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Illegal corporate behavior and the value of firms

Abstract

This paper explores the relationships between illegal corporate behaviors, the value of firms, and economic conditions. Assuming the manager and the board both maximize shareholders' value. The result shows that the most severe situations occur in big firms when businesses prosper. As long as punishment would not cause a firm to collapse, a success in illegality would discourage future crimes, while failures breed further wrongdoings. In addition, the temptation for future illegality is much less for the successful than the failed, meaning that the losers struggle harder to recover what has been lost than the winners trying to garner more.

Keywords: illegal corporate behavior, firm's value, recidivism.
JEL Classification: G18, G38, K42.

Introduction

Profit is not a four-letter word and making profit is exactly what firms are supposed to do. Milton Friedman once said, the social responsibility for businesses is to increase their profits. Some managers, however, have crossed the boundary to undertake illegal projects to enhance their own pockets and perhaps also the earnings of the firms. Roughly two-thirds of America's 500 largest corporations have been involved in illegal behaviors (Gellerman, 1986). The notorious cases of Enron and WorldCom have caused tremendous shock waves throughout the financial market.

Generally, illegal behavior is considered despicable and ethics is an important aspect of corporate illegality (Sims, 1992; Brown, 2007; Crittenden et al., 2009). To be sure, criminal decision-making within a firm is both utilitarian and deontological (Reidenbach and Robin, 1990). As a result, many firms have devoted tremendous resources to clamp down by establishing ethical compliance programs (Kaptein, 2004). However, exercising corporate social responsibility does not necessarily bring financial rewards to firms and its effectiveness may be limited as a result (Wokutch and Spencer, 1987). In addition, ethical codes may not serve as the guidelines for business executives (Rose, 2007) and ethical compliance programs have not ameliorated legal violations (McKendall et al., 2002).

The law, perhaps, is the more practical way to deter illegal corporate behaviors and protect the rights of the investors (La Porta et al., 2000). Szwajkowski (1985) suggests that hefty fines and jail terms could alter the wrongdoers' intention on committing frauds, while Crocker and Slemrod (2005) indicate that direct punishments on the offenders are the most effective in deterring swindles. However, the law alone may not be sufficient in preventing crimes. Karpoff et al. (2008) show that only 40 of 778 enforcement actions invoke Sarbanes-Oxley provisions, and Bales and Fox (2009) evidence shows that its effect is insufficient because corporate scandals and scams continue to increase, while Baucus and Baucus (1997) conclude that the penalties associated with a conviction may not discourage future violations. Even legal actions may not be as desirable as expected. To be sure, there are other aspects of corporate illegality.

From a different perspective, this paper explores the relationships between corporate illegal activities, the value of firms, and economic conditions. Assuming the manager and the board both maximize the value of the shareholders. Via a three-stage setting, a manager in stage one initiates a project, which may be legal or illegal. The board in stage two, based on its own evaluation, decides on the approval of the project, which will be implemented by the manager in stage three. For any project, if it fails and the value of the firm drops below a threshold, the company will be liquidated. On the other hand, if the project is rejected, the scenario will go back to stage one.

On the legal case, there is little need for elaboration. For an illegal project, there are two possibilities: being detected or not detected. If the fraud is not revealed or if the fraud is exposed but the value of the firm still remains above the operation threshold, the firm will go on to the next cycle. Finally, the firm will be liquidated, if the fraud is caught with sufficient punishment imposed.

The analysis depicts a feasible illegal activity terrain (FIAT), which is the range of feasible illegal profit facing a manager deciding whether to undertake illegal activities, increases during economic downturns and shrinks during economic prosperity. In other words, the worse the economic condition, the more temptations for a manager to commit more wrongs. During recessions, there may be more pressures for the manager to push beyond the limit to make more profits, while the need for such illegal actions is smaller when the economy is thriving, a result similar to what Staw and Szwajkowski (1975) and Cochran and Nigh (1987) have found. Furthermore, the model indicates that corporate crimes tend to be more severe during plentiful environment, as suggested by Baucus and Near (1991). As for the probability of getting the illegal payoff, the weak economy may render crimes more easily exposed, coupling with a higher tendency for illegal activities, making economic downturns fraught with fraudulent cases.

On the size of the firm, most literature shows that a large firm with more complicated structure tends to breed illegality (Simpson, 1986; Dalton and Kesner, 1988; Williams et al., 2005). Within a complicated and larger organization, the manager may feel more confident of getting away with punishment. However, that is from the perspective of the manager's private gains. For a manager and board intending to maximize the value of a firm, FIAT actually is larger in small firms, a result similar to that of Clinard et al. (1979). Since small firms are less competitive and with fewer resources in getting deals than big ones, the temptation for them to undertake illegal acts may aggravate. In contrast, the probability of getting the illegal payoff positively relates to the size of the firm, since a delinquent manager may find more ways to conceal the fraudulent act. On the recidivism issue, a successful fraud may indeed discourage future criminal activity, while a manager caught of wrongdoing could be induced to dedicate more efforts to frauds. The endeavor of successful criminals to obtain more illicit gains is much less than the struggle of the losers to cover past losses, a feature analogous to Prospect Theory (Kahneman and Tversky, 1979).

The following section will lay out the specifications of a three-stage setting model with ten propositions to explore the relationships between illegal corporate behavior, the value of firms, and economic conditions. The implications of the result are then elaborated. This paper may shed light on some of the characteristics of corporate illegal behaviors.

1. Three-stage setting

Without profits, few firms could survive. Therefore, the assumption that the goal of the manager and the board is to maximize the shareholders' value seems reasonable. In dealing with corporate illegal behaviors, some researchers have focused on managers' private gains. More attention on the value of the firm may be warranted since a firm is owned by the shareholders. In most cases, the board, supposedly a monitor of the management, acquiesces the manager's illegal behavior, implying that the manager and the board may be on the same ground as long as profits are concerned (Kesner et al., 1986; Davidson and Worrell, 1988; Tosi et al., 2003; Mellahi, 2005; Tillman, 2009). That is, illegal acts may be worthwhile from the shareholders' standpoint if the expected benefits outweigh the expected costs (Davidson and Worrell, 1988). The following sections will delineate the specifications of the model.

At the beginning of period t, the initial value of the firm is I_0, which is not less than 1, a survival threshold set in this model. Provided the value of the firm drops below 1 at any period, the firm will be liquidated. In stage one, the manager initiates a project, which may be legal or illegal. Then, the board in stage two decides the fate of the project, which upon approval is implemented by the manager in stage three. If the board rejects the project, the scenario returns to stage one, starting another cycle.

Assuming the project is legal and profitable. The firm survives and moves on the next period with value V_t. Otherwise, if the value of the firm is less than 1, the firm will be liquidated. In contrast, if the project is illegal, then there are two possibilities: being detected or not detected. In either case, the project may succeed or fail. If successful or the punishment not substantial after being caught of frauds, the firm will move on to the next period with value V_t. Otherwise, the firm will be liquidated. The severity, or considered as the gain, of the illegality at period t is i_t, which is not less than 0. If $i_t = 0$, the project is treated as legal. See Figure 1 for the illustration of the model. The following section will explore the relationships between corporate illegal behaviors, the value of the firm, and economic conditions.

2. The illegal activities, the economic situation, and the value of firms

Illegal corporate behaviors encompass numerous complicated aspects. To simplify the analysis, the following propositions deal with specific aspects of corporate illegal behaviors. See Appendix for the proofs of these propositions.

The approval of a project, legal or illegal, is treated as a Bernoulli trial because whenever a project is proposed, it is either approved or disapproved. As a result, consider the probability distribution of the approval of the project, a random variable X, as the project being approved by the board at period t, with probabilities $Pr_t(X = 1) = p_t$, $Pr_t(X = 0) = 1 - p_t$. When $X = 1$, the project is approved, $X = 0$, otherwise. Hence, the probability density function is:

$$f_t(\lambda; p_t) = (1 - p_t) \cdot \exp\left(\lambda \cdot \ln \frac{p_t}{1 - p_t}\right), \tag{1}$$

$$x = \lambda \in \{0, \ 1\},$$

where x~Bernoulli ($n = 1, p$).

The firm is assumed to grow at the rate of r, if it follows the normal path, that is:

$$V_t = (1+r) \cdot I_0. \tag{2}$$

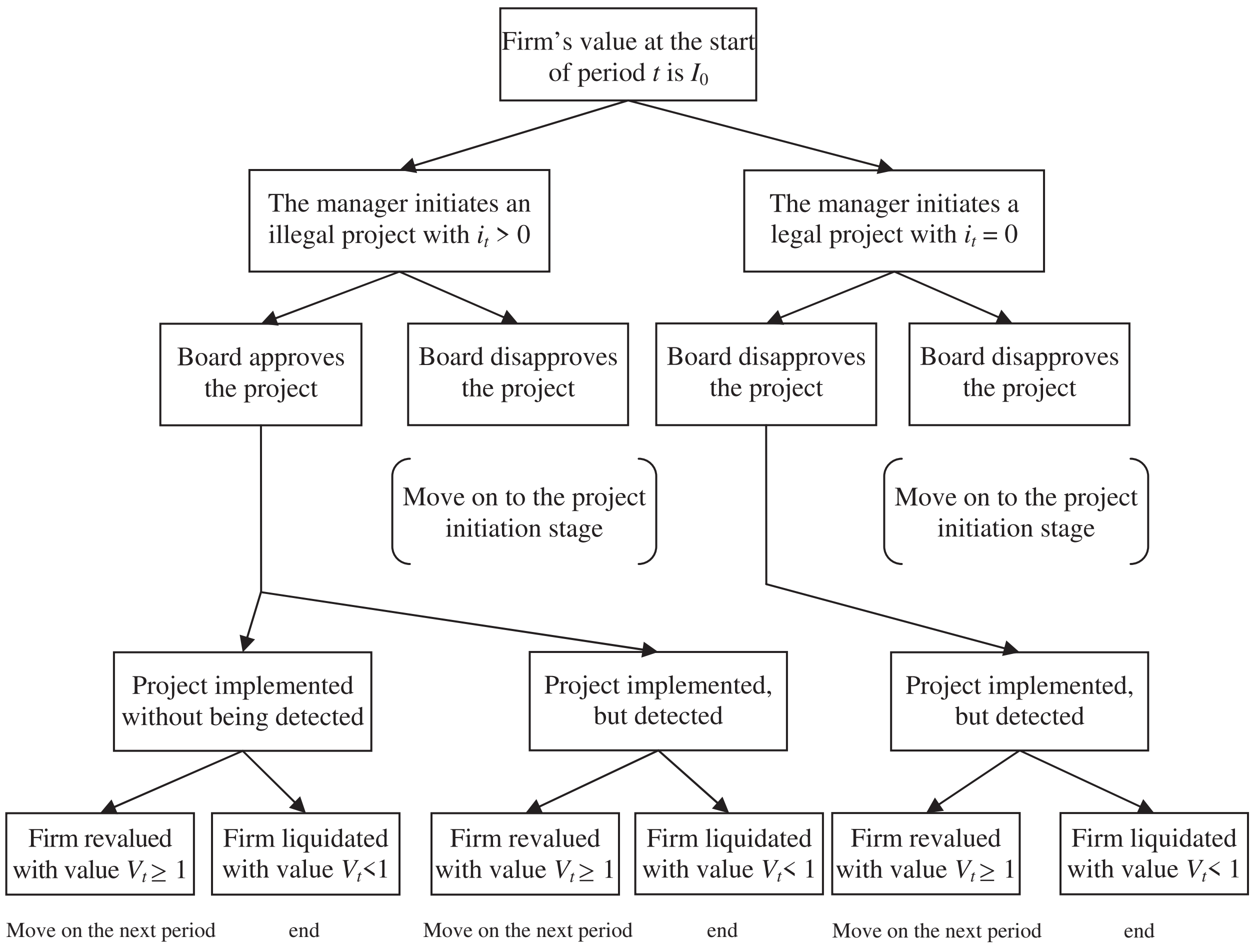

Fig. 1. The three-stage setting

To be sure, most companies exercise monitoring to detect frauds with internal controls and external auditing. The external factors depend on the independence of audit, the intensity of law, and the enforcement of law (Deangelo, 1981; Klein, 2002; Bris, 2005; Smith et al., 2007; Jost, 2001). The greater the external monitoring, the higher the probability of detection. The external monitoring is normalized and denoted by the parameter $m \in (0, 1)$. As for the internal, since higher profits may signify more abnormal activities, the higher the profits of illegal acts, i_t, the higher the probability of detecting frauds. Still, there is a need to make sure that a reasonable case exists for the probability of detection. In addition, it is not reasonable for the payoff from illegality to increase without bound, rendering an upper bound necessary for a feasible solution, as indicated in Proposition 1. Let ξ be the collection of all likely illegal payoff and a: = sup ξ.

Proposition 1. For any nonnegative number $a \geq 0$, the equation

$$x = \frac{1}{(1+r)\cdot I_0 \cdot e^{x \cdot a}}, \text{ with } r \geq 0,\ I_0 \geq 1 \tag{3}$$

has a unique solution $x^* \in (0,1)$.

Suppose m satisfies $0<m<x^*<1$, it is true that

$$0 < m < x^* = \frac{1}{(1+r)\cdot I_0 \cdot e^{x^* \cdot a}} < 1. \tag{4}$$

From the perspective of the manager, the probability of getting the illegal payoff i_t[1] is:

$$\pi(i_t) = e^{-mi_t} \in [0,1]. \tag{5}$$

No pains, no gains; only higher gains could sustain greater pains. That is, higher illegal payoff entices more criminal acts (Dalton and Kesner, 1988; Bowles and Garoupa, 1997; Jost, 2001; Williams et al., 2005; Johnson, Ryan and Tian, 2009). As for the cost of illegal acts, the firm may suffer from monetary fines and the lost of reputation (Baucus and Baucus, 1997; Williams and Barrett, 2000). To make the punishment commensurate with the crime committed, the cost of the firm is whatever the gain from the illegal act. Thus, the penalty is

[1] By assumption, if $i_t = 0$, $\pi(0) = 1$. In contrast, if i_t is very large, the probability for the manager getting away with punishment will be very small. In other words, $\lim_{i_t \to \infty} \pi(i_t) = 0$. Furthermore, equation (5) implies that $\pi(i_t)$ is decreasing and convex in i_t.

$$\frac{\pi(i_t)}{[1-\pi(i_i)]}(-i_t). \tag{6}$$

Since the modern firm carries only limited liability, if the liability is larger than the asset of the firm, it may simply file bankruptcy and the loss will be limited by the value of its asset. The fate of the firm is denoted by γ_{i_t}. If $\gamma_{i_t} = 0$, then the asset of the firm outweigh the expected cost of being caught. Otherwise, the firm is liquidated.

$$\gamma_{i_t} = \begin{cases} 0, \ i \le \dfrac{[1-\pi(i_t)]}{\pi(i_t)} \cdot (1+r) \cdot I_0 \\ 1, \ i > \dfrac{[1-\pi(i_t)]}{\pi(i_t)} \cdot (1+r) \cdot I \end{cases}. \tag{7}$$

From equation (6) and (7), if an illegal act is caught, the firm's expected value will be diminished by

$$[1-\gamma_{i_t}] \cdot \frac{\pi(i_t)}{[1-\pi(i_t)]} \cdot (-i_t) + \gamma_{i_t} \cdot [-(1+r) \cdot I_0]. \tag{8}$$

Thus, at the beginning of period t, a manager may expect the value of the firm at the end of period t to be

$$E_0[V_t] = \{1-[1-\pi(i_t)] \cdot \gamma_{i_t}\} \cdot (1+r) \cdot I_0 + \gamma_{i_t} \cdot \pi(i_t) \cdot i_t. \tag{9}$$

On the relationship between the expected value of the firm and the gain from illegality, Proposition 2 shows the way $\pi(i_t)$ relates to the size of the firm, which is represented by the value of the firm in the model, and the economic situation, of plenty or scarcity.

Proposition 2. The probability of getting the illegal payoff positively relates to the initial size of the firm, I_0, and the economic situation.

Generally, in a large firm with complicated structure, the manager feels more confident that any wrongdoing is much harder to be detected (Simpson, 1986; Dalton and Kesner, 1988; Williams et al., 2005). However, that does not inexorably lead to the manager's illegal behavior. From the perspective of the manager, the criterion for undertaking any project is whether it can maximize the value of the firm, as assumed in this model.

An environment of scarcity seems to breed illegal corporate behaviors, the very time that a manager needs to generate more profits for the firm (Staw and Szwajkowski, 1975; Cochran and Nigh, 1987). However, the frequency of illegal activities does not necessarily mean such actions pay off. Furthermore, in times of scarcity, abnormal cash flow will be more easily revealed, reducing the probability and amount of illicit gains. In contrast, in a plentiful environment firms are making more profits, carrying around with a large cash flow, illegal activities may find a better leeway to hide their abnormality. Thus, Proposition 2 may be plausible.

Inspecting a holistic scenario, illegal activities tend to occur in small firms and scarce environment, but plentiful environment and large firms mean lower detection probability and higher illicit gains. Therefore, a senior and audacious manager may find where the best opportunity for illicit gains lies, perhaps the very reason we have seen so many scandals in big companies during economic prosperity.

To be sure, implementing an illegal project will affect the value of the firm.

Proposition 3. After implementing an illegal project with i_t, at the end of period t the expected value of the firm is

(a) $E_0[V_t] = (1+r) \cdot I_0$, if $0 \le i_t \le \dfrac{[1-\pi(i_t)]}{\pi(i_t)} \cdot (1+r) \cdot I_0$,

(b) $E_0[V_t] \ge (1+r) \cdot I_0$, if $\dfrac{[1-\pi(i_t)]}{\pi(i_t)} \cdot (1+r) \cdot I_0 < i_t < \infty$,

(c) $E_0[V_t] = 0$, if $i_t \to \infty$.

There are three possibilities after implementing an illegal project. Proposition 3(a) is the case that the firm stays on its normal path of growth and 3(c) shows that the firm has to be liquidated. Proposition 3(b) indicates that only if the illicit gain exceeds certain amount it will enhance the value of the firm. There is a tradeoff: more illicit gains may better enhance the value of the firm, but the risk of being caught and causing the firm to go bankrupt also increases.

The expected valuation of the firm at the end of period t after implementing an illegal project is

$$E_0[V_t] = \{1-[1-\pi(i_t)] \cdot \gamma_{i_t}\} \cdot (1+r) \cdot I_0 + \gamma_{i_t} \cdot \pi(i_t) \cdot i_t.$$

Then, the partial differential of the firm's expected value with respect to i_t is

$$\frac{\partial E_0[V_t]}{\partial i_t} = \gamma_{i_t} \cdot \{\pi'(i_t) \cdot [(1+r) \cdot I_0 + i_t] + \pi(i_t)\}. \tag{10}$$

With equation (10), the impact of i_t on the value of the firm may be further explored.

Proposition 4. The relationship between the firm's expected value with respect to i_t at the end of period t is:

(a) neutral, if $i_t \le \dfrac{[1-\pi(i_t)]}{\pi(i_t)} \cdot (1+r) \cdot I_0$,

(b) positive, if

$$\frac{[1-\pi(i_t)]}{\pi(i_t)}\cdot(1+r)\cdot I_0 < i_t < -(1+r)\cdot I_0 - \frac{\pi(i_t)}{\pi'(i_t)},$$

(c) negative, if $-(1+r)\cdot I_0 - \frac{\pi(i_t)}{\pi'(i_t)} < i_t$.

Proposition 4(a) shows that if i_t is less than the upper bound, undertaking the illegal project has no impact on the expected value of the firm. Proposition 4(b) shows that if i_t is between the constraints, increasing the value of illicit gain will enhance the value of the firm. However, if the manager were enticed by a temptation too lucrative to resist, jumping over the upper bound, the consequence will be too hard to bear, as indicated in Proposition 4(c).

The scenario reflects part of the reality. Some people have engaged in illegal activities without any gains, much ado with nothing, while others have done so enhancing their pockets and may have at the same time brought some benefits to the firm they serve. No doubt, there are also people messing around, ruining the futures of themselves and their companies.

The constraints in Proposition 4(b) may be considered as a feasible illegal activity terrain (FIAT), within which a manager engaging in illegal activities can enhance the value of the firm. Therefore, to maximize the value of the firm, a manager needs to find where FIAT lies. A higher i_t carries more temptations, whereas a wider range of FIAT signifies more room for maneuver and still larger lure to the manager.

FIAT plays an important role in deciding whether to engage in illegality. Proposition 5 examines the elements affecting the width of the FIAT.

Proposition 5. The width of FIAT negatively relates to the size of the firm and the economic situation.

FIAT is wider when the size of the firm is small or facing economic downturns, implying that manager have a wider range to manipulate when facing the pressures of making profits in scarce environment (Staw and Szwajkowski, 1975; Cochran and Nigh, 1987). As expected, during economic downturns there will be fewer legitimate profitable projects, aggravating the pressures of making money and pushing a manager over the legal boundary even though the probability of being caught is actually higher.

After discussing the impact of committing frauds in one period, the following will examine the effect of running the firm with illegal activities for two periods. Recall the expected value of the firm at the end of period t is

$$E_0[V_t] = \{1-[1-\pi(i_t)]\cdot\gamma_{i_t}\}\cdot(1+r)\cdot I_0 + \gamma_{i_t}\cdot\pi(i_t)\cdot i_t,$$

which is also the initial valuation of the firm at the beginning of the period $t + 1$. As a result, when $V_t \geq 1$, the expected value of the firm at the end of period $t + 1$ is

$$E_0[V_{t+1}] = \{1-[1-\pi(i_{t+1})]\cdot\gamma_{i_{t+1}}\}\cdot\left(\{1-[1-\pi(i_t)]\cdot\gamma_{i_t}\}\cdot(1+r)^2\cdot I_0 + \gamma_{i_t}\cdot\pi(i_t)\cdot(1+r)\cdot i_t\right) + \gamma_{i_{t+1}}\cdot\pi(i_{t+1})\cdot i_{t+1}. \tag{11}$$

Proposition 6. If $V_t \geq 1$, after implementing a project with i_{t+1}, at the end of period $t + 1$ the expected value of the firm will be

(a) $E_0[V_{t+1}] = (1+r)^2\cdot I_0$, if

$$0 \leq i_t \leq \frac{[1-\pi(i_t)]}{\pi(i_t)}\cdot(1+r)\cdot I_0,$$

and $0 \leq i_{t+1} \leq \frac{[1-\pi(i_{t+1})]}{\pi(i_{t+1})}\cdot(1+r)\cdot V_t$,

(b) $E_0[V_{t+1}] = 0$, if $i_{t+1} \to \infty$.

Proposition 6 shows that if the illegal gains are within bounds, engaging in illegal activities for two periods will keep the firm within the normal growth path. However, any extraordinary temptation will cause the firm to go bankrupt. The impact of the illicit gains on the expected value of the firm at the end of period $t + 1$ is shown in Proposition 7.

Proposition 7. Under the case $V_t \geq 1$, the relationship between the expected V_{t+1} with respect to i_t is

(a) neutral, if $i_t \leq \frac{[1-\pi(i_t)]}{\pi(i_t)}\cdot(1+r)\cdot I_0$,

(b) positive, if

$$\frac{[1-\pi(i_t)]}{\pi(i_t)}\cdot(1+r)\cdot I_0 < i_t < -(1+r)\cdot I_0 - \frac{\pi(i_t)}{\pi'(i_t)},$$

(c) negative, if $-(1+r)\cdot I_0 - \frac{\pi(i_t)}{\pi'(i_t)} < i_t$.

The result of Proposition 7 is similar to that of Proposition 4, showing that i_t carries the same impact on the firm's expected value at the end of periods t and $t + 1$.

Before examining the relationship of V_{t+1} with respect to i_{t+1} in Proposition 8, equation (12) is derived as follows:

$$\frac{\partial E_0[V_{t+1}]}{\partial i_{t+1}} = \gamma_{i_{t+1}}\cdot\left(\pi'(i_{t+1})\cdot\{[1-(1-\pi(i_t))\cdot\gamma_{i_t}]\cdot(1+r)^2\cdot I_0 + \gamma_{i_t}\cdot\pi(i_t)\cdot(1+r)\cdot i_t + i_{t+1}\} + \pi(i_{t+1})\right). \tag{12}$$

Proposition 8. Under the case $V_t \geq 1$, the relationship of the expected V_{t+1} with respect to i_{t+1} is

(a) neutral, if $i_{t+1} \leq \dfrac{[1-\pi(i_{t+1})]}{\pi(i_{t+1})} \cdot (1+r) \cdot V_t$,

(b) positive, if $\dfrac{[1-\pi(i_{t+1})]}{\pi(i_{t+1})} \cdot (1+r) \cdot V_t < i_{t+1}$

$< \{[1-\pi(i_t)] \cdot \gamma_{i_t} - 1\} \cdot (1+r)^2 \cdot I_0 -$

$-\gamma_{i_t} \cdot \pi(i_t) \cdot (1+r) \cdot i_t - \dfrac{\pi(i_{t+1})}{\pi'(i_{t+1})}$,

(c) negative, if

$\{[1-\pi(i_t)] \cdot \gamma_{i_t} - 1\} \cdot (1+r)^2 \cdot I_0 -$

$-\gamma_{i_t} \cdot \pi(i_t) \cdot (1+r) \cdot i_t - \dfrac{\pi(i_{t+1})}{\pi'(i_{t+1})} < i_{t+1}$,

where $V_t = \{1-[1-\pi(i_t)] \cdot \gamma_{i_t}\} \cdot (1+r) \cdot I_0 +$

$+\gamma_{i_t} \cdot \pi(i_t) \cdot i_t \geq 1$.

With Proposition 8(b), $FIAT_{t+1}$ is shown in (13), with which the variations of $FIAT_{t+1}$ may be discerned.

$$\left(\left\{\frac{[1-\pi(i_{t+1})]}{\pi(i_{t+1})}\right\} \cdot (1+r) \cdot V_t, \{[1-\pi(i_t)] \cdot \gamma_{i_t} - 1\} \cdot (1+r)^2 \cdot I_0 - \gamma_{i_t} \cdot \pi(i_t) \cdot (1+r) \cdot i_t - \frac{\pi(i_{t+1})}{\pi'(i_{t+1})}\right). \tag{13}$$

Proposition 9. If an illegal act is undertaken at period t, the impact on $FIAT_{t+1}$ is as follows:

(a) if the illegal act is not caught, increasing one unit of i_t at period t, $FIAT_{t+1}$ will decrease by $(1+r) \cdot \dfrac{1}{\pi(i_{t+1})}$ unit,

if the illegal act is caught,

(b) if $\gamma_{i_t} = 1$, $FIAT_{t+1}$ will not exist,

(c) if $\gamma_{i_t} = 0$, and V_t not less than 1, increasing one unit of i_t, $FIAT_{t+1}$ will increase by

$(1+r) \cdot \dfrac{1}{[1-\pi(i_t)] \cdot \pi(i_{t+1})}$.

Proposition 9(a) states that an undetected illegal project shrinks the room for manipulating future illegal activities. Seemingly, a successful attempt will increase the value and reputation of the firm, decreasing the pressures on the manager for more profits, thus for more illegal attempts. On the other hand, with higher value of the firm, the manger may be able to find more legitimate investment opportunities, again reducing the need to engage in illicit activities. Furthermore, the gain from previous illegal attempt may change the manager's future attitude toward risks (Lazear and Rosen, 1981).

In Proposition 9(b), since the firm is gone, no other elaboration is needed. As for Proposition 9(c), a manager tends to engage in more severe crimes, if the current attempt fails. Suppose the punishment is not sufficient to cause the firm to collapse, the manger tends to engage in more criminal activities, trying to recover the loss (Baucus and Near, 1991). This feature is summarized in Proposition 10.

Proposition 10. After the illegality being detected at period t, the manager will engage in more frauds at period t+1 when $\gamma_{i_t} = 0$.

Generally, the value function is concave for gains and convex for losses. In other words, the gain from additional payoff is less than the pain from additional cost (Kahneman and Tversky, 1979). This aspect is similar to what Propositions 9 and 10 delineate. As a result, effective deterrence toward corporate illegal behaviors must carry sufficient punishment commensurate with the crime committed, decreasing the temptation of frauds. The corporate scandals episode in the late 1990s may vindicate some of the points delineated. For a most effective monitoring, the focus needs to be on big firms and during economic prosperity, as that is where the crime inflicts the most pain.

3. Discussions

Starting from treating the approval of a project as a Bernoulli trial, the model specifies a range of payoff, FIAT, within which a manager may engage in frauds without fatally impacting the firm. The size of the firm coupled with an environment of scarcity or plenty surely affects the incentive of the manager to commit frauds. Likewise, both factors influence the width of FIAT, the room for manipulation by the manager.

Propositions 2 and 5 clarify the relationships between the probability of getting the illegal payoff, FIAT, the size of the firm, and the economic condition. The smaller the size of the firm, the broader the range of FIAT, showing that more opportunities exist for a manager to engage in illegal activities when the size of the firm is small. Thus, illegal corporate behaviors tend to occur in small firms (Clinard et al., 1979). In contrast, in larger firms, from Proposition 2, the probability of getting illicit gains is higher, but the width of FIAT will be smaller, leaving much less leeway for a manager's illicit maneuvering.

Though most illegal activities occur in small firms and during economic downturns, the most scandalous cases seem to permeate in big firms and the peak of business cycles. Under such cases, according to our model, a daring manager will find it more lucrative to undertake illegal activities, since they now carry more payoff, a higher i_t, and a higher probability of not getting caught, a larger $\pi(i_t)$. This result is similar to that of Baucus and Near (1991). The implications of Propositions 2 and 5 are shown in Table 1.

Table 1. Implications of Propositions 2 and 5

	$\pi(i_t)$	FIAT
Large firm	High	Narrow
Small firm	Low	Wide
Plentiful environment	High	Narrow
Scarce environment	Low	Wide

Since it has been reported that most fraudulent managers have engaged in crimes for a long time, the impact of committing frauds for two periods is explored. The result is similar to what have been found for committing crime in only one period. However, there are some implications on recidivism. Those who have been caught tend to exert more efforts on illicit gains, while those not detected of frauds actually risk less of their futures. Therefore, for monitoring concerns, more attention may be warranted on the companies or personnel suspect of wrongdoing.

Concluding remarks

The world is never short of corporate scandals, like a never ending show in town. The authority concerned, to be sure, has implemented numerous measures to deter frauds, but the humiliation seems to aggravate.

From the perspective of maximizing the value of shareholders, this paper has examined the relationship between corporate illegal activities, the value of firms, and economic conditions. The result shows that more cases occur in small firms and during economic downturns. As for the temptation of illegal activities, managers will endeavor more to garner illegal gains, if previous such actions failed, while a successful effort will discourage them from further crimes.

When the economy improves and the value of the firm increases, a manager may feel confident that a feasible illegal activity terrain could be easily located, even though that terrain actually shrinks. Since the payoff from committing crimes increases, the expected value could indeed expand dramatically, enticing audacious attempts. The notorious corporate scandals in the late 1990s seem to vindicate some of the points in this paper.

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Appendix

Proof of Proposition 1. Define a continuous and differentiable function as follows:

$$f(x) = x - \frac{1}{(1+r)\cdot I_0 \cdot e^{x\cdot a}} \text{ on } [0, 1], \tag{A1}$$

(a) $f(0) = -\frac{1}{(1+r)\cdot I_0} < 0$,

(b) $f(1) = 1 - \frac{1}{(1+r)\cdot I_0 \cdot e^{a}} > 0$. (A2)

By the Intermediate Value Theorem, it follows that there is at least one number x^* such that $f(x^*) = 0$. Since

$$f'(x) = 1 + \frac{a}{(1+r)\cdot I_0 \cdot e^{x\cdot a}} > 0 \tag{A3}$$

for every number on (0, 1), this implies that the function *f* is strictly monotonic increasing on (0, 1), i.e. the solution x^* of the equation is unique. Q.E.D.

Proof of Proposition 2. From equation (4)

$$0 < m < x^* = \frac{1}{(1+r) \cdot I_0 \cdot e^{x^* \cdot a}} < 1$$

we can find m decrease in I_0 and r. Additionally, since the partial derivative of π with respect to m is

$$\frac{\partial \pi}{\partial m} = -i_t \cdot e^{-m \cdot i_t} \leq 0, \tag{A4}$$

we have completed the proof of Proposition 2. Q.E.D.

Proof of Proposition 3. Recall that the expected value of the firm from equation (9) is

$$E_0[V_t] = \{1 - [1 - \pi(i_t)] \cdot \gamma_{i_t}\} \cdot (1+r) \cdot I_0 + \gamma_{i_t} \cdot \pi(i_t) \cdot i_t$$

at the end of period t. It is clear that $E_0[V_t] = (1+r) \cdot I_0$ if $i_t = 0$. Now considering with the case $0 < i_t \leq \frac{[1-\pi(i_t)]}{\pi(i_t)} \cdot (1+r) \cdot I_0$, we have

$$E_0[V_t] = \{1 - [1 - \pi(i_t)] \cdot 0\} \cdot (1+r) \cdot I_0 + 0 \cdot \pi(i_t) \cdot i_t = (1+r) \cdot I_0. \tag{A5}$$

This is the result in item (a).

When the case (b) satisfies the condition that $\frac{[1-\pi(i_t)]}{\pi(i_t)} \cdot (1+r) \cdot I_0 < i_t < \infty$, the firm's expected value is

$$\begin{aligned} E_0[V_t] &= \{1 - [1 - \pi(i_t)] \cdot 1\} \cdot (1+r) \cdot I_0 + 1 \cdot \pi(i_t) \cdot i_t = \pi(i_t) \cdot (1+r) \cdot I_0 + \pi(i_t) \cdot i > \pi(i_t) \cdot (1+r) \cdot I_0 + \\ &+ \pi(i_t) \cdot \frac{[1-\pi(i_t)]}{\pi(i_t)} \cdot (1+r) \cdot I_0 = (1+r) \cdot I_0. \end{aligned} \tag{A6}$$

Finally, when $i_t \to \infty$, then

$$\lim_{i_t \to \infty} E_0[V_t] = \lim_{i_t \to \infty} \pi(i_t) \cdot i_t = \lim_{i_t \to \infty} e^{-m \cdot i_t} \cdot i_t. \tag{A7}$$

By the theorem of L'Hospital, equation (A7) can be written as

$$\lim_{i_t \to \infty} E_0[V_t] = \lim_{i_t \to \infty} \frac{1}{m \cdot e^{m \cdot i_t}} = 0. \tag{A8}$$

We have completed the proof. Q.E.D.

Proof of Proposition 4. Part (a) is clear following equations (7) and (10). Before proving parts (b) and (c), we must ensure that

$$\frac{[1-\pi(i_t)]}{\pi(i_t)} \cdot (1+r) \cdot I_0 < -(1+r) \cdot I_0 - \frac{\pi(i_t)}{\pi'(i_t)}. \tag{A9}$$

According to (4), $0 < m < x^* = \frac{1}{(1+r) \cdot I_0 \cdot e^{x^* \cdot a}} < 1$ it is clear that

$$0 < m < \frac{1}{(1+r) \cdot I_0 \cdot e^{x^* \cdot a}} \leq \frac{1}{(1+r) \cdot I_0 \cdot e^{x^* \cdot i_t}} < \frac{1}{(1+r) \cdot I_0 \cdot e^{m \cdot i_t}} < 1 \tag{A10}$$

for the external inhibition m. Now considering (5), the marginal influence on the probability of undetected illegality is

$$\pi'(i_t) = -me^{-m \cdot i_t}. \tag{A11}$$

From equation (A10) and (A11),

$$-\pi'(i_t) < \frac{\pi^2(i_t)}{(1+r) \cdot I_0}. \tag{A12}$$

The reciprocal of (A12) multiplied by $\pi(i_t)$ on both sides,

$$\frac{(1+r)\cdot I_0}{\pi(i_t)} < -\frac{\pi(i_t)}{\pi'(i_t)}. \tag{A13}$$

Equation (A13) subtracts $(1+r)\cdot I_0$ on both sides, $\frac{[1-\pi(i_t)]}{\pi(i_t)}\cdot(1+r)\cdot I_0 < -(1+r)\cdot I_0 - \frac{\pi(i_t)}{\pi'(i_t)}$.

Showing that (A9) must hold.

Now we start the proof of parts (b) and (c). Recall (10) $\frac{\partial E_0[V_t]}{\partial i_t} = \gamma_{i_t}\cdot\{\pi'(i_t)\cdot[(1+r)\cdot I_0 + i_t] + \pi(i_t)\}$.

There exists a unique critical number

$$i_t^* = -(1+r)\cdot I_0 - \frac{\pi(i_t^*)}{\pi'(i_t^*)} \tag{A14}$$

of the function $E_0[V_t]$ on $\frac{[1-\pi(i_t)]}{\pi(i_t)}\cdot(1+r)\cdot I_0 < i_t < \infty$ such that

$$\frac{\partial E_0[V_t]}{\partial i_t} > 0, \text{ if } \frac{[1-\pi(i_t^*)]}{\pi(i_t^*)}\cdot(1+r)\cdot I_0 < i_t < i_t^* = -(1+r)\cdot I_0 - \frac{\pi(i_t^*)}{\pi'(i_t^*)} \tag{A15}$$

and

$$\frac{\partial E_0[V_t]}{\partial i_t} < 0, \text{ if } -(1+r)\cdot I_0 - \frac{\pi(i_t^*)}{\pi'(i_t^*)} < i_t < \infty. \tag{A16}$$

Therefore, equations (A15) and (A16) imply parts (b) and (c). Q.E.D.

Proof of Proposition 5. Reviewing the condition in part (b) of Proposition 4, the feasible illegal activity terrain is

$$\frac{[1-\pi(i_t)]}{\pi(i_t)}\cdot(1+r)\cdot I_0 < i_t < -(1+r)\cdot I_0 - \frac{\pi(i_t)}{\pi'(i_t)}. \tag{A17}$$

Following equation (A17), the extent of interval decreases in r and I_0. Q.E.D.

Proof of Proposition 6. The proof of part (a) is easily follows since $\gamma_s = 0$ for $s = t, t+1$ from equation (7). Now according to the equations (5) and (7), we have $\pi(i_{t+1}) = 0$ and $\gamma_{t+1} = 0$ as $i_{t+1} \to \infty$. Following (9), the proof of part (b) is completed. Q.E.D.

Proof of Proposition 7. Consider the partial differential of $E_0[V_{t+1}]$ in equation (11) with respect to i_t, we have

$$\frac{\partial E_0[V_{t+1}]}{\partial i_t} = \{1-[1-\pi(i_{t+1})]\cdot\gamma_{i_{t+1}}\}\cdot(1+r)\cdot\gamma_{i_t}\cdot\{\pi'(i_t)\cdot[(1+r)\cdot I_0 + i_t] + \pi(i_t)\}. \tag{A18}$$

Equation (A18) can be divided into two items, the first is

$$\{1-[1-\pi(i_{t+1})]\cdot\gamma_{i_{t+1}}\}\cdot(1+r) \geq 0, \tag{A19}$$

and the other

$$\gamma_{i_t}\cdot\{\pi'(i_t)\cdot[(1+r)\cdot I_0 + i_t] + \pi(i_t)\}. \tag{A20}$$

From equation (A19), (A20) and the proof of Proposition 4, we complete the proof. Q.E.D.

Proof of Proposition 8. The proof of this proposition similar to that of Proposition 4 by equation (12). Q.E.D.

Proof of Proposition 9. Consider the case that the illegality is undetected in the period t, the firm's value becomes

$$V_t = (1+r)\cdot I_0 + i_t, \tag{A21}$$

at the beginning of the period $t+1$. Therefore, the FIAT in the period $t+1$ is

$$\left(\frac{1-\pi(i_{t+1})}{\pi(i_{t+1})}\cdot(1+r)^2\cdot I_0 + \frac{1-\pi(i_{t+1})}{\pi(i_{t+1})}\cdot(1+r)\cdot i_t,\quad -(1+r)^2\cdot I_0 - (1+r)\cdot i_t - \frac{\pi(i_{t+1})}{\pi'(i_{t+1})}\right). \tag{A22}$$

Now when we increase 1 unit of i_t, the left side of the interval will increase by

$$\frac{1-\pi(i_{t+1})}{\pi(i_{t+1})}\cdot(1+r) \tag{A23}$$

and the right side of the interval will decrease by $(1+r)$ (A24)

from equation (A22). From equations (A23) and (A24), the FIAT will decrease by

$$(1+r)\cdot\frac{1}{\pi(i_{t+1})} \tag{A25}$$

unit at period $t + 1$, thus the proof of part (a) is complete.

The proof of part (b) is trivial, since the firm is liquidated at the end of the period t. Consider the case (c) that illegality is detected and $\gamma_{i_t}=0$ at period t, the firm's value becomes

$$V_t=(1+r)\cdot I_0-\frac{\pi(i_t)}{1-\pi(i_t)}\cdot i_t\,, \tag{A26}$$

at the beginning of period $t + 1$. Hence, the FIAT at period $t + 1$ becomes

$$\left(\frac{1-\pi(i_{t+1})}{\pi(i_{t+1})}\cdot(1+r)^2\cdot I_0-\frac{1-\pi(i_{t+1})}{\pi(i_{t+1})}\cdot\frac{\pi(i_t)}{1-\pi(i_t)}\cdot(1+r)\cdot i_t,\quad -(1+r)^2\cdot I_0+\frac{\pi(i_t)}{1-\pi(i_t)}(1+r)\cdot i_t-\frac{\pi(i_{t+1})}{\pi^{/}(i_{t+1})}\right). \tag{A27}$$

Now when we increase 1 unit of i_t, the left hand side of the interval will decrease by

$$\frac{1-\pi(i_{t+1})}{\pi(i_{t+1})}\cdot\frac{\pi(i_t)}{1-\pi(i_t)}\cdot(1+r) \tag{A28}$$

and the right hand side of the interval will increase by

$$\frac{\pi(i_t)}{1-\pi(i_t)}\cdot(1+r) \tag{A29}$$

from equation (A27). Following equations (A23) and (A24), the FIAT will increase by

$$(1+r)\cdot\frac{1}{[1-\pi(i_t)]\cdot\pi(i_{t+1})} \tag{A30}$$

unit at period $t + 1$, thus the proof of part (c) is complete. Q.E.D.

Proof of Proposition 10. Following Proposition 9, the range of equation (A27) is larger than that (A22) for $\gamma_{i_t}=0$. Therefore, the first part of the proof for the proposition is complete. As for the second part of the proof, it follows that the firm is liquidated at the end of period t when the illegal corporate behavior is detected. Q.E.D.