistleblowing: A theory of inference from unverifiable reports". *Review of Economic Studies* : 2530-2553.

**Chu, Cyrus, Sheng-cheng Hu, and Ting-yuan Huang. 2000.** "Punishing repeat offenders more severely. " *International Review of Law and Economics* 20: 127-140.

**Dana, David A. 2001.** "Rethinking the puzzle of escalating penalties," *Yale Law Journal* 110(5), 733–783.

**Dilme, Francesc and Daniel F. Garrett 2019.** "Residual deterrence ," *Journal of the European Economic Association* 1654-1686.

**Emons, Winand. 2003.** "A note on the optimal punishment for repeat offenders. " *International Review of Law and Economics* : 23, 253-259.

Farragher, Thomas. February 24 2002. "Church Cloaked in Culture of Silence," The Boston Globe. re-published May 30 2102. https://www.bostonglobe.com/news/special-reports/2002/02/24/church-cloaked-culture-silence/88cLKuodvSiHjvg0dfz24L/story.html.

**Freeh Sporkin & Sullivan, LLP. 2012.** "Report of the Special Investigative Counsel Regarding the Actions of The Pennsylvania State University Related to the Child Sexual Abuse Committed by Gerald A. Sandusky."

**Horowitz, Jason. 2019.** "Pope Issues First Rules for Catholic Church Worldwide to Report Sex Abuse," *The New York Times*, May 9.https://www.nytimes.com/2019/05/09/world/europe/pope-francis-abuse-catholic-church.html.

**Innes, Robert. 1999.** "Remediation and self-reporting in optimal law enforcement." *Journal of Public Economics* 72: 379-393.

John Jay College of Criminal Justice. 2014. "The Nature and Scope of Sexual Abuse of Minors by Catholic Priests and Deacons in the United States 1950-2002: a research study conducted by the John Jay College of Criminal Justice," aka *The John Jay Report*, United States Conference of Catholic Bishops, Washington, D.C, 2004.

**Kaplow, Louis, and Steven Shavell. 1994.** "Optimal law enforcement with self-reporting of behavior.” *Journal of Political Economy* 102: 583-606.

**Kirby, Jen. 2018.** “Michigan State’s Larry Nassar fallout has begun,” *Vox.com*, May 16, 2018, 5:21pm EDT https://www.vox.com/policy-and-politics/2018/1/30/16934634/michigan-state-larry-nassar-settlement-investigations.

**Kozlowski, Kim. 2018.** “ What MSU knew: 14 were warned of Nassar abuse,” *The Detroit News*, 9:58 p.m. UTC Jan 19, 2018. https://eu.detroitnews.com/story/tech/2018/01/18/msu-president-told-nassar-complaint-2014/1042071001/.

**Legget, Theo. 2018.** “How VW tried to cover up the emissions scandal,” *BBC News*, May 5, 2018.

**Mechtenberg, Lydia, Gerd Muehlheusser and Andreas Roider, 2020.** “Whistle-blower protection: Theory and experimental evidence,” *European Economic Review*: 1034-1047.

**Miceli, Thomas J., 2013** “Escalating penalties for repeat offenders: Why are they so hard to explain? ” *Journal of Institutional and Theoretical Economics*: 587-604.

**Miceli, Thomas J., and Catherine Bucci. 2005.** “A simple theory of increasing penalties for repeat offenders.” *Review of Law & Economics*: 71-80.

**Muehlheusser, Gerd and Andreas Roider, 2008.** “Black sheep and walls of silence,” *Journal of Economic Behavior and Organization*: 397-408.

**Nunez, Javier. 2007.** “Can self regulation work?: a story of corruption, impunity and cover-up,” *Journal of Regulatory Economics* 31:209–233.

**Polinsky, A. Mitchell, and Daniel L. Rubinfeld. 1991.** “A model of optimal fines for repeat offenders.” *Journal of Public Economics* 46: 291-306.

**Polinsky, A. Mitchell, and Steven Shavell. 1998.** “On offense history and the theory of deterrence.” *International Review of Law and Economics* 18: 305-324.

**Rezendes, Michael, Matt Carroll, Sacha Pfeiffer, and Walter V. Robinson. 2002.** “Church allowed abuse by priest for years,” *The Boston Globe*, January 06, Part 1 of 2. https://www.bostonglobe.com/news/special-reports/2002/01/06/church-allowed-abuse-priest-for-years/cSHfGkTIrAT25qKGvBuDNM/story.html.

**Rubinstein, Ariel. 1979.** “An optimal conviction policy for offenses that may have been committed by accident.” Applied game theory. Physica, Heidelberg, 406-413.

# 6 Appendix

This Appendix contains the formal proofs of the results in the text. This Appendix also contains an extension of the game between prosector and executive to multiple finite periods and to infinite periods.

## 6.1 Proofs of Results

**Proof of Theorem 1**. Consider period 2. We show (altogether) that there exists a unique equilibrium $(k_2^*(\iota), w_2^*(\iota))$, the equilibrium is unique for any given $\gamma_1$, and the continuation value $V_1(\gamma_1)$ is decreasing in $\gamma_1$.

In the proof here and in all proofs below, note that $\gamma_1$ incorporates any difference in belief following an unsuccessful investigation or the absence of an investigation in period 1. Hence, we drop the $\iota$ notation. Substituting equation (6) into equation (5), an equilibrium of the period 2 game is a fixed point of the function

$$\phi_2(k_2) = \frac{\sigma\gamma_1[1 - R[H(k_2)]\sigma f_2 - f_2^a + \Omega_2]]}{\gamma_1[1 - R[H(k_2)\sigma f_2 - f_2^a + \Omega_2]] + (1 - \gamma_1)} \tag{25}$$

defined on $[0, 1]$.

We show that the function $\phi$ defined over $[0, 1]$ has a unique fixed point $k_2^*$. To see this, let

$$\Phi_2(k_2) \triangleq \phi_2(k_2) - k_2.$$

Note that $\Phi_2(0) > 0$ and $\Phi_2(\gamma_1) < 0$ where the first inequality follows from the assumption that $\widetilde{\omega_2}$ is distributed over $[-\infty, +\infty]$ according to the continuously differentiable cumulative distribution $R$ (so $R(w) > 0$ for all $w$), and the second inequality follows from Bayes' rule. Furthermore, since the cumulative distribution functions $R$ and $H$ are continuously differentiable on $(-\infty, \infty)$ and $(0, 1)$,

$$\Phi_2'(k_2) = -\frac{\gamma_1\sigma^2 f_2 R'[H(k_2)]H'(k_2)](1 - \gamma_1)}{(\gamma_1[1 - R[H(k_2)\sigma f_2 - f_2^a + \Omega_2]] + (1 - \gamma_1))^2} - 1 < 0,$$

so that $\Phi_2(k_2)$ is strictly decreasing in $k_2$.

Hence, there exists a unique $k_2^* \in (0, \gamma_1)$ such that $\Phi_2(k_2^*) = 0$. Furthermore, by implicit differentiation we find that $k_2^*$ is increasing in $\gamma_1$ :

$$\frac{\partial k_2^*}{\partial \gamma_1} = -\frac{[1 - R[H(k_2)\sigma f_2 - f_2^a + \Omega_2]]}{\Phi'(k_2)(\gamma_1[1 - R[H(k_2)\sigma f_2 - f_2^a + \Omega_2]] + (1 - \gamma_1))^2}, \tag{26}$$

and since $\Phi'(k_2) < 0$, $\frac{\partial k_2^*}{\partial \gamma_1} > 0$.

These calculations also determine the unique cut-off $w_2^*$ for the executive as the solution to the equation

$$w_2^* \quad = \quad H(k_2^*)\sigma f_2 - f_2^a + \Omega_2.$$

We show next that $V_1$ is decreasing in $\gamma_1$

$$\frac{\partial V_1}{\partial \gamma_1} = -R'(w_2^*)\frac{\partial w_2^*}{\partial \gamma_1} f_2^a - \int_{w_2^*}^{\infty} H'(k_2^*)\frac{\partial k_2^*}{\partial \gamma_1}\sigma f_2 dR - (w_2^* - \Omega_2 - H(k_2^*)\sigma f_2)R'(w_2^*)\frac{\partial w_2^*}{\partial \gamma_1}.$$

Because $-f_2^a = -\Omega_2 + w_2^* - H(k_2^*)\sigma f_2$,

$$\begin{aligned}\frac{\partial V_1}{\partial \gamma_1} &= -\int_{w_2^*}^{\infty} H'(k_2^*)\frac{\partial k_2^*}{\partial \gamma_1}\sigma f_2 dR,\\ &= -[1 - R(w_2^*)]H'(k_2^*)\frac{\partial k_2^*}{\partial \gamma_1}\sigma f_2.\end{aligned}$$

Since $k_2^*$ is increasing in $\gamma_1$, the conclusion follows.

Next consider period 1. Define the function

$$\Phi_1(k_1) \equiv \frac{\sigma\gamma_0(1 - R(w_1(k_1))}{1 - \gamma_0 R(w_1(k_1))} - k_1,$$

where

$$w_1(k_1) = -f_1^a + \Omega_1 + H(k_1)\left[\sigma f_1 - (1-\sigma)\delta V_1\left(\frac{k_1(1-\sigma)}{\sigma(1-k_1)}\right)\right] - (1 - H(k_1))\delta V_1\left(\frac{k_1}{\sigma}\right).$$

We observe that

$$\begin{aligned} w_1'(k_1) &= H'(k_1)\left[\sigma f_1 - (1-\sigma)\delta V_1\left(\frac{k_1(1-\sigma)}{\sigma(1-k_1)}\right) + \delta V_1\left(\frac{k_1}{\sigma}\right)\right]\\ &- (1-\sigma)\delta\frac{\partial V_1}{\partial \gamma_1}\left(\frac{k_1(1-\sigma)}{\sigma(1-k_1)}\right)\frac{1-\sigma}{\sigma}\\ &- (1 - H(k_1))\delta\frac{\partial V_1}{\partial \gamma_1}\left(\frac{k_1}{\sigma}\right)\frac{1}{\sigma}\\ &> 0\end{aligned}$$

where the inequality is obtained using both the assumption that

$$\sigma f_1 - (1-\sigma)\delta V_1\left(\frac{k_1(1-\sigma)}{\sigma(1-k_1)}\right) + \delta V_1\left(\frac{k_1}{\sigma}\right) > 0,$$

and the fact that $\frac{\partial V_1}{\partial \gamma_1} < 0$.

Given that $\frac{\partial w_1}{\partial k_1} > 0$, we immediately obtain that $\Phi_1'(k_1) < 0$. As $\Phi_1(0) > 0$ and $\Phi_1(\gamma_0) < 0$, there exists a unique equilibrium cut-off for the prosecutor $k_1^*$, and hence a unique equilibrium cut-off for the executive $w_1^*$, which can either be computed using the prosecutor or the executive's best reply function.

This completes the proof of the Theorem. ■

**Proof of Proposition 1.** We consider the function $\Phi_1(k_1)$ characterizing the equilibrium cut-off of the prosecutor in period 1. By implicit differentiation we have

$$\frac{\partial k_1}{\partial \gamma_0} = -\frac{\frac{\partial \Phi_1}{\partial \gamma_0}}{\frac{\partial \Phi_1}{\partial k_1}}.$$

We know that $\frac{\partial \Phi_1}{\partial k_1} < 0$ and

$$\frac{\partial \Phi_1}{\partial \gamma_0} = \frac{\sigma(1 - R(w_1)}{(1 - \gamma_0 R(w_1))^2} > 0,$$

so that $\frac{\partial k_1}{\partial \gamma_0} > 0$. Using the executive's best reply function in period 1 (which is independent of $\gamma_0$), we conclude that $w_1^*$ is also increasing in $\gamma_0$. Next observe that as $k_1$ is increasing in $\gamma_0$, $\gamma_1'$, and hence $\gamma_1$ are increasing in $\gamma_0$. Repeating the same argument, we observe that $k_2^*$ is increasing in $\gamma_1$ and hence in $\gamma_0$ and, using the executive best reply function in period 2, $w_2^*$ is increasing in $\gamma_0$, completing the proof of the Proposition. ■

**Proof of Proposition 2.** By implicit differentiation,

$$\frac{\partial k_1^*}{\partial \Omega_1} = -\frac{\frac{\partial \Phi_1}{\partial \Omega_1}}{\frac{\partial \Phi_1}{\partial k_1}}.$$

We know that $\frac{\partial \Phi_1}{\partial k_1} < 0$ so that the sign of $\frac{\partial k_1}{\partial \Omega_1}$ is the same as the sign of $\frac{\partial \Phi_1}{\partial \Omega_1}$. Now,

$$\frac{\partial \Phi_1}{\partial \Omega_1} = -\frac{\sigma \gamma_0 (1 - \gamma_0) R'(w_1)}{(1 - \gamma_0 R(w_1))^2} \frac{\partial w_1}{\partial \Omega_1}.$$

Using the best reply of the executive in period 1, $\frac{\partial w_1}{\partial \Omega_1} > 0$, and we conclude that an increase in the cost $\Omega_1$ induces a reduction in the equilibrium threshold $k_1^*$.

Using the prosecutor's best response function in period 1 (which is independent of $\Omega_1$), we also obtain that $w_1^*$ is decreasing in $\Omega_1$. In period 2, the increase in $\Omega_1$ only affects the behavior of the prosecutor and the executive through the change in the belief $\gamma_1$. As $k_1$ goes down, $\gamma_1'$ and $\gamma_1$ are reduced, and hence, following the same argument as in the proof of Proposition 1, $k_2^*$ and $w_2^*$ are reduced. ■

**Proof of Proposition 3**. We first show that the continuation value $V_1$ must be decreasing in $f_a^2$. Recall that

$$\frac{\partial V_1}{\partial f_2^a} = -R(w_2^*) - H'(k_2^*) \sigma f_2 \frac{dk_2^*}{df_2^a} [1 - R(w_2^*)]$$

and

$$\frac{dk_2^*}{df_2^a} = \frac{\partial k_2^*}{\partial f_2^a} + \frac{\partial k_2^*}{\partial \gamma_1}\frac{\partial \gamma_1}{\partial f_2^a}.$$

Now,

$$\frac{\partial k_2^*}{\partial f_2^a} = -\frac{R'(w_2)\gamma_1(1-\gamma_1)}{\Phi'(k_2)(\gamma_1[1-R[H(k_2)\sigma f_2 - f_2^a + \Omega_2]] + (1-\gamma_1))^2},$$

and since $\Phi'(k_2) < 0$, $\frac{\partial k_2^*}{\partial f_2^a} > 0$. As similarly, $\frac{\partial k_2^*}{\partial \gamma_1} > 0$, if $\frac{\partial V_1}{\partial f_2^a} > 0$, we necessarily must have

$$\frac{\partial \gamma_1}{\partial f_2^a} < 0,$$

implying

$$\frac{\partial k_1^*}{\partial f_2^a} < 0. \tag{27}$$

Next we compute

$$\frac{\partial k_1^*}{\partial f_2^a} = -\frac{\frac{\partial \Phi_1}{\partial f_2^a}}{\frac{\partial \Phi_1}{\partial k_1}}.$$

We know that $\frac{\partial \Phi_1}{\partial k_1} < 0$ so that the sign of $\frac{\partial k_1}{\partial \Omega_1}$ is the same as the sign of $\frac{\partial \Phi_1}{\partial f_2^a}$. Now,

$$\frac{\partial \Phi_1}{\partial f_2^a} = -\frac{\sigma\gamma_0(1-\gamma_0)R'(w_1)}{(1-\gamma_0 R(w_1))^2}\frac{\partial w_1}{\partial f_2^a}.$$

Next note that

$$\frac{\partial w_1}{\partial f_2^a} = \frac{\partial w_1}{\partial V_1}\frac{\partial V_1}{\partial f_2^a}.$$

Using the best reply of the executive in period 1 (15), $\frac{\partial w_1}{\partial f_2^a} < 0$, and by assumption $\frac{\partial V_1}{\partial f_2^a} > 0$. We conclude that

$$\frac{\partial \Phi_1}{\partial f_2^a} > 0,$$

a contradiction to inequality (27), which shows that $\frac{\partial V_1}{\partial f_2^a} < 0$.

As $\frac{\partial V_1}{\partial f_2^a} < 0$, an increase in $f_2^a$ results in a decrease in $k_1^*$. Using the prosecutor's best response function in period 1, we also obtain that $w_1^*$ is increasing in $f_2^a$.

Next note that

$$\frac{dw_2^*}{df_2^a} = \frac{\partial w_2^*}{\partial f_2^a} + \frac{\partial w_2^*}{\partial \gamma_1}\frac{\partial \gamma_1}{\partial f_2^a}.$$

Using the best response of the prosecutor in period 2 (which is independent of $f_2^a$), the sign of $\frac{\partial w_2^*}{\partial f_2^a}$ is the opposite of the sign of $\frac{\partial k_2^*}{\partial f_2^a}$, hence negative.

By an argument similar to the argument of Proposition 1, $\frac{\partial w_2^*}{\partial \gamma_1} > 0$. Furthermore as $\frac{k_1^*}{\partial f_2^a} > 0$ and $\frac{\partial \gamma_1}{\partial f_2^a} > 0$, $\frac{\partial \gamma_1}{\partial f_2^a} < 0$. Hence, the second term is also negative, establishing that an increase in $f_2^a$ results in a decrease in $w_2^*$. ■

**Proof of Proposition 4** .

Differentiating with respect to $k$ gives the optimal cut off investigation cost:

$$h(k)\left(\frac{\sigma\gamma[1-R(w(k))]}{1-\gamma R(w(k))} - k\right) - H(k)R'(w(k))w'(k)\frac{\sigma\gamma(1-\gamma)}{(1-\gamma R(w(k))^2} = 0. \tag{28}$$

The commitment adds the second term. Since $w'(k) > 0$, the optimal cut off investigation cost $k^C$is lower than non-commitment equilibrium level $k^*$ given by (17). This proves the first statement of the Proposition.

For the second statement, since $w'(k) > 0$, $w_1^C < w_1^*$; The executive covers up more often in period 1. ■

**Proof of Proposition 5**. Computing $\frac{\partial \Pi_1}{\partial \gamma_1}$, we have:

$$\begin{aligned}\frac{\partial \Pi_1}{\partial \gamma_1} &= [\gamma_1 \frac{1-R(w_2)}{1-\gamma_1 R(w_2)} - k_2]k_2'(\gamma_1) \\ &+ H(k_2)\left[\frac{1-R(w_2)}{1-\gamma_1 R(w_2)} + \gamma_1\left(\frac{(1-R(w_2))R(w_2)}{(1-\gamma_1 R(w_2))^2} - \frac{(1-\gamma_1)R'(w_2)w_2'(\gamma_1)}{(1-\gamma_1 R(w_2))^2}\right)\right]\end{aligned}$$

By the Envelope Theorem, $\gamma_1\frac{1-R(w_2)}{1-\gamma_1 R(w_2)} - k_2 = 0$. So the sign of $\frac{\partial \Pi_1}{\partial \gamma_1}$ is the same as the sign of the second term. Simplifying the numerator, $\frac{\partial \Pi_1}{\partial \gamma_1} > 0$ if and only if

$$1 - R(w_2(\gamma_1)) > \gamma_1(1-\gamma_1)R'(w_2)w_2'(\gamma_1), \tag{29}$$

which can be written as

$$\frac{1}{1-\gamma_1} > \gamma_1 \frac{R'(w_2)w_2'(\gamma_1)}{1-\gamma_1 R(w_2)} \tag{30}$$

where the right-hand side is the elasticity of the probability of a cover-up with respect to $\gamma_1$. ■

**Proof of Proposition 6.** As before, differentiating $V_1(\gamma_1)$

$$\frac{\partial V_1}{\partial \gamma_1} = -R'(w_2^*)\frac{\partial w_2^*}{\partial \gamma_1} f_2^a - \int_{w_2^*}^{\infty} H'(k_2^*)\frac{\partial k_2^*}{\partial \gamma_1}\sigma f_2 dR - (w_2^* - \Omega_2 - H(k_2^*)\sigma f_2)R'(w_2^*)\frac{\partial w_2^*}{\partial \gamma_1}.$$

Since in period 2, the executive is acting optimally, $-f_2^a = -\Omega_2 + w_2^* - H(k_2^*)\sigma f_2$, we have

$$V_1'(\gamma_1) = -H'(k_2^*)\frac{\partial k_2^*}{\partial \gamma_1} f_2 \sigma.$$

Differentiating again:

$$V_1''(\gamma_1) = -H''(k_2^*)\frac{\partial k_2^*}{\partial \gamma_1} f_2 \sigma - H'(k_2^*)\frac{\partial^2 k_2^*}{\partial \gamma_1^2} f_2 \sigma.$$

The sign of $V_1''(\gamma_1)$ depends on the sign of $H''(\cdot)$ and $\frac{\partial^2 k_2^*}{\partial \gamma_1^2}$. Straightforward computation shows that a sufficient condition for $\frac{\partial^2 k_2^*}{\partial \gamma_1^2} > 0$ is

$$\frac{-R'(w_2)w_2'(k_2)(1 - 2\gamma_1 + \gamma_1 R(w_2))}{(1 - \gamma_1 R(w_2))^3} > 0,$$

which is satisfied whenever

$$1 - 2\gamma_1 + \gamma_1 R(w_2) < 0.$$

since $R'(w_2) > 0$ and $w_2'(k_2) > 0$.■

## 6.2 Extensions to Multiple Periods

### 6.2.1 Finite Multiple Period Game

We present here the equilibrium for a finite, multiple period setting, where fines can increase over time. This model is a generalization of the period-two model presented in Section 2.1 under the assumption $\sigma = 1$. The proof of equilibrium existence and uniqueness uses backward induction from $T$ in a simple adaption of arguments for the infinite horizon case. In equilibrium, prosecutors' beliefs fall over time and each prosecutor investigates less than her predecessor. However, the executive's strategy $w_t^*$ is not necessarily decreasing in $t$ since penalties $f_t$ and $f_t^a$ are (weakly) increasing and, with finite horizon, the continuation value of the employee's services falls over time.

**Proposition 7** *If $f + \delta V_t(\gamma) > 0$ forall $t$ and all $\gamma \in [0, \gamma_0]$, there exists a unique equilibrium of the non-stationary finite horizon game; in addition, $k_t^* < k_{t-1}^*$ $\forall$ $t$.*

The model and equilibrium shed light on why an organization's leadership might rationally continue to cover-up malfeasance despite the likelihood of high levels of future punishment. In any given period $t$, the executive prefers to escape prosecutor-$t$'s scrutiny rather than be investigated; $\delta V_t(\gamma_t) \geq -f_t$. But there is no guarantee that continuation payoff $V_t(k_t)$ is positive. Reporting the employee in period $t$ is also an admission of past cover-up(s) for which the executive must pay the related fine. On net, then, the executive can be better off continuing to cover-up.

**Proof of Proposition** 7

We start with the last period and prove the following Lemma for period $T$:

**Lemma 1** *At the last period $T$, there exists a unique equilibrium $(k_T^*, w_T^*)$ for any $\gamma_{T-1}$. In addition, given these equilibrium values which depend on $\gamma_{T-1}$, $V_{T-1}$ is decreasing in $\gamma_{T-1}$.*

**Proof of Lemma 1**

First consider the equilibrium in period $T$. For period $T$, there is no continuation value; i.e, $V_T(k_T) = 0$. Substituting $w_T(k_T)$ into $k_T(w_T)$, an equilibrium in period $T$ is a fixed point of the function

$$\phi(k_T) = \frac{\gamma_{T-1}[1 - R[H_T(k_T)f_T - f_T^a - \Omega_T]]}{\gamma_{T-1}[1 - R[H_T(k_T)f_T - f_T^a - \Omega_T]] + (1 - \gamma_{T-1})}$$

defined on $[0, 1]$.

We show that the function $\phi$ defined over $[0, 1]$ has a unique fixed point $k_T^*$. To see this, let

$$\Phi(k_T) \triangleq \phi(k_T) - k_T.$$

Note that

$$\begin{aligned} \Phi(0) &> 0 \\ \Phi(\gamma_{T-1}) &< 0. \end{aligned}$$

where the first inequality follow from the assumption $\widetilde{\omega}_t$ is distributed over $[-\infty, +\infty]$ according to the continuously differentiable cumulative distribution $R$ (so $R(w) > 0$ for all $w$), and the second inequality follows directly (and is the same property of belief updating by Bayes rule that underlies the addiction effect - the posterior is less than the prior).

Furthermore, since the cumulative distribution functions $R$ and $H_T$ are each continuously differentiable on $(-\infty, \infty)$, $\Phi(k_T)$ is decreasing in $k_T$:

$$\Phi'(k_T) = -\frac{\gamma_{T-1} f_T R'[H_T(k_T)]H_T'(k_T)](1-\gamma_{T-1})}{(\gamma_{T-1}[1-R[H_T(k_T)f_T - f_T^a - \Omega_T]] + (1-\gamma_{T-1}))^2} - 1 < 0.$$

Hence, there exists a unique $k_T^* \in (0, \gamma_{T-1})$ such that $\Phi(k_T^*) = 0$. Furthermore, by implicit differentiation we find that $k_T^*$ is increasing in $\gamma_{T-1}$ :

$$\frac{\partial k_T^*}{\partial \gamma_{T_1}} = -\frac{[1-R[H_T(k_T)f_T - f_T^a - \Omega_T]]}{\Phi'(k_T)(\gamma_{T-1}[1-R[H_T(k_T)f_T - f_T^a - \Omega_T]] + (1-\gamma_{T-1}))^2},$$

and since $\Phi'(k_T) < 0$, $\frac{\partial k_T^*}{\partial \gamma_{T_1}} > 0$.

These calculations also determine the unique cut-off $w_T^*$ for the executive as the solution to

$$w_T^* \quad = \quad H_T(k_T^*)f_T - f_T^a - \Omega_T.$$

We show next that $V_{T-1}$ is decreasing in $\gamma_{T-1}$. Recall that

$$V_t(\gamma_t) = \int_{-\infty}^{w_{t+1}} -f_{t+1}^a dR(\omega) + \int_{w_{t+1}}^{\infty} [\Omega_{t+1} + \omega - H(k_{t+1})f_{t+1} + (1-H(k_{t+1}))\delta V_{t+1}]\, dR(\omega).$$

With the equilibrium levels $(k_T^*, w_T^*)$ depending on $\gamma_{T-1}$, differentiating $V_{T-1}$ with respect to $\gamma_{T-1}$ yields

$$\frac{\partial V_{T-1}}{\partial \gamma_{T-1}} = -R'(w_T^*)\frac{\partial w_T^*}{\partial \gamma_{T-1}} f_T^a - \int_{w_T^*}^{\infty} H_T'(k_T^*)\frac{\partial k_T^*}{\partial \gamma_{T-1}} f_T dR - (w_T^* + \Omega_T - H_T(k_T^*)f_T)R'(w_T^*)\frac{\partial w_T^*}{\partial \gamma_{T-1}}.$$

In the last period equilibrium

$$-f_T^a = \Omega_T + w_T^* H_T(k_T^*)f_T,$$

so that

$$\begin{aligned}\frac{\partial V_{T-1}}{\partial \gamma_{T-1}} &= -\int_{w_T^*}^{\infty} H_T'(k_T^*)\frac{\partial k_T^*}{\partial \gamma_{T-1}} f_T dR \\ &= -[1-R(w_T^*)]H_T'(k_T^*)\frac{\partial k_T^*}{\partial \gamma_{T-1}} f_T.\end{aligned}$$

Since $k_T^*$ is increasing in $\gamma_{T-1}$, the conclusion follows. ■

**Lemma 2** *If $\delta V_t(\gamma) + f_t > 0$, for all $\gamma \leq \gamma_0$ then $V_t$ is decreasing in $\gamma_t$.*

**Proof of Lemma 2**

The proof is by backward induction. Suppose that there exists a unique equilibrium $(k_s^*, w_s^*)$ for any $s > t-1$ such that $\delta V_s(\gamma_0) + f_s > 0$ and that $V_s(\cdot)$ is decreasing in $\gamma_s$ for any $s = t, ..., T-1$.

Consider period $t$ with initial beliefs of the prosecutor $\gamma_{t-1}$ and assume that $\delta V_t(\gamma_0) + f_t > 0$. We characterize the equilibrium threshold of the prosecutor $k_t^*$ as a solution to the equation

$$\Psi_t(k_t) = 0,$$

where

$$\Psi_t(k_t) \triangleq \psi(k_t) - k_t,$$

and

$$\psi_t(k_t) \triangleq \frac{\gamma_{t-1}[1 - R[H_t(k_t)f_t - f_t^a - (1 - H_t(k_t))\delta V_t(k_t) - \Omega_t]]}{\gamma_{t-1}[1 - R[H_t(k_t)f_t - f_t^a - (1 - H_t(k_t))\delta V_t(k_t) - \Omega_t]] + (1 - \gamma_{t-1})}.$$

Now

$$\begin{aligned} \psi_t'(k_t) &= -\frac{\gamma_{t-1}R'[H_t(k_t)f_t - f_t^a - (1 - H_t(k_t))\delta V_t(k_t) - \Omega_t]}{(\gamma_{t-1}(1 - R[H_t(k_t)f_t - f_t^a - (1 - H_t(k_t))\delta V_t(k_t) - \Omega_t]) + (1 - \gamma_{t-1}))} \\ &* \frac{\gamma_{t-1}[H_t'(k_t)[f_t + \delta V_t(k_t)] - (1 - H_t(k_t))\delta V'(k_t))]}{(\gamma_{t-1}(1 - R[H_t(k_t)f_t - f_t^a - (1 - H_t(k_t))\delta V_t(k_t) - \Omega_t]) + (1 - \gamma_{t-1}))}. \end{aligned}$$

By the induction hypothesis, $V_t$ is decreasing in $\gamma_t$. In addition $V_t(\gamma_t) + f_t > 0$. Hence, $\psi_t'(k_t) < 0$ and $\Psi_t(k_t))$ is strictly decreasing. In addition, note that

$$\begin{aligned} \Psi_t(0) &> 0, \\ \Psi_t(\gamma_0) &< 0, \end{aligned}$$

so that there exists a unique $k_t^*$ in $(0, \gamma_0)$ such that $\Psi_t(k_t^*) = 0$.

By implicit differentiation, we observe that

$$\frac{\partial k_t^*}{\partial \gamma_{t-1}} = -\frac{[1 - R[H_t(k_t)f_t - f_t^a - (1 - H_t(k_t))\delta V_t(k_t) - \Omega_t]]}{\Psi'(k_t)(\gamma_{t-1}[1 - R[H_t(k_t)f_t - f_t^a - (1 - H_t(k_t))\delta V_t(k_t) - \Omega_t]] + (1 - \gamma_{t-1}))^2} > 0,$$

so that $k_t^*$ is increasing in $\gamma_{t-1}$. The unique equilibrium threshold $w_t^*$ is then obtained as the solution to

$$w_t = H_t(k_t^*)f_t - f_a^t - (1 - H_t(k_t^*)V(k_t^*) - \Omega_t. \tag{31}$$

Finally, we show that $V_{t-1}$ is decreasing in $\gamma_{t-1}$. We obtain

$$\frac{\partial V_{t-1}}{\partial \gamma_{t-1}} = [1 - R(w_t^*)][-H'(k_t)\frac{\partial k_t}{\partial \gamma_{t-1}}[\delta V_t(k_t) + f_t] + (1 - H(k_t))\delta \frac{\partial V_t}{\partial k_t}\frac{\partial k_t}{\partial \gamma_{t-1}}].$$

By the induction hypothesis, $\frac{\partial V_t}{\partial k_t} < 0$. We also note that $\frac{\partial k_t}{\partial \gamma_{t-1}} > 0$ and by assumption $[\delta V_t(k_t) + f_t] > 0$. Hence, $\frac{\partial V_{t-1}}{\partial \gamma_{t-1}} < 0$. ■

Combining Lemmas 1 and 2 gives the proof of the Proposition; if $\delta V_t(\gamma) + f_t > 0$, the unique equilibrium of the $T$ period game is obtained by backward induction.■

### 6.2.2 Infinite Period Game

In this section, we analyze an infinite horizon model, revealing the fundamental driver of cover-ups over time. The updating of beliefs is at the heart of the cover-up path. After an executive retains an employee and an unsuccessful investigation in period $t$, the prosecutor in period $t + 1$ believes it is less likely the organization is harboring a perpetrator; $\gamma_t$ is a strictly decreasing sequence in $t$. With time-invariant punishments, on the unique equilibrium path the executive covers up more over time and each prosecutor investigates less often than her predecessor.

Suppose $T = \infty$ and all benefits and fines—$\Omega_t, f_t^a$ and $f_t$—are independent of $t$. In addition, let $\sigma = 1$ so that any prosecutor's investigation is always successful, and there is no uncertainty about past investigations.

**Theorem 2** *If $f + \delta V(\gamma) > 0 \;\forall\; \gamma \in [0, \gamma_0]$, there exists a unique equilibrium of the stationary infinite horizon game; $w_t^* < w_{t-1}^*$ and $k_t^* < k_{t-1}^* \;\forall\; t$.*

**Proof of Theorem 2**. Under stationarity, $V$ is independent of $t$ except for $\gamma_t$. We show first there exists a finite time $S$ such that $V'(\gamma_t) < 0$ for all equilibrium belief paths starting at any $t \geq S$.

Since (by Bayes' Rule and $\gamma_t \geq 0\; \forall t$) $\gamma_t$ is a strictly decreasing bounded sequence in $\Re$, it converges to some limit $\hat{\gamma}$ as $t \longrightarrow \infty$. $V(\hat{\gamma})$ is

$$V(\hat{\gamma}) = \int_{-\infty}^{\hat{w}} -f^a dR(\omega)) + \int_{\hat{w}}^{+\infty} [\omega + \Omega - H(\hat{k})f + (1 - H(\hat{k}))\delta V(\hat{\gamma})]dR(\omega). \tag{32}$$

and the equilibrium cut-offs of the prosecutor and executive satisfy

$$\hat{k} = \sigma\hat{\gamma}$$

and

$$\hat{w} = -f^a + \Omega + H(\hat{k})f - (1 - H(\hat{k}))\delta V(\hat{\gamma}).$$

Taking the right-hand side derivative of equation (32) with respect to $\hat{\gamma}$, we find

$$V'_+(\hat{\gamma}) = -[1 - R(\hat{w})]H'_+(\hat{\gamma})[-f - \delta V(\hat{\gamma})] + (1 - H(\hat{k}))\delta V'_+(\hat{\gamma}).$$

Rearranging yields

$$\begin{aligned} V'_+(\hat{\gamma}) - (1 - H(\hat{k}))\delta V'_+(\hat{\gamma}) &= -[1 - R(\hat{w})]H'_+(\hat{\gamma})[-f - \delta V(\hat{\gamma})] \\ H(\hat{k})\delta V'_+(\hat{\gamma}) &= -[1 - R(\hat{w})]H'_+(\sigma\hat{\gamma})[-f - \delta V(\hat{\gamma})]. \end{aligned}$$

By assumption, $f + \delta V(\hat{\gamma}) > 0$. Also, since $H(\cdot)$ is continuously differentiable, $H'_+(\hat{\gamma}) > 0$, guaranteeing $V'_+(\hat{\gamma}) < 0$.

Next, since $H(\cdot)$ and $R(\cdot)$ are continuously differentiable, $w_t^*$ and $k_t^*$ are continuously differentiable in $\gamma_{t-1}$, $V(\cdot)$ is continuously differentiable in $\gamma_t$. This implies, as $\lim_{t\to+\infty} \gamma_t = \hat{\gamma}$ and $\lim_{\gamma\to\hat{\gamma}} V'(\gamma) < 0$, there exists an $S$ such that, $\forall\, t \geq S$, $V'(\gamma_t) < 0$.

Now consider some $t \geq S$. We show (1) the dynamic game starting in $t$ has a unique equilibrium and (2) $V'(\gamma_{t-1}) < 0$. Together these results establish, by induction, that the full dynamic game has a unique equilibrium.

(1) Consider prosecutor $t$ with initial beliefs $\gamma_{t-1}$ and assume $f\sigma + \delta V(\gamma) > 0 \;\forall\, \gamma \in [0, \gamma_0]$. Substituting the executive best reply into the prosecutor best reply :

$$k_t = \frac{\gamma_{t-1}[1 - R[H(k_t)f - (1 - H(k_t))\delta V(k_t) - f^a - \Omega]]}{1 - \gamma_{t-1}R[H(k_t)f - (1 - H(k_t))\delta V(k_t) - f^a - \Omega]}.$$

Hence, $k_t^*$ solves

$$\Psi(k_t) = 0,$$

where

$$\Psi(k_t) \triangleq \psi(k_t) - k_t,$$

where

$$\psi(k_t) \triangleq \frac{\gamma_{t-1}[1 - R[H(k_t)f - (1 - H(k_t))\delta V(k_t) - f^a - \Omega]]}{1 - \gamma_{t-1}R[H(k_t)f - (1 - H(k_t))\delta V(k_t) - f^a - \Omega]}.$$

Now consider $\psi_t'(k_t)$. The sign of $\psi_t'(k_t)$ is the sign of

$$\begin{aligned} A &= -H'(k_t)\left[f + \delta V(k_t)\right] \\ &+ +(1 - H(k_t))\delta V'(k_t). \end{aligned}$$

The first term is negative by assumption; the second term is negative because $V'(\gamma_t) < 0$. Hence, $\psi(\cdot)$ and $\Psi(\cdot)$ are strictly decreasing functions of $\gamma$. In addition

$$\begin{aligned} \Psi(0) &> 0, \\ \Psi(\gamma_0) &< 0, \end{aligned}$$

so there exists a unique $k_t^*$ in $(0, \gamma_0)$ such that $\Psi(k_t^*) = 0$.

By implicit differentiation

$$\frac{\partial k_t^*}{\partial \gamma_{t-1}} = -\frac{\frac{\partial \psi_t}{\partial \gamma_{t-1}}}{\Psi_t'(k_t)} = -\frac{1 - R(w_t)}{\Psi'(k_t)(1 - \gamma_{t-1}R(w_t))^2} > 0.$$

The unique equilibrium threshold $w_t^*$ then solves either

$$k_t^* = \frac{\gamma_{t-1}[1 - R(w_t)]}{1 - \gamma_{t-1}R(w_t)} \tag{33}$$

or

$$w_t = H(k_t^*)f - (1 - H(k_t^*))\delta V(k_t) - f^a - \Omega. \tag{34}$$

(2) Consider $V'(\gamma_{t-1})$. Using (7):

$$\begin{aligned} V'(\gamma_{t-1}) &= [1 - R(w_t^*)]\left[-H'(k_t^*)\frac{\partial k_t^*}{\partial \gamma_{t-1}}\left[f + \delta V(k_t)\right]\right] \\ &\quad +[1 - R(w_t^*)]\left[(1 - H(k_t)^*)\delta V'(k_t)\right] \end{aligned}$$

Since $\frac{\partial k_t^*}{\partial \gamma_{t-1}} > 0$, and as $t \geq S$, $V'(\gamma_t) < 0$, we conclude

$$V'(\gamma_{t-1}) < 0.$$

Finally, $k_t^* = \sigma\gamma_t$ is strictly decreasing in $t$ since $\gamma_t$ is strictly decreasing in $t$ and in the period-$t$ equilibrium, if $k_t^* > k_{t+1}^*$ as the executive's best response function is increasing, $w_t^* > w_{t+1}^*$.■