Enforcement Failure under Incomplete Law: Theory and Evidence from Financial Market Regulation*

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Abstract

This paper examines the problem of deterrence failure under incomplete law and analyses how this problem may be addressed by different lawmaking and law enforcement institutions. We demonstrate that when law is incomplete, i.e. when the law fails to unambiguously state that a particular action will give rise to liability, a legal regime that relies exclusively on courts may suffer from deterrence failure. The reason is that courts are desigend to be reactive law enforcers and take action only after others have brought a case before them, typically ex post. We explain the emergence of regulators with the greater demand for proactive enforcement agents who may themselves initiate law enforcement activities even before harm has been done. Regulators' ability to proactively enforce the law helps mitigate the problem of deterrence failure. However, under certain conditions regulators may suffer from regulatory failure. Evidence drawn from UK and US case law and regulatory enforcement activities is provided.

Keywords: regulation; regulatory failure; optimal law enforcement; incomplete law; deterrence failure; financial market regulation

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1 Introduction

Effective law enforcement is a primary concern for any legal system. Even the best-designed law is useless unless it is effectively enforced. The most basic law enforcement device are courts. In modern market economies, however, courts are not the only law enforcement agents. Instead we also observe law enforcement by regulators. The increasing use of regulators has been depicted as the "rise of the regulatory state" (Glaeser and Shleifer, 2003; Majone, 1994).

This paper addresses the basic question why we observe regulators in law enforcement and not only courts. Specifically, it seeks answers to the following questions: Why have regulators become prominent law enforcers in certain areas of the law, such as financial markets, food and drug safety, etc.? Are there conditions under which regulators may be better law enforcers than courts? Conversely, if regulators are effective law enforcers, why have they not replaced courts completely and why don't they play a role in some areas of the law, such as the enforcement of fiduciary duties in corporate or trust law? More generally, under what conditions should courts be the primary law enforcers and when might the creation of regulators be superfluous or even harmful? What can regulators do and what are their limits? Answers to these questions are important for the design of legal/regulatory systems and for understanding law enforcement mechanisms. These questions have become more pressing in light of the inability of the otherwise highly regarded US legal system to prevent law enforcement failures, such as Enron, Worldcom, Adelphi, and their likes.

We are not the first to address the above questions. Our contribution to the literature is to study the trade-offs between the two major law enforcement regimes when both face problems of enforcement failure. We analyze how alternative law enforcement institutions, reactive law enforcers (courts) on one hand, and proactive law enforcers (regulators) on the other, address the problem of deterrence failure that results from incomplete law. We suggest that introducing a regulator reduces the deterrence failure problem. The reason is that regulators enforce law proactively by enjoining harmful actions and as such are less dependent on the law's deterrence function. However, regulatory regimes are not costless. In addition to the costs of establishment and maintenance, regulators may under certain conditions suffer from regulatory failure. The trade-off between the two regimes offers explanations for why we observe regulators in some, but not other areas, or why in some cases the cost of regulation far exceeds its benefits.

Financial regulation has been a major focus in the literature on regulation. Stigler (1964) claimed that "it is doubtful whether any other type of public regulation of economic activity has been so widely admired as the regulation of the securities markets by the Securities and Exchange Commission." This paper also uses

financial market regulation to illustrate the implications of our theory, even though the scope of this theory is potentially much larger. Using financial regulation as our major example, we take as our starting point the claims made in existing literatures that issuers will not disclose true information voluntarily if there is no adequate punishment for misrepresentation. This is because information collection is costly (Grossman and Stiglitz, 1980), there are large traders in financial markets (Laffont and Maskin, 1990), or it is difficult to establish credibility in financial markets (Benabou and Laroque, 1992).

Several literatures are directly related to the central question we address in this paper. The most important among them is the literature on the economics of law enforcement. At the core of this literature is the optimal deterrence function of law (Bentham, 1830) as first modeled by Becker (1968) and further developed by Stigler (1970) and many others (see Polinsky and Shavell (2000) for a survey of this literature). The central issue of law enforcement in that literature is the optimal deterrence regime (Coase, 1960; Becker, 1968; Stigler, 1970). By implication, courts should be the only law enforcers we observe. The implicit premise of this literature is that law is complete, i.e. that all relevant applications of the law are unambiguously stipulated in the law. It follows that law can be understood unambiguously by everybody and that it can be enforced literally provided that evidence is established.

A related literature explains the emergence of regulators. Critics of regulators point to interest group bargains as the reason for their existence and to red tape and regulatory capture as their by-products. This line of argument implies that regulators perform functions that could be performed better by courts (Posner 1974; Stigler 1971). Others have identified potentially beneficial functions of regulators, especially in areas where contractual monitoring is costly (Goldberg 1976; Priest 1993). More recently, it has been suggested that incentive issues associated with law enforcement may explain the emergence of regulators. According to this literature, regulators can be superior law enforcers to courts when effective law enforcement requires costly efforts to collect evidence, an investment for which law enforcement agents need to be sufficiently incentivized (Johnson, Glaeser, and Shleifer 2001). Moreover, according to some authors, regulators may be more resilient than courts against the subversion of justice (Glaeser and Shleifer, 2003).

We believe that this literature has captured some significant aspects of law enforcement in theory and practice. However, we would suggest that it leaves some important questions unanswered. In particular, the task of law enforcement agents goes far beyond evidence collection. Law enforcement agents are involved in lawmaking activities by either interpreting and applying pre-existing norms to new cases, or by formulating or enacting new rules. Regulators in particular are typically endowed with extensive lawmaking functions within the jurisdiction delegated to them by the legislature. The above theories on the rise of the regulatory

state fail to explain the functional differences between courts and regulators. Nor do they explain the emergence of regulators in countries where courts were not evidently corrupt at the time regulators took over important lawmaking and law enforcement functions. Finally, incentive based explanations for the emergence of regulators do not explain why regulators can be observed in some areas, such as financial market regulation, food and drug safety regulations, but not in others, such as the enforcement of fiduciary duties in corporate law (see Pistor and Xu, 2003b).

For the purpose of our analysis we assume away incentive problems (such as moral hazard problems interest group capture, or corruption) judges, regulators, or lawmakers face and instead focus on the problem of incomplete law and its implication for law enforcement by courts as well as regulators. We suggest that the incomplete law problem may well be of first order importance, and certainly of sufficient importance to be addressed separately. In fact, our analysis suggests that the choice between alternative institutions (courts vs. regulators) will have to be informed by the relative cost of deterrence and regulatory failure these institutions face under incomplete law.

Another literature that bears on our work is the voluminous literature in economics on regulation. The literature in the Pigou-Stiglitz tradition (Pigou, 1932; Atkinson and Stiglitz, 1980) defines regulation as state intervention with the purpose of addressing market failures caused by externalities and/or information problems. This literature does not distinguish between courts and regulators as alternative law enforcement mechanisms. Moreover, while there is little doubt that market failure is a necessary condition for state intervention, market failure alone may not be sufficient to justify the need for establishing a regulatory regime in the first place. In fact, some of the best known examples for market failure can be solved by using court-enforced law, as long as law is assumed to be complete. For example, if a law unambiguously stipulates compulsory insurance or compulsory warranties for products under all possible contingencies, court enforcement can efficiently solve the Rothschild-Stiglitz type of insurance market failure problems (Rothschild and Stiglitz, 1976) or the Akerlof lemons problem in used-product markets (Akerlof, 1970). Finally, there is a substantial literature on the new economics of regulation (for an authoritative survey see Laffont, 1994), which explores optimal regulation using contract theory; as well as a substantial literature that applies contract theory to law enforcement (e.g. Mookherjee and Png, 1992; Polinsky and Shavell, 2000). This literature focuses on optimal deterrence and optimal detection levels in the presence of information problems. By comparison, our aim is to understand why regulators as institutions separate from courts may or may not be needed in the first place.

Our theory of enforcement failure under incomplete law is inspired by the incomplete contract literature

(see Hart 1995). Pistor and Xu (2003) develop the notion of incomplete law at a conceptual level. However, that paper does not explicitly discuss deterrence failure; alternative law enforcement mechanisms; the trade-offs of these two enforcement devices – all issues that are at the core of the present paper.

The rest of the paper is organized as follows. Section 2 develops the concept of incomplete law and its implications for law enforcement. Section 3 sets up the benchmark model. Section 4 models deterrence failure due to incomplete law under a 'pure court' regime. Section 5 models a regulator as proactive law enforcer and compares the trade-offs or regulatory and court regimes. Section 6 presents evidence consistent with the predictions of the model. Section 7 concludes.

2 Law, Courts, and Deterrence

We use the term 'law' to refer to statutory or case law specifying liability or sanctions for certain actions or outcomes. We regard a law as complete, if all potential harmful actions can be unambiguously specified in the law. Otherwise a law is incomplete - because the law contains gaps, i.e.it fails to address some actions that with hindsight prove to be equally harmful as those stated in the law, or because it is designed to be open-ended, i.e. the boundaries of the law are not clearly circumscribed. Law can be complete, because it is phrased broadly and uses concepts that require extensive interpretation when applied to a particular case. An example is the concept of "materiality" in US securities law to determine whether the representation of wrongful facts will give rise to liability. Alternatively, law may be incomplete, because it is highly specific and details the actions that will be sanctioned, but fails to anticipate other actions that might result in similar harm as those the law seeks to prevent. Both types of incomplete law have caused problems in law enforcement.

To illustrate enforcement problems under incomplete law, consider the following case.[1] Overend, Gurney & Co was a highly respected and, for many years, profitable partnership in mid 19th century England. However, in recent years the partners had to make considerable advances to the firm to cover losses, amounting to over £4 Mln., only about £1Mln of which they deemed to be recoverable. Overall, the partnership had made around £500,000 losses in each of the previous 5 years. The partners now decided to continue their business as a joint stock company rather than a partnership - thus limiting their exposure to financial risks of the firm. To this end they established "Overend Gurney & Co. Limited" (OGCo. Ltd.), a company with

[1] It is a simplified version of W. Peek, the younger, vs. William Turquand and R.P. Harding, a case that was decided by the English House of Lords in 1867. In re Overend, Gurney & Co. (1867), L.R. 325.

tradable shares. They issued a prospectus, which stated that the company was formed "for the purpose of carrying into effect an arrangement for the purchase from Overend, Gurney & Co., of their long-established business of bill brokers and money dealers." The prospectus also stated that the new company would pay £500,000 to the partnership for its goodwill, to be paid partly in cash and partly in the form of shares. However, the prospectus did not disclose the financial hardship the partnership had suffered in recent years. Nor did it mention a secret side agreement between the new joint stock company and the partnership that allowed the directors to keep the partnership afloat until all its debt had been repaid. Investor William Peek bought shares on the basis of the information disclosed in the prospectus. OGCo. Ltd. failed within a year after it had been established and William Peak lost all of his investment. Peak together with other investors brought suit alleging that the directors had defrauded him by failing to fully disclose the side agreement between the OGCo. Ltd. and the partnership. The court held for the directors. It argued that neither statutory nor case law established an unambiguous obligation of directors to disclose contracts when issuing shares.

At the time the House of Lords heard this case, the English Company Act of 1862 required companies to circulate a prospectus prior to issuing shares to the public. However, the Act did not specify what information had to be included in the prospectus. Existing tort law established that positive misstatements of material facts could give rise to liability, but was unclear whether - absent a positive obligation to disclose - the omission of facts would also trigger liability. In other words, existing law was incomplete. It captured the positive misrepresentation of facts, but was silent on the omission of facts - a mode of fraud hat became increasingly comment in financial transactions of the kind Mr. Peak had participated in.

The example highlights the importance of economic change as a cause for incompleteness of law. Technological change can produce similar results. Consider the question whether individuals who appropriate energy by hooking their households to electricity lines are committing theft. The German Supreme Court denied this and acquitted the accused, even though evidence for their misconduct had been clearly established.. The court argued that theft as defined in the Penal Code required the appropriation of a "thing" (Sache), and that electricity lacked the properties of a "thing" that could be stolen.[2] The court was barred in order to analogize the fact to theft by the principle that the criminal nature of the action had to be defined before the crime had been committed. In 1900, the legislator responded to the evident enforcement failure and 'completed' the law by inserting a new provision in the code that deals specifically with appropriating energy. This example is quite general in scope. The Penal Code of the state of New York, for example,

[2]RGStr 29, 111 and RGStr 32, 165.

expanded its definition of "property" over time to include "any article, substance or thing of value, including any steam, water or electricity" in response to similar problems of law enforcement under incomplete law.[3] As this example demonstrates, lawmakers can respond to the problem of incomplete law in different ways. The German lawmaker added another highly specific provision to cover "electricity theft". When new technology allowed goods to be sold in vending machines that could be manipulated, or when gasoline theft at self-service stations became a concern, additional provisions that specified these actions were introduced. By contrast, the New York lawmaker used increasingly broad terms to ensure comprehensive law enforcement. Both approaches leave law ultimately incomplete. The German approach results in incomplete law, because the lawmaker will never be able to capture all actions that may result in the harm the law seeks to prevent. The New York approach results in incomplete law, because it is ambiguous as to which actions should be excluded from punishment.[4]

The above examples demonstrate that legislatures can address the problem of incomplete law by amending the law in response to new circumstances as they arise. These changes, however, can be made only after the legislature has observed the new circumstances. They typically take place after the fact, and often after many victims have already suffered harm. An alternative approach for addressing the problem of incomplete law is the appropriate design of lawmaking and law enforcement institutions. This paper explores the design of two alternative agents: courts and regulators. Courts and regulators differ in the manner in which they enforce law. Courts enforce law reactively, that is in response to a motion brought by the victim, or a prosecutor. In most cases law enforcement by courts takes place ex post, that is after harm has been done. In principle, a likely victim can use a preliminary injunction to initiate law enforcement by courts before harm has been done. In either case, action must be taken by a party other than the court, because courts are designed to be neutral, and thus passive, arbiters. By contrast, a regulator has the power to initiate law enforcement on its own and thus to enforce law proactively. This proactive enforcement power places a regulator in a better position to prevent harm. A common device to enable regulators to enforce law ex ante is to allow them to screen future actions before they are undertaken and to enjoin them in case the anticipated harm outweighs their benefit. Moreover, regulators are often empowered to establish new rules to address economic or technological change even before harm has been done, whereas courts interpret laws after harm has been done, or at best, when harm is imminent. [5]

[3] Sec. 155 of the Penal Code of New York.

[4] In the remainder of this paper we deal primarily with broad, ambiguous terms as a reason for incompleteness of the law. However, the results equally apply to law that is highly specific, yet fails to address all relevant issues.

[5] Our notion of law enforcement under incomplete law is related to, but differs from the distinction common in the legal

3 The Model

There are four players in on our model: A share issuing company (Issuer), an Investor, a Lawmaker and a Law Enforcer. At the outset there is only one law enforcer, the Court. Subsequently, we will introduce the Regulator as an alternative law enforcer. Issuer seeks to make a public offering that will benefit him. The impact of the same action on Investor's welfare depends on Issuer's willingness to disclose information relevant for Investor. The function of Lawmaker is to minimize the social welfare loss that may result from cheating by designing law and complementary law enforcement institutions to optimize law enforcement. The Court's task is to punish offenders to deter future violations.

Formally, we suppose that the payoffs for Issuer and Investor are related to the underlying value of Issuer's shares, s. The underlying value s follows a random distribution $f(s)$. To keep the model simple we assume that the distribution is uniform, or that $s \in [\mu - S, \mu + S]$. Here, μ is the expected value of all shares issued in this market and S represents their variation.

We suppose that Issuer observes a realized random outcome s, which is not observable by Investor. Issuer chooses disclosure strategy δ with respect to s, where δs denotes what Issuer discloses about s. We suppose that the choice of an honest strategy $\delta = 1$ by Issuer is most beneficial to Investor. Conversely, Investor is harmed if Issuer opts for cheating, as denoted by, $\delta \neq 1$. $|\delta - 1|$ measures the relative level of cheating. Hereinafter $|\delta - 1|$ will simply denote cheating, and $\delta \in (0, \infty)$. We call cheating any deviation of the facts that are disclosed to Investor from the true underlying value of Issuer's shares. This includes any overstatement of positive and any understatement of negative facts.

Investor observes the disclosed information with a noise

$$(\delta + \varepsilon)\, s$$

where ε is a random noise variable that follows a uniform distribution $\varepsilon \in [-x, x]$. x denotes the noise level of information, or the quality of information that Investor has; the quality is perfect, if $x = 0$.[6]

literature between rules and standards (Kaplow, 1992, 1996). Kaplow's definition of rules vs. standards focuses on the timing of the announcement. According to Kaplow, rules are announced ex ante, whereas standards are applied ex post in the context of adjudication. By implication, standards grant more extensive residual lawmaking authority to courts. Our definition of incomplete law suggests that even ex ante announced rules are often incomplete, especially in the context of substantial socioeconomic or technological change, and thus require interpretation at the adjudication stage. The real challenge therefore is not simply to choose between rules and standards, but to design law enforcement institutions that can mitigate the problems associated with deterrence failure under incomplete law.

[6] A possible interpretation of noise is that the disclosed information is vague and that therefore Investor's understanding of

The payoff for Investor from investing in Issuer's shares observing s is

$$U(\delta, s) = ws - \underbrace{hs\,|\delta - 1|}_{\text{harm resulting from cheating}}$$

where w is a parameter that determines the welfare gain to Investor from the random outcome s in the absence of cheating. h is the parameter of harm caused by Issuer's cheating $|\delta - 1|$. As a reduced form expression, w may be related to the benefits Investor derives in the form of dividends and capital gains; and h may be related to losses caused by Issuer's cheating. One reason, why cheating will cause harm to Investor is that Investor may mis-invest scarce resources. Investor knows parameters h and w. However, without knowing s and δ, he is unable to distinguish clearly between an intrinsic loss and a loss that results from Issuer's cheating.[7]

We denote b as Issuer's gains from the underlying value s, and we suppose $h > 1$, which implies that the social welfare gain from cheating is always smaller than the social welfare loss caused by cheating. Normalizing the coefficient for Issuer's gains from cheating as one, his total gain is

$$bs + s\,|\delta - 1|$$

We suppose that cheating is punishable by law.[8] In this context, x, which we defined above as the level of noise, can be interpreted as the quality of evidence available to the court. We assume that the level of punishment (liability) for cheating is related to evidence on the level of cheating that can be established in court. The marginal level of punishment increases with the seriousness of Issuer's cheating. Thus, for a given level of cheating $s\,|\delta + \varepsilon - 1|$, we assume that the punishment is quadratic, $(\delta + \varepsilon - 1)^2 s^2 \tau$,[9] where τ is the punishment standard (or punishment rule) established by law. It specifies the degree of punishment corresponding to the nature of the violation. In the rest of the paper, we refer to τ as the level of punishment.

what is disclosed is stochastic.

[7] The payoff function for Investor embeds an assumption that s is neutral for the relative harm/ benefit received by him. For given parameters h, w and any δ, the ratio of harm caused by Issuer's cheating over gains received from the intrinsic value for Investor is independent from s, $hs\,|\delta - 1|\,/ws = h\,|\delta - 1|\,/w$.

[8] For examples of liability under tort, contract, and criminal law in 19th century England, see Pistor and Xu, 2003.

[9] The quadratic form is not crucial for our results. If the quadratic form is replaced with any convex function of $|\delta + \varepsilon - 1|$ our results are qualitatively unchanged.

Therefore, the payoff for Issuer from employing strategy δ is the following[10]

$$V(\delta;\tau,s) = bs + s|\delta - 1| - (\delta + \varepsilon - 1)^2 s^2\tau$$

We assume that all shares issued in the market follow the same distribution, i.e. that they are homogenous.[11] The focus of our analysis is on incomplete law and how it affects enforcement, not on the incentives Lawmakers or law enforcement agents (courts or regulators) face. We assume that Lawmaker cares about social welfare, which is the sum of payoffs (utilities) of all issuers and investors.[12]

$$SW(\delta;s) = \int_{\mu-S}^{\mu+S}\int_{-x}^{x} (V(\delta;s,\tau(\delta,\varepsilon)) + u(\delta;s)) f(s) f(\varepsilon) d\varepsilon ds$$

We assume that neither Lawmaker nor Court can observe s. However, they both know the distribution of s. The model follows the following time line:

Timing of lawmaking/enforcing

- date 0 – ex ante: A law with punishment level τ is designed and announced to the public;
- date 1 – interim: Issuer has private information s and chooses disclosure strategy δ when making a public offering. Investor invests without knowing s;
- date 2 – ex post: payoffs are received; Investor sues Issuer if he has suffered harm and believes that he was cheated; the law suit establishes evidence regarding the disclosure strategy $\delta + \varepsilon$; and punishment $(\delta + \varepsilon - 1)^2 s^2\tau$ is administered accordingly.[13]

[10] Similar to our assumption on Investor's payoff, s is neutral in Issuer's payoff with regards to the relative gains received from the intrinsic value of shares and from cheating.

[11] If this assumption is relaxed to allow for heterogenous distributions for different share-issuers, i.e. if we assume that for each share issuer i his s_i follows a different distribution, then our model can be extended to analyse different behaviour of share-issuers.

[12] As stated above, we are aware that in reality law enforcers suffer from incentive problems. However, we want to focus on deterrence failure problems caused by incomlete law alone, which is important enough to be analyzed separately. Incorporating Lawmaker's incentive problem will make deterrence failure problem be even stronger and should be in next step of our research.

[13] To focus on our point, we choose not to model investor's decision about litigation nor the probability that a cheater is actually caught. In fact, the results will not change, if victims litigate randomly or if violators are caught randomly. In particular, when replacing the punishment coefficient τ by $t = \pi\tau$, where π is the probability that victims litigate and violators are punished and t is the expected punishment level, the model remains unchanged.

4 Complete vs. Incomplete Law and Deterrence Failure

We use law enforcement under complete law as our benchmark case. Under complete law, all possible harmful actions as well as the level of punishment are specified unambiguously in the law. Our model decomposes the effect on law enforcement of evidence imperfection on one hand, and of incomplete law, on the other. We show that when law is complete and evidence perfect, court enforced law can achieve the first best so that at equilibrium no cheating occurs. By contrast, when law is incomplete, neither Lawmaker nor Issuer or Investor can fully anticipate the scope of their obligations and the outcome of law enforcement by the Court will be uncertain. In that case, even when evidence is perfect law is not enforced at optimal level.

We suppose that Investor suffers harm, if Issuer chooses a dishonest disclosure strategy, and that this reduces social welfare. Lawmaker therefore must deter Issuer from wrongful disclosure. However, Lawmaker faces the problem of defining and measuring truthful as opposed to wrongful disclosure to ensure optimal enforcement. At the outset Lawmaker does not know how exactly the issuance of shares together with the disclosure of information (or lack thereof) might be linked to harm. Lawmaker will therefore write a law that is broad and ambiguous with respect to share issuing, information disclosure, as well as potential harm. This design problem is captured in the US securities law, which imposes liability on those who intentionally misrepresent "material" facts.[14] The meaning of materiality is not further defined. We denote the degree of incompleteness, or ambiguity, of the law as $1-q$, where q is the probability that a particular behavior will be correctly considered a punishable offense provided that evidence has been established.

An incomplete law changes the expected level of punishment for cheaters. It may be used to punish harmless actions, such as misrepresentation of information that is of no relevance for Investor, or that has not been causal for the harm suffered. Specifically, the probability that the law leads to mistakes is $(1-q)$ and the expected level of wrongful punishment is

$$(1-q)\,\eta\tau$$

where η is a coefficient for wrongful punishing harmless actions as a result of incomplete law. Therefore, Issuer's expected payoff is

$$V(\delta; s, \tau) = bs + s\,|\delta - 1| - q\tau s^2\,(\delta + \varepsilon - 1)^2 - (1-q)\,\eta s\tau$$

[14] See Sec. 10(b) and Rule 10(b)-5 of the US Securities and Exchange Act.

4.1 Deterrence Failure under Incomplete Law

In this section we analyze how incomplete law weakens deterrence and may result in deterrence failure.[15] Lawmaker and Issuer in our model both choose their strategies optimally for their own objectives while taking the other's strategy into consideration. At date 1, Issuer will choose a disclosure strategy δ to maximize his expected payoffs based on his information about the relative incompleteness of the law, q; and the punishment level specified in the law τ:

$$\max_{\delta} \frac{1}{2x} \int_{-x}^{x} \left(bs + s\left|\delta - 1\right| - q\tau s^2 \left(\delta + \varepsilon - 1\right)^2 - \left(1 - q\right)\eta s\tau \right) d\varepsilon$$

Responding to the expected punishment as specified in the law, Issuer's optimal disclosure strategy, or optimal level of cheating, is:

$$\left|\widehat{\delta} - 1\right| = \frac{1}{2sq\tau}. \tag{1}$$

The optimal disclosure strategy, equation (1) is intuitive, namely that every thing else being equal, the higher the expected punishment, $q\tau$, the lower the cheating.

Anticipating Issuer's disclosure strategy and taking equation (1) as the incentive compatibility condition for a given level of incomplete law, $1 - q$, and for the perceived quality of evidence that Court is able to collect, x, Lawmaker determines punishment level τ with the aim of maximizing expected social welfare. Lawmaker's program thus is:

$$SW = \max_{\tau} \frac{1}{4xS} \int_{-x}^{x} \int_{\mu-S}^{\mu+S} \left(V\left(\widehat{\delta}; s, \tau\left(\widehat{\delta}, \varepsilon\right)\right) + u\left(\widehat{\delta}; s\right)\right) ds d\varepsilon. \tag{2}$$

To simplify the analysis we assume that under an optimally designed law, τ, all issuers are willing to issue shares.[16]

The solution of the model under complete and incomplete law is summarized in the following. We denote the first best result (complete law and perfect evidence) with super-script *; and the second best result under incomplete law and imperfect information with super-script i.

Proposition 1 *When law is complete and evidence is perfect, at equilibrium no cheating occurs and the optimal level of punishment specified by law is high. When law is incomplete and evidence is imperfect,*

[15] When law is complete and evidence imperfect, our model is close to the Becker model (1968). As stated above, the Becker model implicitly assumes complete law. Moreover, there is no information asymmetry between the offender (Issuer) and the law enforcer, the Court.

[16] Relaxing this assumption will make our results even stronger since this will result in over-deterrence caused by incomplete law.

substantial amounts of cheating occur at equilibrium and the optimal level of punishment specified by law is lower.

Proof In the following we prove the incomplete law and imperfect evidence case first. Solving eqs. (1) and (2) simultaneously, we have the equilibrium disclosure strategy of the Issuer

$$\left|\delta^i - 1\right| = \frac{1}{3s}\frac{(\gamma+\lambda)^{1/2}}{\phi} > 0, \tag{3}$$

and the equilibrium punishment level specified by law

$$\tau^i = \frac{3}{2q}\frac{\phi}{(\gamma+\lambda)^{1/2}}. \tag{4}$$

Here, $\gamma = 9\mu\eta\left(\frac{1}{q}-1\right)$ is the incomplete law effect; $\lambda = x^2\left(S^2+3\mu^2\right)$ is the imperfect evidence effect; and $\phi = \sqrt{2h-1}$. For the first part of the proposition, when law is complete, i.e. $q = 1$, and evidence is perfect, i.e. $x = 0$, from eqs.(3) and (4) at equilibrium disclosure strategy will be $|\delta^* - 1| = 0$; and punishment level will be $\tau^* \to \infty$. QED.

Compared with the first best case, under incomplete law and imperfect evidence, substantial cheating occurs, which results from Courts' failure to deter violations. We call this deterrence failure. From Eqs.(3) and (4) it is easy to see that the incomplete law effect γ is nil if law is complete and the effect increases when law is more incomplete. There are two factors that explain why incomplete law can lead to deterrence failure. First, the chance that Issuer avoids punishment for cheating increases with the incompleteness of law. As a result, for any given punishment level deterrence is weakened.[17] Second, the likelihood that benign actions are punished increases when law is more incomplete. To avoid excessive punishment of harmless actions, Lawmaker will not increase punishment level fast enough so that expected punishment in fact decreases when law becomes more incomplete. This in turn will give rise to more cheating $\left|\delta^i - 1\right|$.[18] The following Corollary demonstrates how higher levels of incomplete law affect deterrence failure.

Corollary 2 *Every thing else being equal, when law becomes more incomplete there will be more cheating, i.e. deterrence failure will be more serious; and the expected level of punishment ($q\tau^i$) will be lower.*

[17] In an implicit complete law setting Bolton (1986) shows that when there is a detection issue, the tradeoff between detection and deterrence drives unlimited punishment, whereas when there is no detection issue, an optimal punishment should be finite. We thank Bolton and Mookherjee for pointing this out.

[18] If we allow for the IR condition to be binding so that Issuer may choose not to issue shares if the punishment specified in the law is too high, the results of our model will be even stronger, because a more incomlete law has a higher likelihood of punishing wrongly and thus will reduce socialwelfare further by over-deterring.

P roof. e the Appendix. ■

It is worth emphasizing that the Corollary 2 is true regardless of the quality of evidence established by Court. This supports our theory that the design of law enforcement agents, in particular the design of courts as reactive law enforcers can result in deterrence failure under conditions of incomplete law, even when evidence can be established perfectly. Nevertheless, our model demonstrates that evidence imperfections can also negatively affect deterrence. This effect is particularly pronounced when evidence becomes more imperfect, i.e. when x becomes larger.

Corollary 3 *Every thing else being equal, under incomplete law deterrence failure is more likely to occur and is more damaging when it occurs, when evidence is more imperfect (larger x); when harm is greater (h is larger); or when the expected gain from share issuance is higher (larger μ); or when the volatility of shares prices is higher (larger S).*

P roof. see Appendix. ■

It is no surprise that problems of deterrence failure become more damaging under incomplete law when evidence is more imperfect (x is larger), when cheating is more harmful (h is larger), and when volatility is higher (S is larger). But it may be somewhat counter intuitive that the problem of deterrence failure is associated with higher expected gains of share issuance, that is, with a larger μ. A closer look at our model helps explain these results. First, deterrence failure is measured by the social welfare loss compared with the first best scenario. What the result show is that when μ increases, social welfare increases only slowly. The larger μ, the slower this trend. The intuition for the potentially harmful impact of μ is that when μ is high, the incentives for Issuer to cheat increase, yet the expected punishment does not increase sufficiently to deter cheating under incomplete law.

Our results have important implications for the effectiveness of law enforcement in a legal system that relies entirely on courts as law enforcers. Courts are reactive law enforcers and cannot initiate enforcement actions on their own. This design feature forces them to rely on deterrence as the exclusive law enforcement mechanism. When law is incomplete, however, reactive law enforcement may suffer from serious deterrence failure problems.[19]

[19] The predictions of our theory are consistent with empirical evidence. Recent findings suggest that the level of criminal punishment has little impact on stock market performance (La Porta et al, 2005). Given that law is highly incomplete, this apparent deterrence failure is not surprising.

5 Proactive vs. Reactive Law Enforcement

The problem of incomplete law and the associated deterrence failure problems can be addressed in a (pure) court regime by changing the law. However, this solution may not produce the desired result, because legal change might take too long, and the new law may once more be rendered incomplete by socioeconomic and or technological change. An alternative solution is to introduce a different type of law enforcement agent, such as a regulator. We define a regulator as a law enforcement agent, which may initiate on its own initiative law enforcement proceedings and adapt legal rules in response to observed deterrence failures. This proactive lawmaking and law enforcement power distinguishes regulators from courts, which - as previously discussed - remain passive until the victim or prosecutor has brought a case before them. The major tool for proactive law enforcement is a screening mechanism the regulator uses to prevent potentially harmful actions. Disclosure and approval rules commonly found in financial market regulations are such devices.

Introducing a Regulator does not come without costs, however. In addition to the costs of establishing and maintaining a Regulator, the costs of potential enforcement errors need to be taken into account. In the following we endogenize the allocation of lawmaking and law enforcement powers to either courts or regulators in light of the trade-offs between the possibility of deterrence failure a court regime faces on the one hand, and the possibility of regulatory failure a regulatory regime may suffer, on the other.[20] We first analyze the regulatory regime, and subsequently address the optimal regime choice.

5.1 Optimal Proactive Enforcement

In an attempt to address the deterrence failure problem of a pure court regime, Regulator is introduced as a proactive law enforcement agent. Regulator requires Issuer to disclose certain information and to obtain Regulator's approval before offering shares to the public. In particular, Regulator requires Issuer to submit certain specified information to Regulator, which Regulator will assess and may use to enjoin potentially harmful actions. The information collected by Regulator ex ante shall help approximate Issuer's disclosure strategy, i.e. δ in the model.

Disclosure Rule:

Under a regulatory regime, all issuers are required to disclose certain information to Regulator before

[20] We are fully aware that in reality when Regulator is introduced Court still plays a role in law enforcement. However, to make our basic point clear in a simple model, we assume that law is enforced either by Court or by Regulator. Subsequent research will address the interactions between Court and Regulator.

proceeding with issuing shares to the public. Knowing all regulatory requirements, Issuer decides how to disclose, i.e. Issuer chooses strategy δ, which is unobservable by Regulator, while ensuring that the disclosure strategy formally complies with the requirements set forth by Regulator. Once the information has been submitted, Regulator conducts a "smell test" (Coffee, 1999) and decides whether to request additional information, such as accounting data, legal documents, or any other information it deems necessary for approving the public share offering.[21] The information needed to comply with Regulator's disclosure regime is typically compiled by intermediaries, such as auditing and accounting firms, underwriters, law firms, etc.

We denote the selective information Regulator collects as k. It reflects Regulator's strategy to discern δ.[22] We assume that with information k Regulator can approximate δ. The larger k, the more accurate the approximation will be. However, collecting and disclosing information incurs a cost, ck, making a high k very costly. Moreover, we assume that the marginal cost c is affected by noise, which is measured by x. That is, when the noise of information, x, is higher, the marginal costs of collecting k will be higher ($c'(x) > 0$). We also assume that the disclosure cost is born by Issuer.[23]

Information disclosure is enforced by Regulator's approval rule. Given that Regulator can only approximate δ by using k, we assume that the approval rule is a stochastic rule: For any given δ and k, an Issuer will receive an approval with a probability, $\Pr(\text{approval}) \equiv \alpha(\delta, k)$.

To capture the idea that Regulator approximates δ by using k, we assume Regulator observes $\beta\delta$, where β is an information-approximation factor, and that $\beta = 1 - e^{-k}$.[24] It is clear that when k is larger $\beta\delta$ becomes closer to δ; and when k is infinitely large, Regulator will be able to discern δ perfectly. We assume the following specific approval rule,

$$\alpha(\delta, k) = \left(1 - e^{-k}\right) \exp\left(-|\beta\delta - 1|\right). \tag{5}$$

[21] Our model corresponds with reality. Still, under US securities law, the SEC asks for information k only randomly and in the absence of active intervention allows an Issuer to proceed with the share issuance after a specified time period. To keep our model simple, we treat k as deterministic. However, the results do not change when interpreting k as the expected disclosure requirement and assuming that all players are risk neutral.

[22] Under our simplified assumption that the knowledge of firm specific information leads to knowledge of s, if Regulator is able to discern Issuer's disclosure strategy δ, Regulator will know s as well.

[23] This assumption is also consistent with reality. Relaxing this assumption to allow disclosure costs being born by both Issuer and Investor (i.e. all tax payers) will not change our results.

[24] This is a simplifying assumption to restrict distortion in one direction, i.e. $\beta \leq 1$. In reality, β can be either smaller or larger than one, which renders essentially the same qualitative results of the model because of the symmetry in the model between $\beta < 1$ and $\beta > 1$.

The approval rule, eq.(5), reflects the following desirable features[25] we want to capture: (a) Regulator will not approve Issuer's application if he receives none of the selected information k, i.e. $\alpha(\delta, k=0)=0$; (b) if Issuer cheats more, his chances of obtaining approval decreases, i.e. $\frac{\partial}{\partial \Delta\delta}\alpha(\delta,k)<0$, where $\Delta\delta=|\delta-1|$; and (c) the higher the disclosure requirement k , the more accurate the approval rule. This means that when k becomes larger, it reduces the chance for a cheater but increases the chance for an honest issuer to obtain approval, i.e. $\frac{\partial^2}{\partial \Delta\delta \partial k}\alpha(\delta,k)<0$, and $\frac{\partial}{\partial k}\alpha(\delta=1,k)>0$. Moreover, only when Issuer is completely honest and k is infinitely large, approval is certain, i.e. $\alpha(\delta=1; k\to\infty)=1$.

The following is the time line for proactive enforcement of disclosure rule.

- date 0 – ex ante: Regulator designs and announces disclosure requirement k and approval rule $\alpha(\delta,k)$;
- date 1 – interim:

  date 1.1: Issuer knows relevant disclosure rules as well as s (private information); and takes disclosure strategy δ.

  date 1.2: Regulator enforces disclosure and approval rules with discretion; only firms that obtain approval may issue shares.
- date 2 – ex post: payoffs are received by Issuer and Investor.

Under a regulatory regime Issuer faces the trade-off between the gains Issuer obtains when his share issuance is approved and the possibility that approval will be denied, if Issuer is caught violating the disclosure rule. At date 1.1, given the disclosure requirement k, and approval rule, $\alpha(\delta,k)$, Issuer chooses a disclosure strategy δ to maximize his expected payoff from offering shares to the public,

$$EV(\delta,k)=\left[\left(1-e^{-k}\right)\exp\left(-|\beta\delta-1|\right)\right](bs+s|\delta-1|)-c(x)k.$$

The optimal disclosure strategy that maximizes Issuer's expected payoff is as follows.

Lemma 4 *For a given disclosure requirement k, Issuer's best disclosure strategy is*

$$\delta^R=\frac{1}{\beta(k)}. \tag{6}$$

[25] While some of these features may overstate what a regulator might do in practice, we propose that they are reasonable approximations of actual decision making processes.

P roof. see the Appendix. ■

Lemma 4 shows that when disclosure requirement k is infinitely high, i.e. $\beta(k) = 1$, Regulator will make no mistakes in designing the approval rule. Thus, Issuer will not cheat. However, as long as k is not sufficient for perfectly discerning Issuer's true strategy (thus $\beta(k) < 1$), Regulator will make mistakes in approval and Issuer will manipulate information accordingly.

Given Issuer's optimal disclosure strategy, eq.(6), Regulator chooses disclosure requirement k to maximize social welfare:

$$SW^R(k) = \max_k \frac{1}{2S} \int_{\mu-S}^{\mu+S} (\alpha(\beta\delta, k)(V(\delta) + u(\delta)) - c(x)k)\, ds \tag{7}$$

By solving eqs.(6) and (7),[26] we obtain the following results.

Lemma 5 *At equilibrium Regulator's disclosure requirement k^R is*

$$k^R = \ln \frac{\mu(b + w + h - 1)}{c(x)}, \tag{8}$$

and Issuer's disclosure strategy δ^R is

$$\delta^R = \frac{\mu(b + w + h - 1)}{\mu(b + w + h - 1) - c(x)} \tag{9}$$

$$\simeq 1 + \frac{c}{\mu(b + w + h - 1)}. \tag{10}$$

From inspecting equilibrium regulatory strategy k^R, eq.(8), and disclosure strategy δ^R, eq.(9), it is clear that they are determined by the trade-off between overall impact of the public offering on social welfare ($\mu(b + w + h - 1)$) and disclosure cost, which in turn is affected by information quality ($c(x)$). Everything else being equal, when disclosure cost is lower that trade-off will make disclosure requirement k^R higher. This will improve accuracy of regulatory approval, which in turn will induce Issuer to be more honest. The following result summarizes the conditions under which the regulatory regime works more effectively.

Proposition 6 *Every thing else being equal, the lower the disclosure costs, the more effective a regulatory regime. Moreover, when one of the parameters, μ, b, w, h, becomes larger, the disclosure requirement k^R increases, and cheating $\left|\delta^R - 1\right|$ decreases.*

[26] To focus on our major point, we suppose disclosure cost ck is never high enough to make EV negative. That is, again the participation constraint for Issuer is not binding.

With lower information noise x, disclosure costs will be lowered. In the extreme, when there is no information noise (i.e. $x = 0$) and disclosure cost $c(x)$ is zero, at equilibrium Regulator will make an infinitely high disclosure requirement ($k \to \infty$). That will make the approval decision perfectly accurate. As a result, the first best will be achieved so that Issuer will be completely honest ($\delta^R = 1$). However, when information is noisy ($x > 0$) and disclosure costs are positive ($c(x) > 0$), at equilibrium the regulatory disclosure requirement k^R will be restricted. As a result, Issuer cheats ($\delta^R > 1$) under a regulatory regime and this may result in regulatory failure.

5.2 Regime Comparison

In a world where both Regulators and Courts are available, the more effective enforcement agent should be chosen to address the problem of incomplete law. The optimal selection of enforcement agents sheds light on why we observe regulators only in some areas, but rely almost exclusively on courts in others.

In this section we compare the efficiency of a reactive court regime with that of a proactive regulatory regime. We analyze the optimal regime choice by comparing the social welfare loss associated with enforcement failure under either regime. By substituting δ^i and τ^i from eqs. (3) and (4) into the corresponding social welfare function (2), we obtain the impact of deterrence failure of the court regime on social welfare as follows.[27]

$$SW^i = \mu(b+w) - \frac{(\gamma(q)+\lambda(x))^{1/2}}{18}\left(3\phi + 2q(\gamma(q)+\lambda(x))^{1/2}\right). \tag{11}$$

When law is complete and evidence is perfect ($q = 1$, $x = 0$, thus $\gamma(q) = \lambda(x) = 0$), from eq.(11) we have the first best social welfare $SW^* = \mu(b+w)$. Under these conditions, a pure court regime suffices and introducing Regulator will not enforce law better. Comparing social welfare under incomplete law and imperfect evidence with the first best case, we obtain social welfare loss caused by deterrence failure. The equilibrium social welfare loss caused by deterrence failure, ΔSW, is

$$\Delta SW^i = SW^* - SW^i = \frac{(\gamma(q)+\lambda(x))^{1/2}}{18}\left(3\phi + 2q(\gamma(q)+\lambda(x))^{1/2}\right). \tag{12}$$

Similarly, by substituting δ^R and k^R from eqs. (9) and (8) into the social welfare function (7), we obtain the impact of regulatory failure on social welfare.[28]

$$SW^R = \mu(b+w) - c(x)\left(1 - \ln\frac{c(x)}{\mu(b+w+h-1)}\right). \tag{13}$$

[27] Details of deriving eq.(11) are in the Appendix.

[28] Details of deriving eq.(13) are in the Appendix.

From eq.(13) it is intuitive to notice that when $c(x)$ approaches zero, a regulatory regime approaches the first best. However, when $c(x) > 0$, the equilibrium social welfare loss incurred by the regulatory regime is

$$\Delta SW^R = SW^* - SW^R = c(x)\left(1 - \ln \frac{c(x)}{\mu(b+w+h-1)}\right). \tag{14}$$

From comparing ΔSW^i and ΔSW^R it is easy to see that when law is more incomplete ($\gamma(q)$ is larger) a court regime suffers from more serious deterrence failure, $\frac{\partial \Delta SW^i}{\partial q} < 0$. Because the regulatory regime does not rely on deterrence, it is not affected by a lower q, i.e. $\frac{\partial \Delta SW^R}{\partial q} = 0$. Therefore, when law is more incomplete a court regime suffers from greater social welfare loss. The following result summarizes these comparisons.

Proposition 7 *Everything else being equal, the more incomplete the law the greater social welfare loss from deterrence failure. Moreover, for any set of parameter values, as long as the court regime dominates when law is complete ($q = 1$), then there exists a threshold value $q^* \in (0,1)$ such that when law is sufficiently incomplete, i.e. $q < q^*$, a regulatory regime dominates a court regime; and vice versa.*

P roof. e the Appendix. ■

One might suspect that deterrence failure associated with a court regime is driven by evidence or information problems. However, from eq. (12), it is easy to see that when law is incomplete, even if evidence is almost perfect ($\lambda(x) \to 0$), a court regime still suffers from deterrence failure. Particularly, when law is sufficiently incomplete, and therefore punishing harmless actions is likely (high η) and when μ is sufficiently high, deterrence failure can be severe due to the design of courts as reactive law enforcers. On the other hand, one might suspect that the potential benefits of Regulator is driven by its informational advantage over Court. But this is not the case. Indeed, even if disclosure costs are fixed, and information close to perfect in both regimes, a regulatory regime dominates.

Corollary 8 *When information is perfect, law is complete and disclosure cost is positive, a court regime dominates.*

P roof. e the Appendix. ■

The trade-off between the two regimes with respect to information noise x does not always point in the same direction. The reason is that with a higher x not only does a regulatory regime perform worse, but the negative impact of imperfect evidence under a court regime deteriorates as well. The imperfect evidence effect depends on other factors and this is true in particular for a court regime. For example, given any level of $x > 0$, the imperfect evidence effect can further deteriorate when μ becomes larger.

Proposition 9 *For any given set of parameter values and* $x > 0$ *if there is a* $\underline{\mu}$ *such that* $\Delta SW^i\left(\underline{\mu}\right) < \Delta SW^R$*, there exists a threshold value* $\mu^* \in \left(\underline{\mu}, \infty\right)$ *such that when* $\mu > \mu^*$*,* $\Delta SW^i < \Delta SW^R$*;and vice versa.*

P roof. e the Appendix. ■

Proposition 9 says that if μ becomes sufficiently high a regulatory regime dominates. The intuition is the following. When μ increases and Issuer gains more from cheating, the level of cheating goes up while the level of punishment does not increase sufficiently when law is incomplete and evidence is imperfect. As a result, the deterrence failure problem associated with the court regime becomes more severe. By contrast, social welfare loss under regulatory regime increases slowly in μ. This is because equilibrium disclosure requirement k^R increases at a decreasing rate when μ increases. Moreover, cheating decreases in μ in regulatory regime (Proposition 6).

Another important factor contributing to deterrence failure is S. In the following we show the trade-off between the two regimes with respect to S for any given $x > 0$. From eqs.(12) and (14) we know that when $x > 0$, ΔSW^i increases monotonically in S whereas ΔSW^R is independent from S. Thus, when S is sufficiently high a court regime is dominated. Let us define $\overline{S}$ such that $\Delta SW^i\left(\overline{S}\right) > \Delta SW^R$ (the court regime is dominated). Then we have the following result.

Proposition 10 *For any given set of parameter values and* $x > 0$*, as long as there is a* $\underline{S} > 0$ *that* $\Delta SW^i\left(\underline{S}\right) < \Delta SW^R$*, there exists a threshold value* $S^* \in \left(\underline{S}, \overline{S}\right)$ *such that when* $S > S^*$*,* $\Delta SW^i > \Delta SW^R$*; and vice versa.*

P roof. e the Appendix. ■

Proposition 10 says that when the volatility of share prices becomes sufficiently high, a regulatory regime dominates. Parameters (μ, S) may be interpreted as indicators of average return and volatility of financial markets.[29] From this perspective the above results imply that for a given level of incomplete law when the average return and volatility of financial markets are both low, a legal system that relies on reactive law enforcement may be optimal. This is because the disclosure costs associated with a regulatory regime are substantial. When deterrence failure is not a major problem, a court regime therefore dominates. However, when average return and volatility increases, i.e. when $\mu > \mu^*$ and/or $S > S^*$, deterrence failure may become too serious a problem to be tolerated. A regulator that can exercise proactive law enforcement powers can

[29] Note that corresponding to μ the annual average Dow Jones index increased from 61 in 1900 to 10,730 in 2000; and corresponding to S the annual standard deviation increased from 4.45 in 1900 to 359 in 2000.

rely more on prevention than on deterrence and therefore is able to enforce law more effectively under these conditions.

The above theoretical results may shed light on the timing of the emergence of a regulator. Specifically, our theory would predict that in an economy that limits excessive punishment and restricts courts to reactive law enforcement, a regulatory regime would be chosen when financial markets have reached a certain threshold of average return and volatility.[30]

However, there is no automatic guarantee that a regulatory regime always enforces law well, since it may suffer from regulatory failure. The effectiveness of the regulatory regime depends on Regulator's ability to collect reliable information k prior to approving issuing shares to the public. The reliability of k is determined by the costs incurred in collecting k. These disclosure costs, c, can be understood as a particular form of transaction costs. They consist not only of the direct costs of collecting and compiling the information requested by Regulator, but are also influenced by the absence or presence of market intermediaries that can collect and verify the information as well as the inherent quality of existing information (e.g., the existence of relevant markets for adequately pricing assets are missing).

Proposition 11 *Everything else being equal, the higher the disclosure costs, the less advantageous a regulatory over a court regime. Moreover, for any set of parameter values, as long as there are disclosure costs* $\overline{c}$*, there exists a threshold value* $c^* \in (0, \overline{c})$ *such that if disclosure costs are sufficiently high, i.e.* $c > c^*$*, a court regime dominates; and vice versa.*

P roof. e the Appendix. ■

Notice that the above result is valid for any set of parameter values including the case that a court regime suffers from deterrence failure. This implies that when disclosure costs are sufficiently high, regulatory failure, which could be even more severe than deterrence failure, may occur. Factors affecting disclosure cost vary a lot across economies. Examples include the lack of functioning markets and the lack of correspondent intermediaries in transition economies and in lessdeveloped economies. For similar reasons, when new markets for particular assets are absent or only emerging, the likelihood of regulatory failure increases.

[30] Several years before the US securities market crash there were unprecedented market volatilities together with an extraordinary expansion of the security market. The annual average of Dow Jones index surged from 99.7 in 1924 to 313.3 in 1929. The annual standard deviation of the index surged from 6.9 in 1924 to 38 in 1929 (the annual spread of the index increased from 32.2 in 1924 to 182.5 in 1929).

5.3 Example

In the following we use the Overend case, introduced in Section 2, to illustrate our model. We suppose that the payoffs for Issuer, OGCo. Ltd., and Investor Peak, are all related to the underlying value of OGCo. Ltd.'s shares, s, which is known to the directors of OGCo. Ltd., but not to either Peak, or to law enforcement agents. OGCo. Ltd. chooses disclosure strategy δ with respect to s, the prospectus. The choice of an (honest) strategy $\delta = 1$ by OGCo. Ltd. benefits Peak most; conversely, Peak is harmed if OGCo. Ltd. opts for cheating, as denoted by, $\delta \neq 1$**.** In this particular case, disclosing the secret agreement would have revealed that the major purpose of the new OGCo. Ltd. was to serve the debt of the old firm. Failure to disclose this information inflicted harm on Peak who bought shares without knowing the true state of affairs. Without knowing s and δ from the prospectus, Peak observes $(\delta + \varepsilon)\, s$**,** where ε is information noise and x is the level of noise (variation of ε) for the information Peak observes.

If law is complete, i.e. $q = 1$, if all possible harmful actions as well as the level of punishment were specified unambiguously in the law, OGCo. Ltd. would know that failure to disclose relevant information would be deemed a violation of the law resulting in civil and/or criminal liability. If evidence was perfect, i.e. $x = 0$, our model predicts that the punishment level stipulated in the law , τ, can be designed optimally and OGCo. Ltd. will not cheat, i.e. $\delta = 1$. Even if evidence was not perfect, OGCo. Ltd. would not cheat substantially as long as the probability of establishing evidence was sufficiently high.

However, if law is incomplete, $q < 1$, OGCo. Ltd. may avoid liability even when harm has been done (i.e. Peak looses his investment) and even when evidence about the secret side agreement has been established. The reason is that the law did not anticipate that failure to disclose information in general, and contracts between the issuing company and its predecessor in particular, might result in harm to investors. Facing a low probability of conviction, even if evidence is established, our model will predict that OGCo. Ltd. is unlikely to disclose the secret agreement and will intentionally exaggerate its s. Our theoretical prediction is consistent with the facts of the case.

Suppose a Regulator had existed at the time. Such a regulator would have adopted a disclosure rule specifying the kind of information OGCo. Ltd. would have had to disclose prior to issuing shares to the public. A simple approval rule widely used by stock exchanges is the requirement to disclose the firm's profits for the last several years prior to issuing shares to the public. Without such disclosure, no approval would be granted. Based on this disclosure requirement, k, OGCo. Ltd. would have had to disclose the losses the firm had incurred over the past 5 years, but not the secret side agreement or the advances made by the

partners. Thus, the disclosure rule could have been used to discern some, even if not all information necessary to assess the company's disclosure strategy. However, a Regulator equipped with approval and additional investigatory powers might have requested the company to disclose additional information, which might have helped to uncover the secret side agreement before harm was done. Obviously, this outcome depends on the quality of k, i.e. the ability of Regulator to specify information that was relevant for assessing the potential harm of a share issuance, and the cost of disclosure ck borne by Issuer. The lower the quality of k, the greater the likelihood that regulatory failure will occur.[31]

6 Evidence

Our model generates predictions related to three distinct even though related issues, namely a) deterrence failure; b) conditions under which the introduction of a regulatory regime is beneficial; and c) regulatory failure.

First, Proposition 1 (and Corollary 2) predicts that deterrence failure associated with a pure court regime is worsened when law is more incomplete, i.e. when $1 - q$ is sufficiently large; evidence is more imperfect (larger x); or market volatility (S) is higher (Corollary 3).

Second, Propositions 7, 9 and 10 predict that when law becomes more incomplete, or when S becomes larger, a regulatory regime is more effective than a court regime.

Finally, Proposition 11 predicts that when disclosure costs are sufficiently high, which could be caused by greater noise x, regulatory failure will occur.

In the following subsections we seek to provide evidence consistent with each of the above predictions. We use case law from 19th century England to illustrate the first prediction of deterrence failure under incomplete law. We provide evidence from US securities markets prior to the crash in 1929 to analyze the implications of our model for highly volatile share markets. Finally, we examine the challenges the major financial market regulator in the US, the SEC, faced in the 1990s, a period characterized by rapid market expansion and substantial technological change to test the predictive power of our model for regulatory failure.

[31] Note that k is the standardized information a Regulator will request from any company issuing shares. It is not identical with s, which is the private information of the issuer, or x, which denotes the noise that distorts available information. Ideally, k will allow the Regulator to improve its estimate of s.

6.1 Deterrence Failure and Incomplete Case Law

The Overend case presented in the previous section is not a singular event. When stock markets developed in 19th century England and elsewhere, courts frequently failed to deter financial frauds, because they applied law that had been designed to address different fact patterns to radically different ones. Moreover, in the rapidly developing securities market the sophistication of issuers and intermediaries in arbitraging rules designed to protect investors outpaced the ability of legislatures to adapt the law in a timely fashion. Thus, 19th century UK offers an interesting example for assessing how well our model captures the problems a pure court regime faced under conditions of rapid socioeconomic and technological change.

6.1.1 19th Century UK

England was the first country to develop a viable market for corporate stock. By the late 1850s the value and liquidity of corporate securities for the first time exceeded government securities (Michie, 1999). England had already a well developed body of contract and tort law. When courts applied existing law to stock fraud cases, however, they frequently ended up denying liability, as past case law did not fit the new fact patterns that emerged. The most important legal weapon in the hands of investors was a tort claim based on stock fraud. Contractual claims were of only limited use, as investors often acquired their shares from intermediaries, not from the company or the directors that were implicated in the misrepresentation of information.[32]

According to standard principles of tort law, which have essentially remained unchanged, a claim based on fraud or deceit must establish that the defendant had made (1) a statement of fact that was (2) materially misleading; that the defendant (3) intended to induce the plaintiff to undertake an action (i.e. to buy securities); which in turn (4) caused harm. A contractual relation between the two parties was not required, but the plaintiff had to be an addressee (5) of the fraudulent statement in order to make a claim based on fraud. Causation and harm did not raise new questions in the context of securities fraud. For the remaining four elements Table 1 summarizes important case law that sought to clarify the law as applied to transaction in securities, in particular the representation of information in the context of initial public offerings (IPO).

[INSERT TABLE 1 HERE]

Column 1 lists the critical elements for establishing fraud according to existing case law. Column 2 gives

[32] A more detailed discussion of 19th century contract law and its application to stock fraud cases can be found in Pistor and Xu (2003).

the first landmark case that addresses the relevant element in a case of alleged securities fraud. Columns 3-5 report how the question was resolved and what issues remained unresolved. Column 6 lists cases that followed after the first landmark case had been decided. We list only selected cases that have been decided by higher courts. Even so, the long list of cases is indicative of the extent of enforcement failure, as each new case was filed only after such a failure has occurred.

To begin with, in the 19th century corporations were under no legal obligation to circulate a prospectus or to disclose particular information to the investing public. It was thus left to the Issuer what to disclose and what not to disclose, and finally to the courts to determine ex post, whether the information provided in the prospectus was fraudulent or not. A question that soon surfaced was whether failure to disclose a material fact should be treated similarly as the positive misstatement of such a fact. As indicated in the Overend case discussed above, courts held that the failure to disclose a secret contract did not result in directors' liability. The Parliament responded by including a new provision in the Companies Act (CA) that required companies to disclose "all contracts" in their prospectus. This provision, once again rendered the law incomplete, because it was over-inclusive. A literal interpretation of the law was unenforceable or would have confused investors by flooding them with a great deal of irrelevant information. Thus, the law left it in the hands of the courts, which contracts had to be disclosed, and which ones did not with little guidance given to issuers. Later revisions of the CA in 1900 sought to clarify the matter by stating that only contracts other than those concluded in the "ordinary course of business" were to be disclosed. This formulation again required specification on a case by case basis.

The inability of courts to clearly specify the kind of information that ought to be provided gave rise to ever more detailed disclosure requirements in statutory law in 1900, 1908 and, finally in the 1928/29 revision of the CA. The hope was that these requirements would reduce, if not eliminate, stock fraud. Consistent with our notion that law (be it statutory or case law) is inherently incomplete, every legislative intervention gave rise to new cases that resulted from enforcement failure. For example, case law now had to establish whether failure to comply with the new statutory disclosure requirements would indeed be treated as fraud - the answer was yes (See Table 1 for details).

Other cases raised the question what (positive) statements of fact would be regarded as material. In Henderson v. Lacon (1867) investors had bought shares in a corporation allegedly in reliance on the statement that the directors themselves had also bought shares - which turned out to be incorrect. After the company failed, the shareholders went to court. The court held that the statement was "material", because a "reasonable investor" would have relied on such a statement when deciding whether or not to buy shares.

This definition is echoed in the US Supreme Court's definition of materiality in a 1976 decision. The Court held that a "material fact" was one that would be "viewed by the reasonable investor as having significantly altered the "total mix" of information made available."[33]

Under conventional tort principles, liability for fraud requires intent, implying that in order to invoke liability directors must positively know the incorrectness of the facts presented in the prospectus. In the words of Lord Esher in a 1893 ruling, "a man is entitled to be as negligent as he pleases towards the whole world, if he owes no duty to them".[34] Widespread misrepresentation of information in the context of public issuances, however, raised the question, whether a lower standard than intent should be adopted for such cases. In Edgington v. Fitzmaurice (1885) the answer was that recklessness was sufficient. Liability for fraud, it was held, does not require a willful telling of a lie. The legal standard of recklessness, however, excluded negligence and left the burden to prove recklessness on the Investor. The courts refused to change these standards by case law. In Derry v. Peek (1889) the House of Lords was asked to determine liability of directors for a prospectus that had represented that government approval for converting an animal powered rail track into a steam powered one had already been granted. In fact, no such approval had been given and when it did not come forward, the company collapsed. The House of Lords held that the directors had honestly believed that approval had been granted, i.e. that they acted negligently, but not recklessly and denied liability. The Lords added that shifting to a negligence standard for such cases would require legislative intervention.

The legislature responded immediately and in 1890 enacted the Directors' Liability Act (DLA). Under the DLA, directors were held liable for negligent misconduct, unless they proved that they did not act negligently. Nevertheless, in subsequent case law directors continued to defend themselves successfully against liability by insisting that they "honestly believed" in the truthfulness of the prospectus. Only ten years after the enactment of the DLA did courts clarify that the law meant what it said, namely that in order to avoid liability, *directors* had to prove that they had reasonable grounds for believing that the statement was true (Thomson v. Lord Clanmorris). This ruling reduced the number of cases in subsequent years that challenged the element of "intent" when establishing fraud. It did not imply, however, that other elements of stock

[33] TSC Indus., Inc. v. Northway, Inc., 426 U.S. 438 at 449 (1976). Subsequent attempts to further complete the element of "materiality", including by the SEC, did not bear fruit. Thus, 1980 Staff Bulleting of the SEC defines materiality as "the omission or misstatement of an item in a financial report is material, if, in the light of surrounding circumstances, the magnitude of the item is such that it is probable that the judgment of a reasonable person relying upon the report would have been changed or influenced by the inclusion or correction of the item."

[34] Lord Esher in Le Liever v. Gould [1893] 1 Q.B. 491 (497).

fraud became equally settled, or that the law now was sufficiently complete to deter future violations and thus avoid enforcement failure.

6.1.2 The Case of US: Incomplete Law, Volatility of Stock Markets and the Crash of 1929

US law on protecting shareholders and investors was based on the same common law principles as English law discussed in the previous section. An important difference was that the US *never* adopted a code similar to the 1890 Directors' Liability Act that lowered the threshold for directors' liability. Moreover, unlike English company law, which greatly expanded mandatory disclosure rules between 1900 and 1928, US corporate law remained largely silent on the issue.[35] As a result, US investors faced a substantially higher burden of proof in court, which discouraged litigation and thus further undermined reactive law enforcement. Thus, US law governing stock fraud cases was more incomplete in 1929 than UK law at the turn of the century.

Moreover, the US legal regime faced substantial challenges from market changes in the period following World War I. One of the major changes was the rapidly growing separation between owners (shareholders) and directors (managers). For example, from 1902 to 1931, the American Telephone & Telegraph Corporation had increase its number of shareholders 52-fold, from 12,000 to 642,800. In the same period Pennsylvania Rail increased its shareholders by a factor of 7.5 and US Steel by a factor of 6 (Berle and Means, 1933). The changes in the ownership structure of firms meant that existing case law that had addressed primarily the agency problems between minority shareholders and blockholders was incomplete when applied to the agency problem between managers and absentee shareholders.

The deterrence effect of existing law was further undermined by the rapidly increasing volatility of stock markets. Recall that according to our model, an increase in volatility increases incentives for the Issuer to cheat, while the punishment level specified in the law is not increased proportionately. If we measure the highest monthly volatility in each year leading to the 1929 crash (for the methodology and data, see the appendix), we find that it increased from 0.038 in February 1924 to 0.079 in March 1926.[36] Consistent with the predictions of our model we find evidence for increasing fraudulent activity during this period. Estimates by state officials suggest that investors lost about US$ 25 bln. in the decade prior

[35] In the United States, corporate law falls in the jurisdiction of states, not the federation. Still, this assertion is true for corporate law across states, including Delaware, which had established itself by the early 20th century as the major hub for incorporation by companies all over the country. See Arsht (1976).

[36] In the month of the "Black Thursday," October 1929, the monthly market volatility was 0.235, the highest volatility level that the NYSE ever reached.

to the crash as a result of fraudulent schemes (Seligman, 1983). Most of the case-based evidence comes from a Congressional investigation into the practices of investment banks, commercial banks, and stock exchange floor members, the so called Pecora hearings. They revealed widely used schemes to defraud investors, such as stock pools, which planted wrongful tips and stories with leading newspapers, including the New York Times, the Wallstreet Journal, or the New York Herald Tribune. Journalists in turn received cash payments for these stories. On many occasions, executives of the issuing companies participated in such pools. This was verified for major corporations, including American Commercial Alcohol, the Chase National Bank, Sinclair Consolidated Oil, General Asphalt, Fox Film Corporation, among others. Other abuses of shareholder rights included insider trading by investment bankers and/or executives, substituting already issued securities with securities of far lower value, and manipulation of financial statements (Seligman, 1983). The summary report referred to "unfair methods of speculation employed by large operators and those possessing inside information" as well as the "failure of corporations to publish full and fair reports of their financial conditions".[37] Congress came to the conclusion that relying on a pure court regime was insufficient for deterring stock fraud and that voluntary disclosure lead to "excessive speculation," stock manipulation and fraud (the preamble of the 1934 Act).[38] It therefore moved to establish the Securities and Exchange Commission (SEC) as a federal regulator for financial markets and vested with extensive powers to enforce the Securities Act of 1933 and the Securities and Exchange Act of 1934.

6.2 Regulatory Response to Deterrence Failure: The SEC

Our model predicts that when law is highly incomplete and/or when stock markets are highly volatile, a pure court regime cannot effectively deter harmful actions. Thus, deterrence failure may occur. Under such conditions, a regulatory regime is a superior law enforcement device from social welfare perspective (Corollary 2 and 3 and Propositions 7, 9 and 10). There is substantial evidence that the introduction of the SEC with its broad proactive rule making and enforcement powers has reduced the volatility of shares for much of the period after 1934.

[37] A summary of the Pecora Hearings is available in the Report of the Committee on Banking and Currency of 17 April 1934, S. Rep No. 792, 73rd Cong., 2nd Sess. (1934).

[38] According to the SEC, ". . . during 1929 the prices of over 100 stocks on the New York Stock Exchange were subject to manipulation by massive pool operations. One of the principal contributing factors to the success of the manipulator was the inability of investors and their advisors to obtain reliable financial and other information upon which to evaluate securities." (SEC – A 25 year Summary, 1959)

The most explicit proactive measure introduced by the 1933 Act is the registration requirement. According to the Act, all publicly traded firms must have a registration statement (prospectus), covering balance sheets, audited profit, loss statements, description of the business, and intended use of the funds etc. And it has to be approved by the SEC.[39] The SEC was given key powers to initiate law enforcement activities, including enjoining the issuance of shares, requesting additional information, as well as filing civil or criminal suit against violators of the Act. These powers are consistent with the Regulator's proactive law enforcement powers in our model.

There has been much debate about the efficacy of the new regulatory regime. Compiling decisive evidence has been complicated by the Great Depression in the US and World War II. As a result, markets recovered to the pre 1929 levels only in the early 1960s (Stigler 1964). Given the predictions of our model we are primarily interested in the impact of the new regulatory regime on stock price volatility as a means to reduce the likelihood of investor fraud. In a widely cited article that questioned the efficacy of the SEC regime, Stigler (1964) found that the variance of returns on new issues fell by approximately half after the introduction of the SEC regime. He interpreted this finding as evidence for over-regulation, which deterred high-risk issuers from the public market. Commenting on these findings, however, Friend and Herman (1964) contend that they demonstrate the beneficial effects of mandatory disclosure. In particular, they argue that they confirmed that mandatory disclosure enforced by the SEC reduced the scale of fraudulent and manipulative practice in the market. This interpretation is shared by many, such as Seligman (1983). Other studies have confirmed Stigler's original findings, including Jarrell (1981)and Simon (1989). Simon examined trading on the NYSE and regional markets before and after the establishment of the SEC. She found that investors' forecast errors measured by the dispersion of abnormal returns across markets and types of issuers (new issuers as well as seasoned issuers) were significantly lower post 1934. The effect was particularly strong for IPOs in regional markets, where IPOs had been significantly over-priced in pre-SEC period, however, not after the SEC had been established.

There might still be reasons to doubt these findings, because in world where investors are well diversified, reduction of idiosyncratic volatility alone may not benefit investors much as long as expected returns of stocks remain unchanged after introduction of the SEC regime.[40] For this reason, measuring the impact

[39] As former SEC Chairman Levitt stated, "Ever since the SEC was established in 1934, our approach has been to require companies who wanted to list or trade their securities to comply with initial and continuing disclosure obligations. The goals of this approach are to prevent misleading or incomplete financial reporting and to facilitate informed decisions by investors." (Levitt, 1997)

[40] It is a consensus in the literature that the 1933/34 Acts did not have significant impacts on expected returns of the stocks.

of the SEC regime on market volatility rather than idiosyncratic stock volatility may be a more decisive indicator for assessing the impact of this new regulatory regime.

Using daily return data of the New York Stock Exchange (NYSE) for the 80-year period from 1890 to 1970 Li and Xu (2006) provide evidence that the introduction of the SEC regime in 1933/34 reduced market volatility substantially. They follow the approach of French, Schwert and Stambaugh (1987) and Schwert (1989) and construct an ex post measurement for monthly volatility of stock market returns.[41] Based on multiple regression analysis, they find that the general level of stock market volatility fell by 15% in the post 1934 period even when controlling for the effect of the great depression and macroeconomic variables. They also test for multiple structural breaks (following Bai and Perron, 1998) in the mean levels of stock volatility, treating as unknown the existence, the number and the timing of structural breaks in the volatility time series. Once again controlling for the great depression the statistically identified break date is August 1934. This date divides average market volatility into two regimes, the high volatility regime before August 1934 and the low volatility regime thereafter. The 1934 Securities and Exchange Act, which established the SEC as the federal financial market regulator was enacted in June 1934. While the Securities Act, which established the mandatory disclosure regime had been enacted already in June 1933, enforcement of that Act had been temporarily vested with the Federal Trade Commission. We interpret the coincidence of the introduction of the SEC with the break date as supportive of our theory that a proactive regulator may substantially enhance law enforcement over a pure reactive court regime.

If the 1933/34 Acts were effective in protecting investors' interests, the extension of the Acts to other markets should have observable impacts as well. By investigating the impacts of the 1964 Amendments, which extended the 1934 Act that applied to firms traded on NYSE and AMEX since 1934 to large firms traded Over-the-Counter (OTC), Ferrell (2007) finds mandatory disclosure is associated with a dramatic reduction in the volatility of OTC stock returns. Moreover, together with Greenstone et al. (2006) they both find abnormal positive returns enjoyed by the OTC stocks after the 1964 Amendments.

By studying stock returns before and after the implementation of the 1933 Act, Stigler (1964) found that there was no significant difference before and after the introduction of the SEC. Benston (1973), Jarrell (1981) and Simon (1989) also reported similar results.

[41] Officer (1973) reported that the SEC had no significant impact on market volatility. However, his way of measuring market volatility is based on poor methodology, as has been pointed out in the literature.

6.3 Regulatory and Deterrence Failure: The Boom and Bust of the 1990s

According to our theory, a regulatory regime is not immune against enforcement failure. The insights from our model may shed some light on the boom and bust of US stock markets in the late 1990s/early 2000s. The enforcement failure witnessed in 2000 is all the more remarkable, because it has been the most significant failure since the establishment of the SEC regime 70 years earlier.

Recall that our model predicts regulatory failure when the quality of information deteriorates and/or the cost of disclosure is too high. We suggest that the quality of information did indeed deteriorate in the 1990s as a result of the information technology revolution that sparked investments in IT firms across the board, resulting in the "dot com" bubble and ultimate crash of the market. In addition, we show that the environment in the 1990s as also highly susceptible to deterrence failure, as the enforcement capacity of courts and regulators was curtailed.

Information Quality The deterioration of information quality in the late 1990s can be explained by the lagged learning curve of investors as well as regulators when new business sectors emerge whose future performance is difficult to assess on the basis of available information. In other words, even though the disclosure standards did not change, with respect to new sectors, including IT and biotech firms, it became much more difficult to distinguish noise from relevant data. Not surprisingly, the information content of share prices traded in US markets in general, and stocks in the IT and biotech sectors that were traded on NASDAQ in particular, deteriorated dramatically over the course of the 1990s. Evidence for this is provided by a substantial increase in the co-movement of stocks (Brooks and Del Negro, 2002).[42] Lack of reliable firm-specific information undermines the efficacy of proactive law enforcement. As suggested by our model, the lower the quality of information, the greater the enforcement error, and the less effective overall levels of law enforcement. This problem was aggravated by changes in accounting rules that took place during the same period. The Federal Accounting Standards Board (FASB) extended the use of "fair value" beyond its traditional use in historical cost accounting. In a 2001 release, FASB specified that "fair value" accounting could be used for assets for which a market price did not exist.[43] Allowing fair value accounting in these

[42] The co-movement of stock has been identified as an indicator for the level of firm-specific information found in a given stock market. The higher the co-movement of stock on a given market, the lower the level of firm-specific information (Morck, Yeung, and Yu, 1999).

[43] The release states that "if a quoted market price is not available, the estimate of fair value should be based on the best information available in the circumstances. The estimate of fair value should consider prices for similar assets or similar liabilities and the results of valuation techniques to the extent available in the circumstances ()." (as quoted in (Benston et al., 2003)

circumstances effectively vests corporate officers (and their accountants) with extensive discretion, making the information less reliable to investors.

The number of firms that were forced to restate their earnings, which can be read as a rough proxy for the amount of actual fraudulent activity (Coffee, 2004), indicates the enforcement failure problems especially in the IT and biotech sectors. Prior to 1998, on average 49 firms restated their earnings in a given year. From 1997 to 1998 the number of firms restating their earnings increased by 86% to 91. In the following year the number increased by another 65% to 150.[44] The largest industry sector being forced to restate earnings was the information technology sector with 9 out of 91 firms having to restate in 1998, and 57 out of 150 in 1999.[45]

Enforcement Capacity While changes in the market place challenged the SEC's ability to make effective use of its proactive enforcement powers, its effectiveness as law enforcer was further diminished by inadequate staffing levels and budgetary appropriations to respond to these changes. Between 1993 and 2000, the dollar value of securities filed for registration grew on average by 24 percent p.a., while the SEC budget grew by only 6 percent p.a.. To make things worse, the SEC lost 25 percent of its attorneys, accountants, and examiners primarily due to pay differentials between the private and public sectors (Seligman, 2004). As a result, the SEC fell behind its self-set goals of exerting oversight over the market through regular checks of financial statements. This self-set goal was to fully review at least once every 3 years the 10-K annual reports filed by any company within its jurisdiction. In fact, as of 2000 over 53 percent of all companies had not seen their statements reviewed in the past three years. "Enron, then the most notorious example of staff neglect, had last received a partial review of its Formal 10-K annual report in 1997 and had been last subject to a full review in 1991." (Seligman, 2004 at p. 249).

As the analysis of deterrence failure in the 1920s suggests, courts were unlikely candidates to compensate for the weakening SEC enforcement given the condition of the 1990s. High stock market volatility had increased the incentives to cheat, while liability and punishment levels did not keep up. This trend was re-enforced by legislation introduced in the mid 1990s aimed at curtailing the use of class action suits in the

at p. 39). In practice, fair value accounting has been used, among others, for new securities, including derivatives and energy trading certificates, instruments for which reliable market prices did not exist.

[44] Evidence available from the report of the Government Auditing Office, 2002-03-138 at http://www.gao.gov/new.items/d03138.pdf.

[45] The total number of firms that had to sbumit financial statements was, of course, much larger as every firm that is traded on a national exchange is subject to these regular disclosure requirements.

context of stock fraud. In 1995 Congress enacted the Private Securities Litigation Reform Act (PSLRA), the stated goal of which was to reduce the number of so-called strike suits against publicly traded firms. The legislation was heavily lobbied for by firms in the IT sector. Available data clearly indicate that litigation declined following the enactment of this law. In 1994, a total of 231 class action suits in securities matters had been filed. In 1995 the number declined to 188, and in 1996 further to 110.[46] Subsequently the number of suits increased again, most likely, however, in response to the growing incidence of fraud - and not necessarily in proportion to the growing incidence of fraud.[47]

7 Conclusion

This paper identifies two types of enforcement failure: Deterrence failure and regulatory failure. Deterrence failure depicts the failure of reactive law enforcers, i.e. courts, to effectively deter violations. Regulatory failure refers to the inability of proactive law enforcers, i.e. regulators, to prevent harmful actions from taking place in the first place.

We argue that when socioeconomic or technological change is comparatively slow or infrequent and when the expected harm from actions that are not deterred can be contained, reactive law enforcement by courts will be socially optimal. By contrast, when actions may result in substantial harm that may not be easily reversed, a pure court regime may result in under-enforcement and potentially in deterrence failure, causing substantial social welfare loss. Areas that are susceptible to rapid socioeconomic and technological change are particularly prone to the problem of deterrence failure. Financial markets is such an area. The rapid development of financial markets and the constant stream of financial innovations that have accompanied it have challenged lawmakers and law enforcers time and again. The recent scandals that have plagued financial markets in the US and elsewhere are only the latest incidence of the inability of legal systems to achieve optimal law enforcement.

Historically, the major institutional invention to address repeated problems of deterrence failure in financial markets has been the introduction of a regulatory regime. Regulatory functions were first assumed by self-regulatory organizations, such as stock exchanges. In response to market failures that affected its profits and those of its members, the New York Stock Exchange was the first exchange to introduce listing

[46] Data are available at http://securities.stanford.edu/.

[47] For an assessment of the PSLRA in terms of its effectiveness to reduce strike suits, see Peng and Roell (2004) and Johnson (2002).

requirements and establish special departments for enforcing these rules in the middle of the 19th century (Coffee, 1999 and Pistor and Xu, 2003). Subsequently, major aspects of this regulatory regime were taken over by regulators at the state level (in the so called "blue sky" laws), and ultimately by the federal regulator, the SEC. This paper explains why a regulator has been such an important invention based on our theory of incomplete law. Unlike other theories that explain the rise of the regulatory state primarily with inventive problems of judges, we suggest that the problem of incompleteness. Incompleteness of the law is inherent to law, but becomes more serious in areas of the law affected by rapid socioeconomic and technological change, such as financial markets. Incompleteness of the law can result in deterrence failure when other conditions are in place, in particular, when law is highly incomplete, and markets are highly volatile. Under such conditions, a regime that relies exclusively on reactive law enforcement, is ineffective. Introducing a proactive law enforcer in the form of a Regulator provides an important, albeit not perfect, remedy. Regulators may initiate their own law enforcement actions, in fact they can establish screening devices, such as mandatory disclosure that allow them to intervene and enjoin potentially harmful actions at any time. This places them at a substantial advantage over courts, which have to wait for others to initiate legal action before they can even review a case. Still, regulators can and do fail. Low quality information and lack of enforcement capacity are critical variables that explain regulatory failure. The paper uses different episodes of enforcement failure to explore our theory. We have limited our analysis so far to the UK and the US, the two countries with a long history of well developed financial markets and a highly developed legal system. However, we suggest that the basic insights of our theory could be equally applied to emerging markets, and indeed, to other areas of the law - beyond financial market regulation.

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9 Appendix

Proof of Corollary2 Straight forward comparative statics from eqs.(3) and (4).

Proof of Corollary3 Comparative statics from eq.(3) to show cheating increasese in these parameters.

Proof of Lemma4 It is straightfoward for the case of $\beta = 1$. For the case of $\beta < 1$, when $\delta \leq \frac{1}{\beta}$, $EV(\delta)$ increases monotonically. Thus, any $\delta < \frac{1}{\beta}$ cannot be optimal. When $\delta \geq \frac{1}{\beta}$, if $b \geq 1$, $EV(\delta)$ decreases in δ monotonically thus $\delta^R = \frac{1}{\beta}$[48].

Derive eq.(11) Given τ^i is independent from s and ε (eq.(4)), we can substitute eq.(4) into eq.(3), $U(\delta, s)$ and $V(\delta; s, \tau)$, and notate τ^i as τ, then have $\left|\delta^i - 1\right| = \frac{1}{2sq\tau}$; $U(\delta, s) = ws - h\frac{1}{2q\tau}$; and $V(\delta; s, \tau) = bs + \frac{1}{2q\tau} - \frac{1}{4q\tau}(2qs\tau\varepsilon + 1)^2 - (1-q)\eta s\tau$. Using these in social welfare function (), we have

$$\begin{aligned} SW^i &= \frac{1}{4xS}\int_{-x}^{x}\int_{\mu-S}^{\mu+S}\begin{pmatrix} bs + \frac{1}{2q\tau} - \frac{1}{4q\tau}(2qs\tau\varepsilon+1)^2 \\ \\ -(1-q)\eta s\tau + ws - h\frac{1}{2q\tau} \end{pmatrix} dsd\varepsilon \\ &= (b+w)\mu - \frac{1}{4q\tau}(2h-1) - (1-q)\tau\mu\eta - \frac{qx^2\tau}{9}\left(S^2 + 3\mu^2\right) \\ &= (b+w)\mu - \frac{(\gamma+\lambda)^{1/2}}{18}\left(3\phi + 2q(\gamma+\lambda)^{1/2}\right). \end{aligned}$$

Derive eq.(13):

Given k^R is independent from s (eq.(8)), and notate k^R as k, we can substitute eq.(8) into eq.(9), $\alpha(\delta, k), \beta(k), U(\delta, s)$ and $V(\delta; s)$, then have $\delta^R = \frac{1}{\beta}, V(\delta, k) = bs + s\left(\frac{1}{\beta} - 1\right), U(\delta, s) = ws - hs\left(\frac{1}{\beta} - 1\right)$. Notice that $k = -\ln(1-\beta)$; let $z = \mu(b + w + h - 1)$, and notice that $\beta = 1 - e^{-k} = \frac{z-c}{z}$,

[48] The above result is under the condition that , if $b \geq 1$. If $b < 1$, $EV(\delta)$ is concave with a single peak at $\delta^R = 1 + \frac{1}{\beta} - b$. The intuition of this result is that when the gains from issuing shares are low (the case of lower b), the trade-off between the probability of approval being denied and the potential of selling shares for a higher price when approval is granted will prompt Issuer to cheat more, i.e., $\delta^R = 1 + \frac{1}{\beta} - b$. Qualitatively this result is not different from the results we obtain when $b \geq 1$.

then using these in social welfare function (), we have

$$\begin{aligned}
& \frac{1}{2S}\int_{\mu-S}^{\mu+S}\left(\beta\left(\left(bs+s\left(\frac{1}{\beta}-1\right)\right)+ws-hs\left(\frac{1}{\beta}-1\right)\right)+c\ln\left(1-\beta\right)\right)ds \\
= & \mu\beta\left(b+w+h-1-\frac{1}{\beta}\left(h-1\right)\right)+c\ln\left(1-\beta\right) \\
= & \left(\frac{z-c}{z}z-\mu\left(h-1\right)\right)+c\ln\frac{c}{z} \\
= & \left(z-\mu\left(h-1\right)\right)-c+c\ln\frac{c}{z} \\
= & \mu\left(b+w\right)-c\left(1-\ln\frac{c}{\mu\left(b+w+h-1\right)}\right)
\end{aligned}$$

Proof of Proposition7 Since $\frac{\partial\Delta SW^i}{\partial q}<0$ and ΔSW^i goes to infinity when q goes to zero, for any set of parameters,if $\Delta SW^i(q=1)<\Delta SW^R$, given $\frac{\partial\Delta SW^R}{\partial q}=0$, there must be a low $\underline{q}\in(0,\overline{q})$ that $\Delta SW^i(\underline{q})>\Delta SW^R$. Following the Mean Value Theorem, there must exist a threshold value $q^*\in\left(\underline{q},\overline{q}\right)$ such that $\Delta SW^i(q^*)=\Delta SW^R$.

Proof of Corollary8 Substituting $x=0$ into eqs. (12) and (14), and look at cases that $q=1$ for eq.(12) and $c>0$ for eq. (14) respectively.

Proof of Proposition9 From eqs.(12) and (14) both ΔSW^i and ΔSW^R increase in μ, but ΔSW^R is highly concave in μ whereas ΔSW^i is almost linear that ΔSW^i increases faster when μ is large. Given definition of $\underline{\mu}$ the existence of μ^* follows the Mean Value Theorem.

Proof of Proposition10 The existence of S^* follows the Mean Value Theorem.

Proof of Proposition11 By definition, $\Delta SW^i<\Delta SW^R\left(\overline{c}\right)$. Moreover, we know that $\Delta SW^i>\Delta SW^R(c=0)$. Then given $\frac{\partial\Delta SW^R}{\partial c}>0$ and $\frac{\partial\Delta SW^i}{\partial c}=0$, following the Mean Value Theorem we have the result.