Working papers series

WP ECON 07.18

The Adoption of a Code of Best Practice: Incentive Implications

Eduard Alonso-Paulí (U. Pablo de Olavide)

JEL Classification numbers: G38, D23, L20

Keywords: Codes of Best Practice, Corporate Governance, Agency model, Limited Liability

Department of Economics

The adoption of a Code of Best Practice: Incentive implications.*

Eduard Alonso-Paulí†

November 2007

Abstract

We study the incentives induced by the adoption of a Code of Best Practice. Using an agency model, we analyze whether and when firms are interested in adopting a Code that allows the shareholder to reduce the manager's discretion. Our results suggest that if a voluntary Code is available, not all firms will be interested in it. In firms that do adopt it, the Code is not always used to reach more efficeint outcomes. Regarding investment decisions, we show that a proper design of a Code can alleviate the distortions caused by the agency problem at the investment level. Finally, we analyze some features that a regulator protecting shareholder's wealth should consider. Our findings suggest that heterogeneity in Codes may be partially explained by differences in the distribution of firms or by different abilities of the regulator.

JEL Classification: D-23, G-38, L-20.

Keywords: Codes of Best Practice, Corporate Governance, Agency model, Limited Liability.

*I am very grateful to Inés Macho-Stadler for her help. I would also thank Francisco Azpitarte, Joan Crespo, Joan de Martí, Miguel Ángel García-Cestona, David Pérez-Castrillo, Rosella Nicollini, Pau Olivella and seminar participants at UAB-Workshop in Corporate Governance, XXI Jornadas de Economia Industrial at Bilbao and II Workshop of Corporate Governance at the EIASM-Brussels for their helpful comments. I acknowledge financial support from the research projects BEC2003-01132 and BEC2001-2552-c03-c01 (Spanish Ministry of Education and Science) and 2005SGR-00813 (Generalitat de Catalunya). All remaining errors are my own responsibility.

†Universitat Autònoma de Barcelona, Edifici B, Facultat de Ciències Econòmiques i Empresarials, Campus de la UAB 08193. E-mail: ealonso@idea.uab.es

1 Introduction.

Separation of ownership and control is one of the main characteristics of any limited company. Although the benefits that arise from this separation are important,[1] it involves some costs, as well. These costs are known as the agency problem (Jensen and Meckling, 1976, Fama and Jensen, 1983). Generally, the manager retains significant control rights (discretion) and makes choices in order to maximize his own utility, where his objectives typically differ from those of owners. This may lead to very undesirable situations for the firm's owners. In extreme cases, it can even produce the collapse of firms, as it has recently happened in US (Enron, WorldCom and Tyco) and in Europe (Parmalat).

Since many of the manager's decisions cannot be determined ex-ante in a contract, shareholders use a variety of mechanisms of corporate governance to alleviate this agency problem. Examples of these mechanisms are the remuneration schemes contingent on the firm's performance, the use of a large claimholder that can monitor the manager or the market for corporate control (raiders). The main objective of these mechanisms is to align the interests of the manager with the ones of the shareholder.[2]

During the last decade, both private and public organizations, have started suggesting the use of a new normative device, known as a Code of Best Practice, in order to reduce this manager's problem (EU, 2000). In general terms, a Code of Best practice, also considered as a "soft law", can be defined as a set of rules of voluntary adoption that suggest how a firm should supervise management.[3] A Code of Best Practice bears on wide aspects related to the firm's governance; it affects executive compensation, the role of auditors, disclosure, shareholder voting and capital structure or the role of large shareholders and anti-takeover devices. However, the main recommendations suggested by a Code of Best Practice focus on the board's control over manager's decisions.[4]

[1] For instance, an investor will be able to construct a well diversified portfolio, and hence reduce the risk. Analogously, owners can contract professionals that are better prepared to take charge of the firm.

[2] See for instance the survey by Shleiffer and Vishny (1997) in which the different control mechanisms are investigated. Murphy (1999) presents an extense survey about executive compensation.

[3] By management we refer to top executives such as CEO, Chief Executive Officer.

[4] Some of the topics included in the recommendations include board membership criteria, separation of the role of chairman of the board and CEO, board size, the frequency of board meetings, the proportion of inside versus outside (and independent) directors, the appointment of former executives as directors, evaluation of board performance, the existence, number and structure of board committees, and assignment and rotation of members (Becht *et al.*)

This new trend begins with the publication of the Cadbury Report in 1992, which includes a Code of Best Practice that it is considered the reference Code, as a consequence of financial scandals arising at the end of the 80's.[5] Following this trend almost all countries in Europe have created their own Code. We just mention the Preda Report (1999) in Italy, the Olivencia Report (1998) in Spain, Vienot I Report (1995) in France or the Peter's Report (1997) in the Netherlands. In Asia, we find Codes for instance in China, Japan, India or Indonesia. In America, there are Codes of Best Practice in Brazil, Mexico, Canada, the U.S. or Peru. Even transnational organizations have been working in the composition of Codes, as for instance, the Commonwealth, the OECD or the ICGN.[6]

Empirical studies describing the consequences of the use of Codes of Best Practice lead to results that are not very conclusive. For instance, Dahya *et al.* (2002) and Dedman (2000) finds that the adoption of a Code leads to an improvement in the board's control (Dahya *et al*, 2002, or Dedman, 2000), while in other cases the adoption of the Code does not have effects in this dimension, as documented by Jong *et al.* (2002).[7] We want to add to the discussion by providing a theoretical model that can help understand this contradictory empirical evidence.

We model the Code assuming that it has an effect on the board's control. On the one hand, the introduction of the Code of Best Practices makes the manager play with some rules that improve the monitoring by the board (Dahya *et al.*, 2002). On the other hand, the introduction of a Code of Best Practices (like the Cadbury report) also produced an intense debate about the validity of the self-regulation norms. For instance, the CBI

[5] At the end of the 80's, UK was in crisis after a decade of growth. Obviously, some firms got losses. Yet, some of these collapses were spectacular. Firms like Coloroll, Maxwell's MCC or BCCI got very bad performances. The London Stock Exchange, the Financial Review Council and the Accountancy Profession set the Cadbury Commitee since they considered that these collapses were caused by a lack of Corporate Governance. In particular, the regulators considered that these failures were characterized by a lack of internal control and an excess power of the leader's company (CEO).

[6] The ECGI (European Corporate Governance Institute) provides a webpage (www.ecgi.org updated regularly) where any Code can be checked.

[7] Since the publication of the Cadbury Report in 1992, there has been an intense debate in the UK not only about the validity of a few features of the Code but also about the way it should be implemented. For instance, investment groups considered that the Code's reccomendations did not solve completely the internal control problem or even some executives wanted a mandatory backing for the Cadbury Report. See Jones and Pollit (2001).

and IoD[8] considered that a Code was too bureaucratic, which in turn could affect firm's competitiveness.[9] We model these two effects by considering that the Code allows the shareholder to reduce manager's discretion at a cost (borne by the manager) of following some predetermined rules.

We introduce a Code in an agency problem where the shareholders cannot fully contract manager's decisions. We first consider this situation in the traditional framework where the shareholders design an incentive mechanism to motivate the manager. Second, we define a Code as a mechanism that allows the shareholder to increase control over manager's decisions and analyze the effects of its introduction. Importantly, since the Code is of voluntary adoption, we show that some firms decide not to adopt the Code. This is so because its adoption implies some losses: either in terms of a loss in flexibility or in terms of the adequacy of the decisions the manager makes. We also show that the shareholder's motivation for adopting the Code relies on the fact that it is a mechanism that reduces manager's rents. This motivation, though, may improve or decline firm's efficiency. Some firms adopt the Code and the manager's effort increases. In other firms, the manager's effort is reduced when the Code is adopted.

Third, we analyze different investment distortions that may be caused by the agency problem: underinvestment or overinvestment situations and the abandon of profitable projects. The former situation arises when investment and manager's decisions are complementary, while overinvestment takes place when both are substitutes. We show that a Code can partially alleviate both problems only if it is properly designed. Quite interesting, we find that firms might overshoot when deciding the investment level.

Finally, we analyze the design of a Code when the regulator is concerned with shareholder's profits. The regulator owns a technology to design Codes of Best Practice. This technology describes the trade-off between the ability to design rules that improve board control and the inflexibility that these rules entail in the manager's decision making. Our results suggest that the design of the Code will be influenced by the population of firms as well as by the regulator's technology. If the regulator is facing a low valued industry, it should provide a flexible Code whereas a rigid Code turns out to be optimal when the

[8]Conference of British Industry and Institute of Directors, respectively.

[9]See for instance Financial Times, February 25, 1994. The article points out that the Cadbury Report (the "benchmark" Code) has too much bearing on monitoring. The author, the BTR's Chairman, considers that this over-emphasis on monitoring can affect the firm's competitiveness.

industry is highly valued. Similarly, better technologies will lead the regulator to provide more rigid Codes.

Since Codes of Best Practice are a recent corporate Governance device, the theoretical literature regarding this issue is still very scarce. Nevertheless, our approach is related to some recent literature linking ethics and incentives. Casadesus (2004) and Stevens and Thevaranjan (2003) introduce the role of ethics in the agency model. For instance, Casadesus (2004), albeit different from our approach, suggests that introducing ethical standards in the manager's behavior induce him to accept contracts where incentives are lowered. The manager accepts lowering the incentives because he fears from breaking ethical standards. In our model, the shareholder (principal) sets an institution (the Code of Best Practice) as a mechanism that lets the shareholder reduce manager's discretion. This, in turn, also induces the manager to accept contracts with lower incentives.

The paper is organized as follows. In Section 2, we present the model. We find the optimal contract under symmetric and asymmetric information without a Code, as a benchmark, in Section 3. In Section 3, a Code of Best Practice is presented. We study the optimal contract when no Code is available and when the Code is adopted. We determine the adoption decision of an exogenous Code and their incentives implications by comparing both situations. Using this result, we investigate in Section 4 the role of a Code of Best practice at solving problems at the investment decision level. An analysis of the regulator's policy about the design of a Code is examined in Section 5. Section 6 concludes and presents future research. All proofs are included in an Appendix.

2 The Model.

Consider a firm owned by a shareholder (principal) and assume that she does not have the skills or she lacks the time to manage the firm. The firm is run by a manager (agent) who is in charge of finding and implementing a project, as stated in Fama and Jensen (1983).

The firm has access to the following investment opportunity. At $t = 1$ the firm can invest an amount $I > 0$ in a project that generates a random outcome at $t = 2$. If no investment is made, the project is not viable. In Section 3 and 4, the level of investment is given (it is decided at a previous stage). In Section 5, we study the model when the level of investment is endogenous.

If the realization of the outcome is "success" the payoff generated by the project is $\overline{V}$ while the project generates a payoff of $\underline{V}$ when the outcome is "failure". The outcome depends on the manager's decision or effort that we will denote by $e \in (0,1)$. Without loss of generality, we assume that the probability of "success" is given by e and "failure" is given by $(1-e)$. Therefore, the net expected value of the project is $[e\overline{V} + (1-e)\underline{V}] - I$ or $[\underline{V} + e\Delta V] - I$ where $\Delta V \equiv \overline{V} - \underline{V} > 0$.

The shareholder's expected profits are:

$$\pi(I,e,w) = \underline{V} + e\Delta V - w - I,$$

where w is the expected amount that the shareholders pay to the manager.

We assume that the manager is risk neutral over income. His utility function takes the form

$$U_m(w,e) = w - c(e),$$

where w is the payment scheme and $c(e)$ is the cost of attaining the probability of success e. This is the traditional moral hazard set up. The cost $c(e)$ associated to the effort e can also be interpreted as the (opportunity) cost of working for the firm, that is, the forgone benefit of dedicating effort e to other activities that only benefits him. The manager's effort is, then, interpreted as the time devoted to the firm's interests and not to his own interests.[10] We assume that $c(0) = c'(0) = 0$ and that $c(e)$ is strictly increasing and convex for $e \in (0,1)$. To guarantee an interior solution, we also assume $c'(1) = \infty, c'''(e) \geq 0$.

To have a well-defined moral hazard problem when the manager is assumed to be risk neutral, we consider that he is endowed with limited liability. The payment he receives is bounded from below at any state of the world. We assume that w must always be nonnegative and we also set the manager's reservation utility to be zero.[11]

[10] See Jensen and Meckling (1976) as a model where managers enjoy perquisites.

[11] This reservation utility is the utility associated to the best outside option available to the manager. This could be a position in another firm or the value of the leisure if the manager chooses not to work. Setting the limited liability constraint to zero, i.e. the level we set the manager's reservation utility, is not without loss of generality. Yet, our main results remain qualitatively unchanged and it simplifies our calculations.

The shareholder considers remuneration scheme of the form:

$$\begin{array}{ll} w & if\ failure \\ w + \Delta w & if\ success. \end{array}$$

This type of remuneration mechanism can be interpreted as a fixed payment independently of the outcome and a bonus, denoted Δw, earned by the manager in case of "success".

For the sake of comparison, imagine for a moment that the manager's effort is a verifiable variable. Hence, the effort can be included into a contract enforced by the Court of Law. Thus, in absence of informational asymmetries, the optimal contract $(w, \Delta w, e)$ is the solution to the following program,

$$\begin{aligned} \underset{\{w,\Delta W,e\}}{Max}\ \pi^{FB} &= [\underline{V} + e\Delta V - I - w - e\Delta w] \\ w + e\Delta w - c(e) &\geq 0 \qquad (PC) \\ w &\geq 0 \qquad (LL_1) \\ w + \Delta w &\geq 0 \qquad (LL_2) \end{aligned}$$

that is, the shareholder maximizes profits by selecting the level of effort and the payment scheme $(w, \Delta W, e)$ such that the manager accepts to participate (PC), and limited liability constraints are respected (LL_1) and (LL_2).

It is easy to check that the optimal level of effort e^{FB} selected by the shareholder is the one that equates the marginal value of the project with the marginal cost of the manager's effort, i.e. e^{FB} is set such that $c'(e^{FB}) = \Delta V$. Since both the manager and the shareholder are risk neutral, the shareholder has a continuum of possible contracts to offer to the manager. The set of optimal remuneration schemes $(w, \Delta w)$ that the shareholder can offer to the manager that respects the limited liability constraints are of the type $w = c(e^{FB}) - e^{FB}\Delta w$ and any $\Delta w \in (0, \frac{c(e^{FB})}{e^{FB}})$. Moreover, any contract in this set implies an expected cost for the shareholder and an expected payment for the manager equal to $c(e^{FB})$. In particular, a fixed salary, $(w, \Delta w) = (c(e^{FB}), 0)$ is optimal.

Henceforth, we turn to the case where effort is non-verifiable, the manager chooses the one that maximizes his expected utility. This constraint is referred to as the Incentive Compatibility Constraint (ICC), and can be written as:

$$e \in \underset{e^0 \in\ [0,1]}{argmax} \quad (w + e^0\Delta w - c(e^0)).$$

Given our assumptions on $c(e)$, we can use the first order condition of this program instead of the program itself. In our case, ICC becomes

$$c'(e) = \Delta w. \tag{ICC}$$

3 A Code of Best Practice

In this section we define a Code of Best Practice (CBP hereafter) and consider the incentive effects derived from its introduction. We pay attention to the optimal contract in two different cases: a case where there is no Code and a second case where the shareholder adopts the Code. Comparing both situation lead to the optimal shareholder's adoption decision.

First, the adoption of a Code can improve board control (Dahya *et al*, 2002). In the model, we introduce this fact by assuming that the manager will not be able to exert effort below certain level $\underline{e} > 0$, i.e., the manager decision e has to satisfy $e \geq \underline{e}$. Second, the CBP rules of behavior generate a cost in the manager's decision-making. The manager needs time to fulfill all Code's requirements. Similarly, the creation of committees or the need to reach agreements with the independent directors in the board impede a flexible reaction to the needs of a given project. In the model we consider that the costs from adopting the Code are borne by the manager. Formally, the manager's cost of effort increases from $c(e)$ to $\theta c(e)$ where $\theta > 1$.

To sum up, we consider that the Code allows the shareholder to shrink manager's discretion (by determining a minimum effort $\underline{e}$), but generates some inflexibilities to the manager (captured by θ). Hence, in our model a CBP is defined by a pair $C = (\underline{e}, \theta)$. We assume that the adoption of the Code is a discrete decision, i.e. either the firm adopts it or refuses it, and it cannot be gradually adopted.

We state that the Code $C = (\underline{e}, \theta)$ is rigid when the lower bound set is high since the manager has almost no room for their own actions whereas we define that the Code is flexible when $\underline{e}$ is low.[12] Finally, let us highlight that the Regulator is the agent in charge

[12]Rigidity is, in our view, related to the selection of the rules that reduce manager's discretion, i.e. $\underline{e}$ high or low. Intution suggests that a rigid Code goes along with larger costs entailed by the manager (θ). However, in Section 4 and 5 we focus on all potential Codes that are in the interest of the firm. In section 6 we do pay attention to this effect when the regulator designs the Code.

of promoting the Code and the firm take both variables ($\underline{e}$ and θ) as given.

3.1 Incentive contract when there is no Code.

When the shareholder has no Code to adopt, she proposes the contract that solves the following program,

$$\underset{\{w,\Delta w,e\}}{Max}\ \pi^{SB} = [\underline{V} + e\Delta V - w - e\Delta w - I] \qquad \text{[P1]}$$
$$s.t \quad (PC),\ (ICC),\ (LL_1),\ (LL_2)$$

In words, the shareholder maximizes the expected profits requiring that the agent accepts the contract (PC), has enough incentives (ICC) and is protected by limited liability $(LL_{1,2})$.

The optimal contract solving this program is defined by a payment scheme $(w, \Delta w)$ that determines the optimal effort as a function of the parameter of the model, ΔV. The shareholder can still achieve the first best effort by offering a contract including $\Delta w = \Delta V$. However, implementing e^{FB} is not longer optimal, since the manager enjoys limited liability ($w \geq 0$) and obtains informational rents (i.e., manager's utility above his reservation utility). The shareholder can improve her profits by limiting the incentives, i.e. $\Delta w < \Delta V$ and $w = 0$. Note that, in this case, SB profits are $\pi^{SB} = \underline{V} + e^{SB}(\Delta V - \Delta w) - I$. This is the trade-off the shareholder faces when dealing with limited liability: increasing the incentives increases the revenues but it also increases costs. Eventually, the shareholder prefers a lower level of effort and saving on incentive costs. We summarize the optimal payment scheme and the induced level of effort in the following lemma.

Lemma 1 *Under asymmetric information on manager's effort, the optimal payment scheme $(w, \Delta w)$ that solves [P1] is defined by:*

$$w = 0, \Delta w = c'(e^{SB}) < \Delta V$$

where e^{SB} is the effort implemented by the manager. The level of effort e^{SB} is implicitly defined by: $\Delta V = c'(e) + ec''(e)$.

As compared to the symmetric information outcome, the asymmetry of information reduces manager's effort since, as stated above, providing incentives has a cost to the shareholder. Furthermore, this effect is large if the project is highly valued. Since the manager has an informational advantage, the shareholder provides him with informational rents obtaining more than his outside option. As a consequence, of the reduction of the manager's effort, the shareholder reduces her expected profits. In contrast,

Finally, low-valued projects are not profitable when $\underline{V} < I$, and the shareholder optimally ought to refuse to finance these projects. The agency problem enlarges the set of projects that the shareholder is not willing to finance (due to $e^{SB} < e^{FB}$). This is so because the shareholder anticipates that implementing an effort that would be sufficient to make the project viable brings too much incentives costs. Let us define ΔV^{FB} and ΔV^{SB} as the thresholds such that $\underline{V} - I + e^{FB}\Delta V^{FB} - c(e^{FB}) = 0$ and $\underline{V} - I + e^{SB}\Delta V^{SB} - e^{SB}c'(e^{FB}) = 0$, respectively, being $\Delta V^{FB} < \Delta V^{SB}$.

Corollary 1 *As compared to the symmetric information allocation (FB), the agency problem causes that :*

(a) both manager's effort and firm's profit are reduced. This reduction is increasing with the value of the firm's project.

(b) the manager obtains more than his outside option ($EU > 0$). These informational rents increase with the value of the firm's project.

(c) for $\underline{V} < I$, the set of projects that are not financed is enlarged. This occurs if $\Delta V \in (\Delta V^{FB}, \Delta V^{SB})$.

3.2 The Optimal Contract when the Code is Adopted

In this subsection we assume that the Code has been adopted, and we obtain the optimal contract in this case. Both the incentive and the participation constraints are modified when a firm adopts the Code. Solving backwards, the manager chooses the level of effort that maximizes his utility given the payment scheme. Formally,

$$e \in \underset{e^0 \geq \underline{e}}{argmax} \quad (w + e^0\Delta w - \theta c(e^0)). \qquad \text{(ICC')}$$

Note that (using First Order Approach) from (ICC'), we obtain the following:

$$\begin{aligned} e &= \underline{e} \qquad if\ \Delta w \leq \theta c'(\underline{e}) \\ e &> \underline{e} \qquad defined\ by\ \Delta w = \theta c'(e)\ if\ \Delta w > \theta c'(\underline{e}). \end{aligned}$$

In words, since the Code forces the manager to make at least an effort $\underline{e}$, the shareholder does not need to provide incentives to expect this level of effort. For instance, a flat wage and no informational rents allow her to achieve $\underline{e}$. Instead, if the shareholder wants to achieve a higher level of effort she needs to offer at least $\Delta w = \theta c'(\underline{e})$. To understand the incentive condition, imagine that $\theta = 1$. In this case, effort $\underline{e}$ is obtained at no extra-cost, namely no informational rents to the manager, while an effort larger than $\underline{e}$ would need an incentive similar to the one without a Code. Since the manager's effort increases when the Code is adopted, if $\theta > 1$ providing incentives is more expensive for $e > \underline{e}$.

The participation constraint of the manager is also modified. Given a payment scheme, the manager accepts the contract if $w + e\Delta w - \theta c(e) \geq 0$. Let us call this constraint (PC'). Thus, the optimal payment scheme $(w, \Delta w)$ when the Code is adopted is the solution to:

$$\underset{\{w,\Delta w,e\}}{Max} [\underline{V} + e\Delta V - w - e\Delta w - I] \qquad [P2]$$

$$s.t \quad (PC'), (ICC'), \ (LL_1), \ (LL_2)$$

The following lemma summarizes the optimal contract obtained from solving [P2]. It states that, for highly valued projects, it is in the shareholder's interest to implement a large effort in order to increase chances of success, while if the project is low valued, the manager receives no informational rents and $\underline{e}$ is the effort implemented in order to save on wages. In Lemma 2, we implicitly define e^{CBP} as the level of effort satisfying $c'(e) + ec''(e) = \frac{\Delta V}{\theta}$, and ΔV^{CBP} is implicitly defined by $e^{CBP}(\Delta V^{CBP} - \theta c'(e^{CBP})) = \underline{e}\Delta V^{CBP} - \theta c(\underline{e})$.

Lemma 2 *If the Code $C = (\underline{e}, \theta)$ is adopted, there is a cut-off value ΔV^{CBP} such that:*
(a) for $\Delta V \leq \Delta V^{CBP}$, any contract $(w, \Delta w)$ such that $\Delta w \leq \theta c'(\underline{e})$ and $w = c(\underline{e}) - \underline{e}\Delta w \geq 0$ is optimal. The effort implemented is $\underline{e}$.
(b) for $\Delta V \geq \Delta V^{CBP}$, the optimal contract is $(w, \Delta w) = (0, \theta c'(e^{CBP}))$. The effort implemented is $e^{CBP} > \underline{e}$. The manager obtains informational rents in this region.

Note that the level of manager's effort $e^{CBP} < e^{SB}$ due to the inefficiencies generated by the adoption of the Code (measured through $\theta > 1$).

3.3 The Adoption Decision and Incentives Implication

As stated previously, one of the main characteristics of a Code of Best Practice is that it is voluntary rather than compulsory. Hence, the aim of this section is to find the condition under which the shareholder will decide to adopt the Code and the incentive implications derived from the adoption of the Code provided by the regulator. The shareholder will adopt the Code by comparing the level of profits obtained by the optimal contract stated in Lemma 1 with the level of profits obtained by the optimal contract when the Code is adopted (Lemma 2). Let us define $\Delta V(1)$ and $\Delta V(2)$ as the two intersections of $\pi(\underline{e})$, the level of profits when $\underline{e}$ is implemented and π^{SB}, the level of profits when the Code is not adopted (see Appendix for further details).

Let us summarize the comparison of the profits obtained in Lemma 1 and Lemma 2 in the following proposition:

Proposition 1 *(a) The shareholder adopts voluntarily the Code of Best Practice* $C = (\underline{e}, \theta)$ *if and only if the following two conditions hold:*
(i) the cost borne by the manager when following the Codes' recommendations are low enough ($\theta \leq \widehat{\theta} = \frac{\underline{e}c'(\underline{e})}{c(\underline{e})}$) *and*
(ii) the firm's project takes intermediate values ($\Delta V \in [\Delta V(1), \Delta V(2)]$)*,*
otherwise the Code is not adopted.
(b) When the Code is adopted, the level of effort implemented is always $\underline{e}$*.*

Proposition 1 states that in order to adopt the Code two conditions need to be satisfied. First, it is important that the adoption of the Code does not generate too much costs at the manager's decisions level, namely θ must be low enough. Intuitively, the shareholder should not adopt the Code if the costs of adopting it (the costs it induces in the managerial compensation $\theta c(\underline{e})$), is larger than the benefit, (the reduction of the informational rents $\underline{e}c'(\underline{e})$). This explains the condition in part (i) of Proposition 1. However, this is only a necessary condition. Part (ii) of Proposition 1 states that a Code should not be adopted if it induces undesirable level of efforts. This bias can go in either direction. A firm may refuse the adoption of the Code because its project is low valued and the lower bound $\underline{e}$ is too high for the shareholder. This is so because the adoption of the Code implies an increase in cost wages (up to $\theta c(\underline{e})$) that is not compensated by the increase in revenues (associated to an increase in the probability of success). It can also be the case that the firm refuses the adoption of the Code when its project has a high expected value because the Code makes more expensive to provide incentives to the manager. When the project is high valued the shareholder wants a high level of effort, even in the absence of the Code.

Since adopting the Code induces some inflexibilities (measured through θ), it is cheaper to provide incentives refusing the Code rather than adopting it. These two caveats, the Code forces a too high effort for low values of the project and implies a high cost of effort for high valued projects, explain condition (ii) of Proposition 1.

Figure 1 represents graphically condition (ii) of Proposition 1. We depict the firm's profits when the Code is adopted (π^{CBP}) and compare them to the level of profits when it is not adopted (π^{SB}). Note that firm's profits obtained by adopting the Code (π^{CBP}) are shaped by the functions $\pi^{SB}(\theta > 1)$ and $\pi(\underline{e}, \theta > 1)$, as it is explained in Lemma 2. By comparing both functions, we observe that the adoption of the Code is only profitable for projects with intermediate values. Note also that if θ increases, π^{CBP} shifts clock wise while π^{SB} remains unchanged, which implies that for large values of θ the CBP is not adopted (part (i) of Proposition 1)

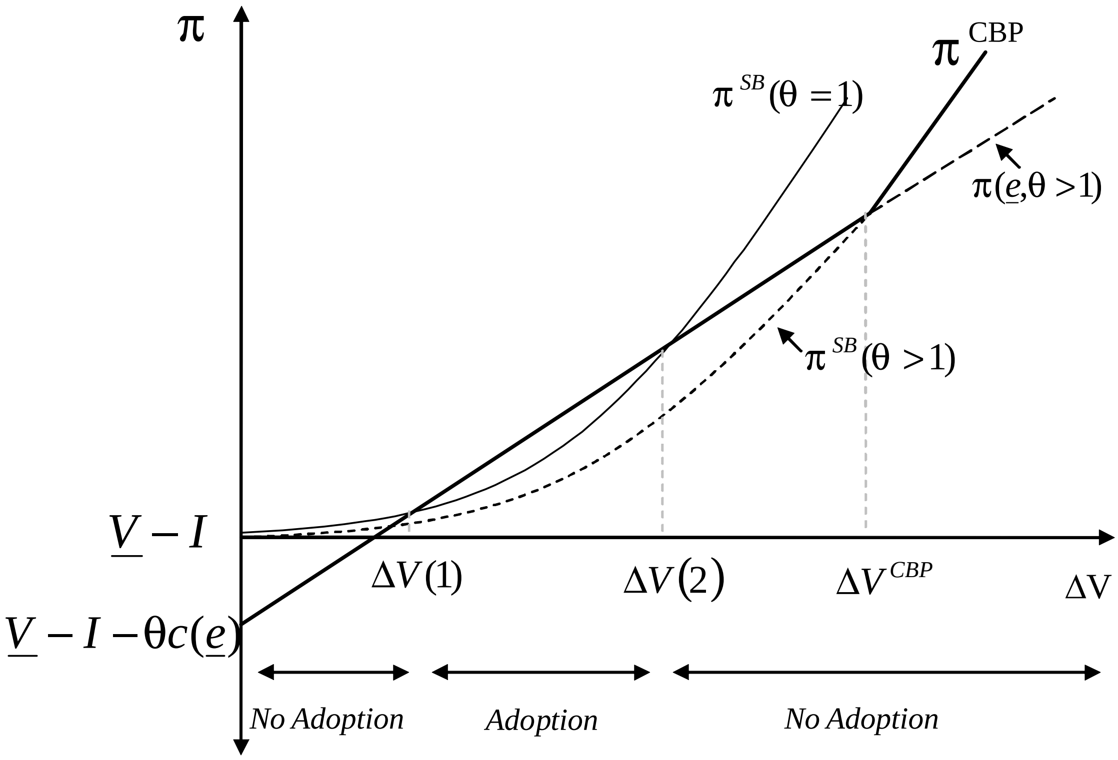

Figure 1: The Adoption decision as a funtion of the firm's value

Finally, from Proposition 1 we conclude that the effort implemented is always $\underline{e}$. Indeed, the main motivation for the shareholder to adopt the CBP is that she can force the manager to achieve at least the minimum level of effort without providing informational rents. Proposition 2 highlights that this effect is not always associated with a better manager's performance.

Proposition 2 *When the firm adopts voluntarily the Code $C = (\underline{e}, \theta)$ it may be the case that, as compared with the case where there is no Code,*
(a) the manager increases his effort. This situation takes place for $\Delta V \in [\Delta V(1), c'(\underline{e}) + \underline{e}c''(\underline{e})]$.
(b) the manager's effort is reduced. This situation arises for $\Delta V \in (c'(\underline{e}) + \underline{e}c''(\underline{e}), \Delta V(2)]$.

Part (a) of Proposition 2 refers to the case where there is an increase of the manager's effort. The Code allows the shareholder to demand $\underline{e}$ while without it, the contract (Lemma 1) would have implemented a lower effort. On the contrary, part (b) of Proposition 2 shows the cases where the adoption of the Code reduces manager's effort. If no Code is available, incentives are provided via informational rents. When a Code is available, in this region it is optimal for the shareholder to design a payment scheme implementing $\underline{e}$. The rationale for this decision is that the shareholder compares the loss in revenues (a reduction in the probability of success $\underline{e} < e^{SB}$) with the saving in wages $(c(\underline{e})\theta < e^{SB}c'(e^{SB}))$.

Agency problems causes the shareholder to implement a level of effort lower than the efficient one (Corollary 1). Proposition 2 states that adopting the Code is not always a good device for correcting this biais. Part (b) of Proposition 2 shows the case where this biais increase: adopting the Code goes along with a decrease in the firm's efficiency (measured through manager's effort, $(e^{FB} - \underline{e}) > (e^{FB} - e^{SB}) > 0$ for all $\Delta V \geq c'(\underline{e}) + \underline{e}c''(\underline{e})$). Part (a) of Proposition 2 shows the cases where this bias might be reduced. In other words, adopting the Code increases firm's efficiency for, at least, some firm's project.

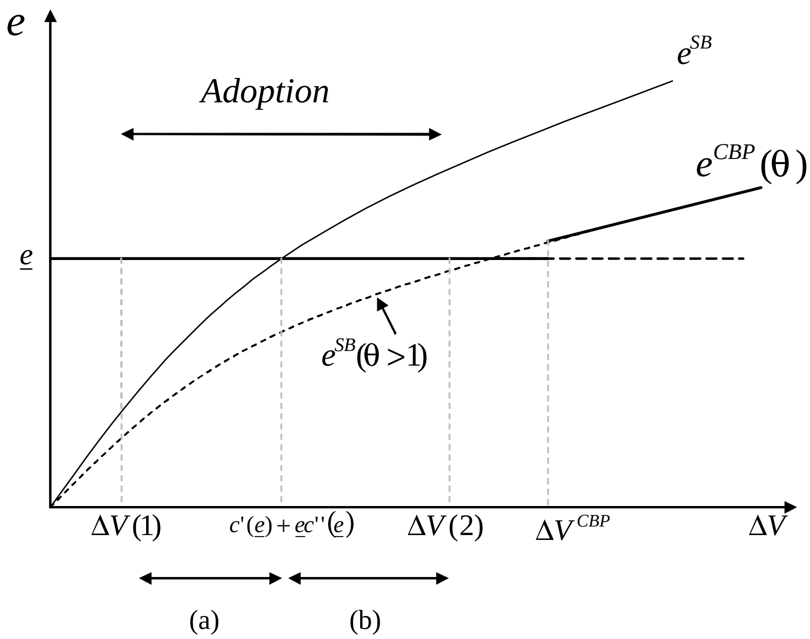

Figure 2: The CBP increases manager's effort in region (a) and in region (b) reduces manager's effort

We illustrate the main arguments stated in Proposition 2 graphically. Part (a) in Figure 2 include cases where profits increase by both increasing effort and eliminating informational rents while the cases where the profits increase by extracting rents to the manager and reducing his effort are depicted in part (b) of Figure 2.

Finally, suppose that the cost that the manager incurs when the Code is adopted is reduced ($\theta \to 1$), then the firm adopts the Code more often ($\frac{d\Delta V(1)}{d\theta} > 0 > \frac{d\Delta V(2)}{d\theta}$). In the limit, i.e, if the Code does not lead to any cost for the manager ($\theta = 1$), the shareholder would be indifferent between adopting and refusing for large values of the project ($\Delta V \geq \Delta V(2)$) while she would still prefer refusing it for low values of the Code ($\Delta V \leq \Delta V(1)$). Indeed, in this case, the firm can achieve FB's profits by adopting the Code for $\Delta V = c'(e^{FB}) \in (\Delta V(1), \Delta V(2))$. Furthermore, we may ask about the effects of the CBP if it induces efficiency gains in the manager's cost of effort ($\theta < 1$). In this case, only firms with low valued projects have no incentives to adopt the Code, otherwise, there is a strict preference for adopting it. The intuition for low valued projects remains unchanged, since the lower bound $\underline{e}$ is too high for that set of firms. Obviously, since adopting the CBP induces efficiency gains, firms with high valued projects have an strong incentive to adopt the Code.

4 Investment Decisions

The aim of this section is to analyze the role that a Code of best practice may play at improving investment level I. We assume that in this Section that the level of investment I is endogenous. It is decided by the shareholder before the contract is designed and it is observable by the manager. In this framework, we distinguish two potential distortions caused by the agency problem. Distortions at the level of investment and profitable projects are not financed. We assume that the realization of the project depends positively on the amount invested at $t = 1$. If the outcome is "success" the payoff is $\overline{V}(I)$, and the payoff is $\underline{V}(I)$ if the outcome is "failure" with $\overline{V}'(I) > 0$ and $\underline{V}'(I) > 0$ and we will denote $\Delta V(I) \equiv [\overline{V}(I) - \underline{V}(I)]$ being $\Delta V(I) \geq 0$ for all I. Therefore, the expected value of the project becomes

$$(1-e)\underline{V}(I) + e\overline{V}(I) = \underline{V}(I) + e\Delta V(I).$$

By backwards induction, the shareholder decides on the optimal investment taking into account the contract she will be offering to the manager. If the manager's effort is verifiable the shareholder will implement $e^{FB}(I)$ (defined in Section 2) satisfying $\Delta V(I) = c'(e^{FB})$. When the manager's effort is not verifiable and there is no CBP, in the continuation of the game, she will implement $e^{SB}(I)$ (defined in Section 3) satisfying $\Delta V(I) = c'(e^{SB}) + e^{SB}c''(e^{SB})$, which, as always, implies a distortion in the level of effort associated to the agency problem, i.e. $e^{SB}(I) < e^{FB}(I)$ for any I.

Thus, when effort is verifiable the optimal level of investment I^{FB} satisfies:

$$I^{FB} \in \arg\max_{\{I\}} \{\underline{V}(I) + e^{FB}(I)\Delta V(I) - I - c(e^{FB}(I))\}$$

while if effort is not verifiable, the shareholder chooses the level of investment I^{SB} that solves

$$I^{SB} \in \arg\max_{\{I\}} \{\underline{V}(I) + e^{SB}(I)\Delta V(I) - I - c'(e^{SB}(I))e^{SB}(I)\}$$

4.1 Distortions at the Investment level

The distortions that the agency problem causes on the level of the investment depends on how the level of investment affects the risk of the project. There might be projects in which increasing the investment increases the mean of the project but also its risk ($\Delta V'(I) > 0$). In turn, this affects the level of the effort. In other words, the level of investment and the level of effort are strategic complements. On the contrary, there might be projects in which a larger level of investment reduces the risk of the project ($\Delta V'(I) < 0$). This affects negatively the level of effort. In other words, the level of investment and the level of effort are strategic substitutes.

In the former case, the complementarity assumption implies that the larger the size of the project, the more crucial the role played by the manager is in its expected value. Therefore, an increase in the level of investment makes the agency problem more acute. In the latter case, when effort and investment are strategic substitutes, the larger the project is, the less important the role played by the manager. In other words, investment can be seen as an instrument alleviating the agency problem.

Under complementarity, the marginal profitability of the project increases with the initial investment ($\Delta V'(I) > 0$), which in turn imply that the optimal level of effort tends to increase with the level of investment ($\frac{de^{FB}}{dI} > \frac{de^{SB}}{dI} > 0$). The shareholder uses strategically the level of investment as a device for correcting manager's behavior. Due to the complementarity effect, she anticipates that a large level of investment would imply paying a large level of informational rents. The shareholder optimally limits this amount by reducing the level of investment when effort is not verifiable. Under substitution between effort and investment, the shareholder increases the level of investment because it can reduce the cost paid to the manager.

Let us presents formally this result in the following lemma:

Lemma 3 *When effort and investment are strategic complements ($\Delta V'(I) > 0$), agency problem generates underinvestment, i.e. $I^{SB} < I^{FB}$. Instead, when effort and investment are strategic substitutes, agency problem generates overinvestment, i.e. $I^{SB} > I^{FB}$*

A natural question is under which conditions a code might help to reduce at least partially the underinvestment (overinvestment).[13] In a nutshell, the code may both palliate or reinforce the underinvestment problem. The intuition is the following: as showed in Section 3 the Code allow the shareholder to implement $\underline{e}$. This implies that she implements this minimum level of effort without providing incentives, and this is precisely the

[13]The intuition for the case of substitution are the opposite than the case of complementarity. The main intutions are explained bny using the case of complementarity.

main reason why the shareholder is willing to adopt the Code . Therefore and due to the complementarity effect, if a Code is relaxed, namely $\underline{e}$ low, it may induce the shareholder to underinvest. Analogously, if the Code is intrusive, namely $\underline{e}$ high, the shareholder might overshoot when deciding the investment level (relative to the FB) if the Code is adopted.

Parallel to the case where there is no code, the optimal investment level I^{CBP} solves:[14]

$$I^{CBP} \in \arg\max\{\underline{V}(I) + \underline{e}\Delta V(I) - I - c(\underline{e})\}$$

To present the results on investment when the Code is adopted, let us define $\underline{e}_1$ and $\underline{e}_2$ as $c'(\underline{e}_1) + \underline{e}_1 c''(\underline{e}_1) = \Delta V(I)$ and $c'(\underline{e}_2) = \Delta V(I)$, respectively. These thresholds are such that the investment chosen when $\underline{e} = \underline{e}_1$ coincides with I^{SB} and the investment chosen when $\underline{e} = \underline{e}_2$ coincides with I^{FB}.

Lemma 4 *When effort and investment are complements, if the Code $C = (\underline{e}, \theta)$ is adopted, the investment I^{CBP} is such that:*

$$I^{CBP} \in \begin{array}{ll} (I_{\min}, I_{SB}] & \text{if } \underline{e} \in (0, \underline{e}_1] \\ (I_{SB}, I_{FB}] & \text{if } \underline{e} \in (\underline{e}_1, \underline{e}_2] \\ (I_{FB}, I_{\max}) & \text{if } \underline{e} \in (\underline{e}_2, 1) \end{array}$$

where $I_{\min}$ solves $\underline{V}'(I) = 1$ and $I_{\max}$ solves $\underline{V}'(I) + \Delta V'(I) = 1$.

When effort and investment are substitutes, if the Code $C = (\underline{e}, \theta)$ is adopted, the investment I^{CBP} is such that:

$$I^{CBP} \in \begin{array}{ll} (I_{\min}, I_{FB}] & \text{if } \underline{e} \in (0, \underline{e}_1] \\ (I_{SB}, I_{SB}] & \text{if } \underline{e} \in (\underline{e}_1, \underline{e}_2] \\ (I_{SB}, I_{\max}) & \text{if } \underline{e} \in (\underline{e}_2, 1) \end{array}$$

Lemma 4 shows that if the Code is adopted, it alleviates the distortion outcome only if $\underline{e} \in (\underline{e}_1, \underline{e}_2]$. In contrast, if the Code is either too relaxed or too intrusive, adopting the Code induces the firm to underinvest if $\underline{e} \in (0, \underline{e}_1]$ or overinvest if $\underline{e} \in (\underline{e}_2, 1)$. Finally, since firms decide voluntarily to adopt or not the CBP, we consider the adoption decision and the manager's effort.

[14] As showed in the previous Section, it is not optimal to adopt the code and implementing a larger level of effort than the minimal guaranteed by the code. This is because adopting the Code causes an inefficiency in the manager's decision taking ($\theta > 1$).

Proposition 3 *The Code $C = (\underline{e}, \theta)$ is adopted if two conditions hold: $\theta < \widehat{\theta}$ and $\underline{e} \in (\underline{e}_1^{CBP}(\theta), \underline{e}_2^{CBP}(\theta)]$ with $\underline{e}_1^{CBP}(\theta) < \underline{e}_1 < \underline{e}_2^{CBP}(\theta)$.*

Proposition 3 is analogous to Proposition 1: the shareholder adopts the Code because it lets the shareholder extract rents to the manager (vis-a-vis a situation where there is no Code in the economy). Thus, a Code is adopted when the inefficiencies generated at the manager's level are not very high ($\theta < \widehat{\theta}$) and $\underline{e}$ takes intermediate values.

Lemma 4 states that when $\underline{e} \in (\underline{e}_1, \underline{e}_2]$ the Code partially alleviates the fact that firms underinvest. Nevertheless, Proposition 4 states that this is not always the case and underinvestment might be reinforced, namely $I^{CBP} < I^{SB}$. This takes place if the CBP is very relaxed and implements $\underline{e} \in (\underline{e}_1^{CBP}, \underline{e}_1]$. For instance, assume that $\underline{e} = \underline{e}_1$, then by Lemma 4, we know that the level of investment if the Code is adopted coincides with the investment if the code is not adopted. Yet, the level of profits are larger if the Code is adopted because of the informational rents. Therefore, a firm will be willing to adopt a more relaxed Code. This Code, due to complementarity, makes the shareholder to select a lower level of investment. Quite interesting, we also find that very rigid Codes are not always good because, in this case, we may face overinvestment ($I^{CBP} > I^{FB}$). Overinvestment only arise if the Code is very intrusive and the costs associated are also very low. To see how, assume that the Code provided is $\widehat{C} = (\underline{e}_2, 1)$. Then, both the investment and of profits coincide with the FB situation. If the firm adopts a Code a bit more intrusive than $\widehat{C}$, the shareholder selects a larger level of investment. This situation takes place if $\underline{e} \in [\underline{e}_2, \underline{e}_2^C(\theta)]$. [15]

We can represent the investment levels graphically. In Figure 3, corresponding to a low value θ, we illustrate the investment selected when the Code is adopted and compare it with the FB and SB levels as a function of $\underline{e}$. Neither the FB nor the SB level of effort depend on $\underline{e}$ and from Lemma 4 we know that $I^{SB} < I^{FB}$. On the contrary, if the CBP is adopted, the level of investment does depend on $\underline{e}$ (positively due to complementarity). Note that the level of investment induced by the adoption of the Code corrects the bias when $\underline{e} \in (\underline{e}_1, \underline{e}_2)$. An undesirable situation, though, arises outside this interval. The shareholder is still willing to adopt the Code, but it distorts the investment level and

[15]Note that the set of potential Codes that causes overinvestment might be empty, since it seems natural to consider that a large level of effort implies a large level of costs. Yet, the Code is taken as given for the firm, and we consider all potential Codes

either underinvestment ($\underline{e} \in (\underline{e}_1^{CBP}, \underline{e}_1)$) or overinvestment (($\underline{e} \in (\underline{e}_2, \underline{e}_2^{CBP})$)) might come out.

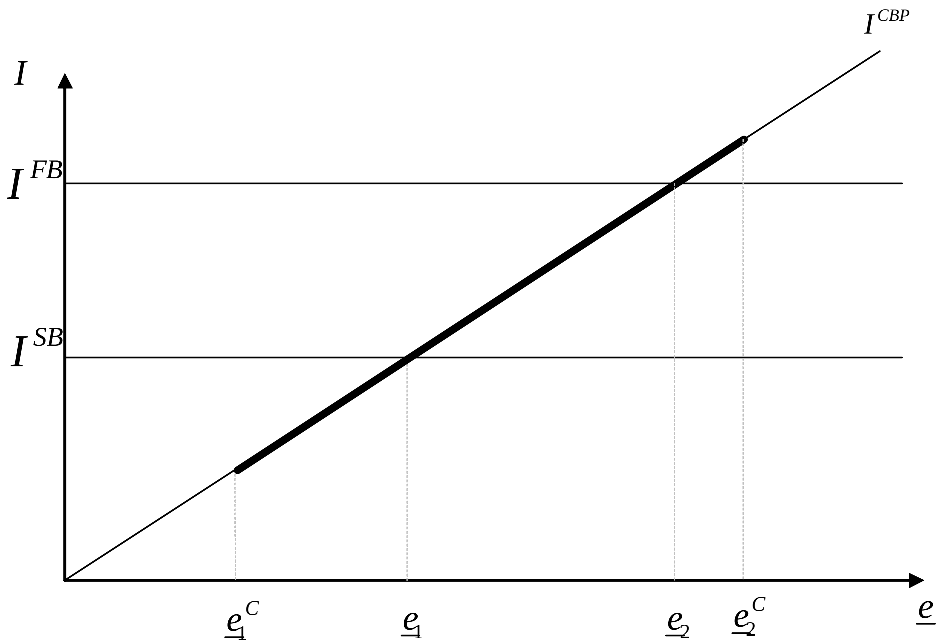

Figure 3: Optimal Investment if a Code is adopted compared to the SB level and the FB level.

For high values of θ, i.e. if $\underline{e}_2^C < \underline{e}_2$, overinvestment cannot arise in equilibrium and very rigid Codes help to alleviate that firms correct the underinvestment bias.

Finally, let us highlight that the adoption of the Code might alleviate another distortion caused by the agency problem: there might be situations where the shareholder does not provide funds to a profitable project, i.e. in the FB the firm obtains positive proceeds, because of the agency problem, as already appointed in Corollary 1. The intuition is that a firm adopts the code since profits increase. If there are projects that were not financed, it is plausible that by adopting this projects will be adopted.

5 Policy Implications.

In the previous sections, a firm has access to a given Code and we analyze its adoption is optimal and the implications that a Code has on certain decisions such as investment level. The purpose of this section is to consider which Code the regulator should promote to firms if its objective is to maximize welfare. In this framework, we assume that the regulator wants to protect the shareholder which in turn imply that the regulator will maximize firms' profits. In other words, we want to identify the Code that the regulator ought to design when it faces a population of firms as a function of firms' characteristics and the technology to build up Codes.

5.1 Regulator's technology

A Code entails the guaranty of a minimum level of effort ($\underline{e}$) and an increase in the manager's cost (θ). We assume that the regulator can design different Codes, some very intrusive (i.e. high $\underline{e}$ and θ), other very relaxed or "laissez-faire" (low $\underline{e}$ and θ). For the sake of simplicity, let us consider the following linear regulator's technology:

$$\theta(\underline{e}) = 1 + b\underline{e} \tag{CC}$$

where $b > 0$.[16] The parameter b describes the regulator's ability. Different regulators might own different pieces of information about the governance of firms acting in the market. This effect can be interpreted in this model by considering different values of the parameter b.

The regulator faces a population of firms characterized by its project ΔV and uniformly distributed on the interval $[0, \overline{\Delta V}]$.[17] We denote by $\pi(\underline{e}, \theta(\underline{e}), \Delta V)$ firm's profits having a project with value ΔV, and the sharholder can adopt a Code $C = (\underline{e}, \theta(\underline{e}))$. Then, the regulator chooses the Code, given b, solving,

$$\begin{aligned} &\underset{\{\underline{e}\}}{Max}\left\{\frac{1}{\overline{\Delta V}}\int_0^{\overline{\Delta V}} \pi(\underline{e}, \theta(\underline{e}), \Delta V) d\Delta V\right\} \\ &s.t \quad \theta(\underline{e}) = 1 + b\underline{e} \end{aligned}$$

The regulator's objective function is to maximize the sum of the firms' profits and we assume that the regulator cares only about improving the aggregated value of the firms acting in the market. Therefore, a first intuition would suggest that the regulator would like to choose rigid rules in order to let very good firms (namely, firms with valuable

[16]The results does not depend on the functional form as long as non-(strict) concavity holds. The linear technology helps us to explain the solution of the regulator in a simpler way.

[17]We assume uniform distribution for tractability, but intuition remains unchanged for more general distributions.

projects - high ΔV) adopt the Code . Nevertheless, the regulator's willingness to promote rigid rules is limited by the inefficiencies caused by the Code itself. Hence, the regulator chooses $\underline{e}$ (which has a given b associated) in such a way that the marginal benefits from adopting the Code equates the marginal costs from adopting it. The marginal revenues are equal to the aggregated average of firms adopting the Code (LHS in the following equation), while the marginal costs are equal the costs of rewarding a larger effort plus the increased cost associated (LHS of the following expression):

$$\frac{\Delta V(1) + \Delta V(2)}{2} = c'(\underline{e}) + b(c(\underline{e}) + \underline{e}c'(\underline{e}))$$

Clearly, a more efficient regulator's technology, *caeteris paribus*, let the regulator opt for more stringent Codes.

On the other hand, if firms are more concentrated, in the sense that the upper limit of the distribution is lower keeping fixed the mean, the regulator finds optimal to promote a more relaxed Code. It is still true that the regulator has still interest in increasing the lower bound of the Code, yet in this case, since there are less firms with very valuable projects, the regulator would be concern on the benefits of firms of intermediate value. The following proposition summarizes the optimal solution of the program faced by the regulator:

Proposition 4 *Consider that firms are distributed uniformly on the interval* $[0, \overline{\Delta V}]$ *and* $\theta(\underline{e}) = 1 + b\underline{e}$. *Then, the regulator opts for a Code where the rules implement a minimum level of effort positive, i.e.* $\underline{e} > 0$. *Besides, the optimal bound* $\underline{e}$ *depends on*
(a) the regulator's technology ($\frac{d\underline{e}}{db} < 0$)
(b) the distribution of firms. Consider that ΔV *is distributed uniformly on* $[\underline{\Delta V}, \overline{\Delta V}]$ *the more dispersed the firms are, the more rigid the Code* ($\frac{d\underline{e}}{d\overline{\Delta V}} > 0$)

Proposition 5 shows that the regulator should promote different codes when it faces different firm's distribution. A consequence of this statement is that heterogeneity in the design of Codes may not necessarily imply that some codes are superior to others. Take two codes A and B such that $\underline{e}_A > \underline{e}_B$ and $b_A = b_B$. If the market has very good projects, the regulator should consider the creation of codes as rigid as possible in order to alleviate the agency problem of the firms with more valuable projects. This rationalizes the choice of Code A. On the other hand, if the regulator faces firms having less valuable projects, using code B is not suboptimal. Consider, in this case, would have chosen code A. The reduction of agency problem would only benefits very few firms. A more flexible Code such as B will allow more firms to be interested in adopting it generating a higher performance for the overall market. To sum up, for different distribution of firms a regulator, with a given ability to design Codes, will take different decisions and just by comparing the Codes we cannot conclude that the Code A is better than the Code B.

A similar argument can be constructed through the technology that the manager owns. Different countries have different regulators that may have different technologies to design Codes. Take two Codes A and B such that $\underline{e}_A = \underline{e}_B$ and $b_A < b_B$. In this case, we can conclude that Code A is superior to Code B. However, note that for some regulators Code A can be unfeasible. The heterogeneity in the technology may come from different sources like informational asymmetries or other influences by agents acting in the market. In the latter, Jones and Pollit (2001) suggest that the improvements on the Code in UK has been subject to the different players in the market. In particular, academics, the mass media, insiders and investment groups have tried to influence the Code in one or in other way. These pressures have translated into changes in the Code since in our wording they affect the regulation's technology. For instance, insiders would like to have a Code as flexible as possible in order to avoid a battle for rents, which in our model would reflect in a higher b. Roughly speaking, heterogeneity of Codes suggests, in this case, that a flexible Code signals an inefficient regulator, which implies that Codes can be ranked by its severity.

Finally, let us remark that the predictions of our model are subject to the selected distribution (uniform distribution). However, our model would not change qualitatively if we allow for more general distributions. Let us fix the upper limit of the distribution $\overline{\Delta V}$. If instead of having a uniform population, we would have a distribution where firms tend to have good projects, i.e. the probability is increasing in ΔV, the incentives for the regulator to increase $\underline{e}$ are reinforced since there are more firms involved in larger valued projects. Hence, the regulator will choose the most rigid Code. On the contrary, if firms are concentrated in low valued projects, the density is decreasing in ΔV, the regulator will tend to choose a more flexible Codes.

6 Conclusions and Further research.

This paper focuses on the role of a Code of Best Practice as an incentive device. We propose a very simple agency model where the shareholder (principal) decides on the adoption of the Code, depending on its effects on profits. We also consider the design of the Code by a regulator concerned by the efficiency of its population of firms.

We define a Code as a mechanism allowing the shareholder to shrink manager's discretion. We show that there are firms whose shareholders optimally choose not to adopt the Code, either it implements a too high level of activity or the Code imposes costs at operating structures, reducing the time that the manager devotes to the needs of a project. Among the firms that do adopt the Code, efficiency may increase or decrease. In some cases, the Code induces a better manager's behavior due to an increase in board's oversight. In other cases, the Code only allows to reduce rents at the cost of a lower effort.

Using our results of the effects of the Code on firm's efficiency, we investigate the role that a Code of best Practice may play regarding investment decisions. In our framework, investment decisions are distorted due to the agency problem. We concentrate on two possible distortions: underinvestment and profitable projects remain unfinanced. In regard to the first distortion, we show that a Code is a good mechanism only under certain conditions. If a very relaxed Code is promoted, we show that underinvestment is reinforced. Very stringent Codes solve underinvestment but firms might overshoot when selecting the optimal investment level. A code is also proved to be useful when dealing with the second distortion. Under financial restrictions in the financial market, the Code helps the shareholder to finance projects that would remain unfinanced. In this situation, any Code that is voluntarily accepted by the firm has this positive effect.

Concerning our result regarding the adoption decision, the literature provides evidence suggesting that if the manager owns a large fraction of firm's shares, there are less incentives for the firm to adopt the Code.[18] We can provide two possible explanations for this evidence. First, if the manager owns a larger fraction of the firm, the agency problem associated with the separation of ownership and control is smoothed. Second, a manager

[18]Young (2000) and Dedman (2000) confirm empirically this result.We also find evidence in the descriptive analysis provided by Dahya *et al* (2002). For instance, they highlight as one of the characteristics of the firms that do not adopt the Code the fact that the best payed executive owns between 3 and 4 times more shares than the one working in firms that adopt the Code.

owning a large set of shares may have enough power to block the adoption of the Code. Our model suggests that this second argument makes sense if the adoption of the Code induces a battle for rents. In such a case, the manager has incentives to avoid the adoption because it harms his utility.

In this paper, we also tackle the optimal Code that a shareholder's oriented regulator should promote. Our result of the analysis suggests that it might be optimal to promote a flexible Code, meaning that the manager has more discretion, if the regulator faces low valued population of firms. Hence, the heterogeneity of Codes that we perceive in reality, in the sense that there exist coexistence, may be rational because they cannot be ranked. We also deal with deal with the regulator's ability. In this dimension, caeteris paribus, we do rank the Codes, since the better the regulator's technology is (b low), the better the Code of Best Practice is.

To our knowledge, this is one of the first attempts to provide a model of Codes of Best Practice. Even if we abstract from several important issues that a Code of Best Practice takes into account, we think that we can explain important features. Other issues relevant in the Code of Best Practice are the role played by the institutional investors in controlling managers, the need for an improvement in the quality of the information provided to the investor as well as the role played by the capital structure. In particular, and given the evidence presented before, we consider that capital structure or who is in charge of the decision of adopting the Code may be crucial to explain the effectiveness of one Code respect to others.

References

[1] Becht, M., P. Bolton and A. Roell, 2002, "Corporate Governance and Control", Working Paper N^o 02/2002 ECGI.

[2] Cadbury Report, 1992, "The report of the Committee on the Financial Aspects of Corporate Governance". London: Gee Publishing.

[3] Casadesus-Masanell, R., 2004, "Trust in Agency", Journal of Economics and Management Strategy.

[4] Dahya, J., J.McConnell and N.V. Travlos, 2002, "The Cadbury Commiteee, Corporate Performance and Top management Turnover", Journal of Finance, 57, pp. 461-483.

[5] Dedman, E., 2000, "An investigation into the Determinants of UK Board Structure Before and After Cadbury," Corporate Governance, 8, pp.133-153.

[6] European Commission, 2001, "Comparative study of Corporate Governance Codes Relevant to the European Union and its Member States".

[7] Fama, E. and Jensen, M.C., 1983, "Separation of Ownership and Control", Journal of Law and Economics, 26, 301-325.

[8] Holmstrom, B. 1979, "Moral hazard and observability", Bell Journal of economics, 10, 74-91.

[9] Jensen, M.C. and Meckling, W.H., 1976, "Theory of the Firm: managerial behavior, agency costs and ownership structure", Journal of Financial Economics, 3, 305-360.

[10] Jones, I. and M. Pollit, 2001, "Who influences debates in Business ethics? An investigation into the development of corporate governance in the UK since 1990", ESRC WPn^{o}221.

[11] Jong, A., D. DeJong, G. Mertens and C. Wasley, 2002, "The Role of self-regulating in Corporate Governance: Evidence from the Netherlands," Working Paper.

[12] Macho-Stadler, I. and D. Perez-Castrillo, 2001, "Introduction to the economics of Information", Oxford University Press.

[13] Murphy, Kevin, 1999, "Executive Compensation", in Ashenfelter, O. and D. Card, eds.: Handbook of Labor Economics (North Holland).

[14] Park, E., 1995, "Incentive contracting under limited liability". Journal of Economics and Management Strategy, 4, 477-490.

[15] Shleifer, A. and R. Vishny, 1997, "A survey of Corporate Governance", Journal of Finance, 52, 737-783.

[16] Stevens, D and A. Thevaranjan, 2003, "Ethics and Agency Theory: Incorporating a Standard for Effort and an Ethically Sensitive Agent", mimeo, Syracuse University.

[17] Young, S., 2000, "The increasing use of non-executive directors: its impact on UK board structure and governance arrangements." Journal of Business, Finance and Accounting, 27, 1311-1342.

A Appendix

Proof of Lemma 1. We solve [P1]. First, we notice that $[LL_2]$ cannot be binding due to (ICC) and (LL_1). Second, (PC) is also not binding. Indeed, using (ICC), (PC) can be rewritten as $w + ec'(e) - c(e) > w$ for any $e > 0$. Therefore (LL_1) implies (PC). Let $L(w, e; \rho) = V - I + e\Delta V - w - ec'(e) + \rho w$ be the lagrangian corresponding to [P1], ρ is the lagrange multiplier associated to (LL_1) respectively. The FOC's with respect to w and e are, respectively,

$$\begin{aligned} \rho &= 1 \\ \Delta V - c'(e) - c''(e)e &= 0 \end{aligned}$$

The second equation defines e^{SB}. From the first equation, (LL_1) is binding, since $\rho = 1$, hence $w = 0$. Finally, the ICC implies that $\Delta w = c'(e^{SB})$. ■

Proof of Corollary 1. Part (a) of the corollary is proved by comparing the implicit functions determining the level of effort in the FB and SB. Formally,

$$\Delta V = c'(e^{SB}) + c''(e^{SB})e^{SB} \text{ and } \Delta V = c'(e^{FB})$$

since $c(e)$ is increasing and convex $e^{FB} > e^{SB}$. Note also that $\frac{de^{FB}}{d\Delta V} = \frac{1}{c''(e^{FB})} > \frac{de^{SB}}{d\Delta V} = \frac{1}{2c''(e^{SB})+ec'''(e^{SB})} > 0$. Finally note that $\frac{d\pi^{FB}}{d\Delta V} = e^{FB} > \frac{d\pi^{SB}}{d\Delta V} = e^{SB}$.
It is also clear that $EU_m = ec'(e^{SB}) - c(e^{SB}) > 0$. Also, $\frac{dEU_m}{d\Delta V} = e^{SB}c''(e^{SB})\frac{de^{SB}}{d\Delta V} > 0$ imply that the informational rents increase with the firm's project. This is part (b).

Since $\pi^{FB} = (\underline{V} - I) + e^{SB}\Delta V - e^{SB}c'(e^{SB})$ and $\pi^{SB} = (\underline{V} - I) + e^{SB}\Delta V - e^{SB}c'(e^{SB})$. Then, noting that $\pi^{FB}(\Delta V = 0) = \pi^{SB}(\Delta V = 0) < 0$, and $\frac{d\pi^{FB}}{d\Delta V} > \frac{d\pi^{SB}}{d\Delta V} > 0$ imply that $\Delta V^{FB} > \Delta V^{SB} > 0$ exist and they are unique. ■

Proof of Lemma 2. We solve [P2]. The manager cannot exert efforts below $\underline{e}$ and manager's costs switch from $c()$ to $\theta c()$. Hence, we need to analyze two different programs: the case where $e \leq \underline{e}$ which means that $e = \underline{e}$ and the case where $e > \underline{e}$.

(a) In the first case, if $e = \underline{e}$, the solution to this program is obtained by solving

$$\underset{\{w,\Delta w\}}{Max} [\underline{V} + \underline{e}\Delta V - w - \underline{e}\Delta w - I]$$

$$s.t \quad w + \underline{e}\Delta w \geq \theta c(\underline{e}),\ \Delta w \leq \theta c'(\underline{e}),\ \Delta w \geq 0,\ w \geq 0.$$

Note that the objective function consists on minimizing the expected manager's payment $(w + \underline{e}\Delta w)$. Hence, the solution is any pair $(w, \Delta w) \geq 0$ such that (PC) binds and $\Delta w < \theta c'(\underline{e})$. Note that since $w + \underline{e}\theta c'(\underline{e}) \geq \theta c(\underline{e})$, it is the case that $\Delta w < \theta c'(\underline{e})$. Therefore, if $\underline{e}$ is implemented $\pi(\underline{e}) = \underline{V} - I + \underline{e}\Delta V - \theta c(\underline{e})$, which is an increasing linear function of ΔV.

(b) In the latter case, $e > \underline{e}$ the program is slighty different to the one solved in Lemma 1. It is exactly the same but $\Delta w = \theta c'(e)$ and the manager's cost changing from $c(e)$ to $\theta c(e)$. Therefore, let $L(w, e; \lambda, \rho) = V - I + e\Delta V - w - \theta ec'(e) + \rho w$ be the lagrangian corresponding to this case. The FOC's of this program are

$$\rho = 1 \textit{ and } \Delta V = \theta(c'(e) + c''(e)e)$$

In this case, the optimal effort e^{CBP} is defined implicitly by the second equation. Note that $EU > 0$ (PC) is not binding due to $\rho = 1$. Therefore, if e^{CBP} is implemented $\pi(e^{CBP}) = \underline{V} - I + e^{CBP}\Delta V - \theta e^{CBP}c'(e^{CBP})$, which is an increasing and strictly convex function of ΔV.

(c) Finally, comparing (a) and (b), we derive the threshold ΔV^{CBP}. If $\Delta V \in [0, \theta(c'(\underline{e}) + c''(\underline{e})\underline{e})]$ the level of effort must be the minimum level of effort $\underline{e}$ since $e^{CBP} < \underline{e}$. Also, at $\Delta V = \theta(c'(\underline{e}) + c''(\underline{e})\underline{e})$, $\underline{e} = e^{CBP}$ and $\pi(\underline{e}) > \pi(e^{CBP})$ since $EU > 0$ if e^{CBP} is the effort implemented, and $EU = 0$ otherwise. Finally since $\pi(\underline{e})$ is linear increasing while $\pi(e^{CBP})$ is strictly convex and $\pi(\underline{e}) \mid_{\Delta V=0} < \pi(e^{CBP}) \mid_{\Delta V=0} = 0$, both function cross only at one point for $e > \underline{e}$. Let us define ΔV^{CBP} as the ΔV such that $\pi(\underline{e}) = \pi(e^{CBP})$. To sum up, the profit function is:

$$\pi^{CBP} = \begin{array}{ll} (V-I)+\underline{e}\Delta V-\theta c(\underline{e}) & if \;\; \Delta V \leq \Delta V^{CBP} \\ (V-I)+e^{CBP}\Delta V-\theta e^{CBP}c'(e^{CBP}) & if \;\; \Delta V \geq \Delta V^{CBP} \end{array}$$

which is continuous and $\frac{d\pi^{CBP}}{d\Delta V} > 0$. ■

Proof of Proposition 1. Proving Proposition needs to compare $\pi^{SB}$and π^{CBP}. The shareholder adopts the Code if $\pi^{SB} < \pi^{CBP}$. First of all, note that if $\Delta V \geq \Delta V^{CBP}$choosing the Code is a dominated strategy: $e^{FB} > e^{SB} > e^{CBP}$ and $\theta > 1$ which implies that $\pi^{CBP} = (V-I)+e^{CBP}\Delta V-\theta e^{CBP}c'(e^{CBP}) < \pi^{SB} = (V-I)+e^{SB}\Delta V-e^{SB}c'(e^{SB})$. For $\Delta V \leq \Delta V^{CBP}$, since π^{CBP} is an increasing linear function with $\pi^{CBP}(\Delta V = 0) < 0$ while π^{SB} is a convex and increasing function with $\pi^{SB}(\Delta V = 0) = 0$. Then, since $\lim\limits_{\Delta V \to \infty} \pi^{SB} = \infty$ if both function cross they do it twice. Note that $\frac{d\pi^{SB}}{d\theta} = 0 > \frac{d\pi^{CBP}}{d\theta}$. This implies that if θ is large enough both function do not cross each other.

Let us assume that $\theta = 1$, then both functions cross twice since at $\Delta V = 0$ $\pi^{SB} > \pi^{CBP}$ while at $\Delta V = c'(\underline{e})+\underline{e}c''(\underline{e}) \rightarrow \pi^{SB} < \pi^{CBP}$since$\underline{e} = e^{SB}$ and $c(\underline{e}) < e^{SB}c'(e^{SB})$ by convexity of $c()$. Consider now $\theta = \frac{\underline{e}c'(\underline{e})}{c(\underline{e})}$, then at $\Delta V = c'(\underline{e})+\underline{e}c''(\underline{e})$ $\pi^{SB} = \pi^{CBP}$, which in turn imply that $\pi^{SB} > \pi^{CBP}$ for $\Delta V \neq c'(\underline{e})+\underline{e}c''(\underline{e})$ since π^{SB} is convex while π^{CBP} is linear and $\pi^{SB}(\Delta V = 0) = 0 > \pi^{CBP}(\Delta V = 0)$. Therefore, if $\theta \in (1, \frac{\underline{e}c'(\underline{e})}{c(\underline{e})})$ $\pi^{CBP} > \pi^{SB}$ if $\Delta V \in [\Delta V(1), \Delta V(2)]$ where $\Delta V(1), \Delta V(2)$ are obtained implicitly by solving $\pi^{SB} = \pi^{CBP}$ whenever $\theta \in (1, \frac{\underline{e}c'(\underline{e})}{c(\underline{e})})$. ■

Proof of Proposition 2. Since the firm adopts the Code, it implies that $\Delta V \in [\Delta V(1), \Delta V(2)]$ (see Proof of Proposition 1). From Proposition 1 it is also clear that $\Delta V(1) < c'(\underline{e})+\underline{e}c''(\underline{e}) < \Delta V(2)$. Finally, note that e^{SB} is an increasing function of ΔV while the minimum level of effort is independent of ΔV. Therefore, $e^{SB} < \underline{e}$ if $\Delta V \in [\Delta V(1), c'(\underline{e})+\underline{e}c''(\underline{e})]$ while $e^{SB} > \underline{e}$ if $\Delta V \in [c'(\underline{e})+\underline{e}c''(\underline{e}), \Delta V(2)]$. ■

Proof of Lemma 3. This proof is obtained by deriving the FB program and the SB program respectively:

$$\begin{aligned} I^{FB} &\in \arg\max\{\underline{V}(I)+e^{FB}(I)\Delta V(I)-I-c(e^{FB}(I))\} \\ FOC &= 0 \Longleftrightarrow \underline{V}'(I)+e^{FB}(I)\Delta V'(I)-1 = 0 \end{aligned}$$

while

$$\begin{aligned} I^{SB} &\in \arg\max\{\underline{V}(I) + e^{SB}(I)\Delta V(I) - I - c(e^{SB}(I))\} \\ FOC &= 0 \Longleftrightarrow \underline{V}'(I) + e^{SB}(I)\Delta V'(I) - 1 = 0 \end{aligned}$$

Finally we can guarantee that the interior solution is well defined if $SOC < 0$. This happens whenever the marginal profitability is not huge enough, since if larger the optimum would be find in a corner solution. Then, if

$$\Delta V'(I^{FB}) \in (0, -\frac{\underline{V}''(I^{FB}) + e^{FB}\Delta V'(I^{FB})}{\frac{de^{FB}(I^{FB})}{dI^{FB}}})$$

and $\underline{V}'(0) > 1$ let us guarantee that the solution always exists. Hence, we only need to compare both solutions and since $e^{FB}(I) > e^{SB}(I)$ it is the case that $I^{SB} < I^{FB}$ when $\Delta V'(I) > 0$ and $I^{SB} > I^{FB}$ when $\Delta V'(I) < 0$. ∎

Proof of Lemma 4. If a firm adopts the Code, the level of investment depends on the rules selected, which implement $\underline{e}$. Analogously to the previous Lemma,

$$\begin{aligned} I^{CBP} &\in \arg\max\{\underline{V}(I) + \underline{e}\Delta V(I) - I - \theta c(\underline{e})\} \\ FOC &= 0 \Longleftrightarrow \underline{V}'(I^{CBP}) + \underline{e}\Delta V'(I^{CBP}) - 1 = 0 \end{aligned}$$

and the $SOC < 0$ since $\underline{V}''(I^{CBP}) + \underline{e}\Delta V''(I^{CBP}) < 0$. Note that by differentiating totally FOC=0, we obtain that

$$\frac{dI^{CBP}}{d\underline{e}} = \frac{-\Delta V'(I^C)}{\underline{V}''(I^C) + \underline{e}\Delta V''(I^C)}$$

which is positive for complements and negative for substitutes and let us define $\underline{V}'(I^{\min}) = 1$ and $\underline{V}'(I^{\max}) + \Delta V'(I^{\max}) = 1$. From Lemma 3 and these definitions we can notice that $I^{\min} < I^{SB} < I^{FB} < I^{\max}$ if complements and the reverse if complements. Therefore, we only need to realize that at $c'(\underline{e}^1) + \underline{e}^1 c''(\underline{e}^1) = \Delta V'(I)$ $\underline{e}^1$ coincides with e^{SB}, and $\underline{e}^2$ coincides with e^{FB} at $c'(\underline{e}^2) = \Delta V'(I)$. This proves Lemma 3. ∎

Proof of Proposition 3. Let us prove the conditions for adopting the Code. Note that the level of profits obtained if the Code is adopted are

$$\begin{aligned} \pi^{CBP} &= \underline{V}(I^{CBP}(\underline{e})) + \underline{e}\Delta V(I^{CBP}(\underline{e})) - I^{CBP}(\underline{e}) - \theta c(\underline{e}) \\ \frac{d\pi^{CBP}}{d\underline{e}} &= \Delta V(I^{CBP}(\underline{e})) - \theta c'(\underline{e}) = 0 \\ \frac{d^2\pi^{CBP}}{d\underline{e}^2} &= \Delta V'(I^{CBP}(\underline{e}))\frac{dI^{CBP}}{d\underline{e}} - \theta c''(\underline{e}) < 0 \end{aligned}$$

where we have used the envelope theorem in obtaining the FOC and SOC if the marginal profitabilities are not large enough. As we can observe both the level of profits as well as the optimal minimum level of effort decreases if θ increases. If $\widehat{\theta} = \frac{\underline{e}c'(\underline{e})}{c(\underline{e})}$, $\underline{e} = \underline{e}_1 = e^{SB}(I^{SB})$, and moreover, at $\underline{e} = \underline{e}_1$ $\pi^C = \pi^{SB}$, which in turn imply that if $\theta > \widehat{\theta}$ the shareholder does not adopt the Code. Therefore, if $\theta < \widehat{\theta}$, we have that at $\underline{e}_1$ $\pi^C > \pi^{SB}$. Given that π^C is concave in regard $\underline{e}$ while π^{SB} is constant respect $\underline{e}$, then $\pi^C = \pi^{SB}$ are equal in two points $\underline{e}_1^C$ and $\underline{e}_2^C$. Moreover $\underline{e}_1^C < \underline{e}_1 < \underline{e}_2^C$.

Part 2 of Proposition 1 is derived from the previous analysis. We know that the Code is adopted if $\underline{e}_1^C < \underline{e}_1 < \underline{e}_2^C$, then if $\underline{e} \in (\underline{e}_1^C, \underline{e}_1)$, the level of Investment selected if the Code is adopted is lower than the SB situation, as we showed in Proof of Lemma 3. Similarly if $\underline{e} > \underline{e}_1$ we have that underinvestment effect is alleviated ($I^C > I^{SB}$). Assume that $\theta = 1$, then it is clear to realize that $\underline{e}_1^C < \underline{e}_2 < \underline{e}_2^C$ due to the concavity of π^C since the maximum is achieved at $\underline{e}_2$. Therefore, as long as $\pi^{FB} > \pi^{SB}$ we have $\underline{e}_2 < \underline{e}_2^C$. Finally and as we showed before, if $\theta = \widehat{\theta}$ $\underline{e}_1^C = \underline{e}_1 = \underline{e}_2^C < \underline{e}_2$.

Therefore, this implies that, by continuity, there exists a $\theta = \widetilde{\theta}$ such that $\underline{e}_2 = \underline{e}_2^C$. This proves the last part of Proposition 3 since if the Code is very rigid and $\theta < \widetilde{\theta}$ we obtain that $\underline{e} \in (\underline{e}_2, \underline{e}_2^C)$ which in turn imply that $I^C > I^{FB}$. ■

Proof of Proposition 4. In this case, the program that the regulator must solve is the following

$$\underset{\{\underline{e}\}}{Max}\frac{1}{\overline{\Delta V}}\{\int\limits_{0}^{\Delta V(1)} \pi(e^{SB})d\Delta V + \int\limits_{\Delta V(1)}^{\Delta V(2)} \pi(\underline{e})d\Delta V + \int\limits_{\Delta V(1)}^{\Delta V(2)} \pi(e^{SB})d\Delta V\}$$

$$s.t \quad \theta(\underline{e}) = (1 + b\underline{e})$$

The first order condition of this program is

$$\begin{aligned}
\int\limits_{\Delta V(1)}^{\Delta V(2)} [\Delta V - \theta(\underline{e})c'(\underline{e}) - \theta'(\underline{e})c(\underline{e})]d\Delta V &= 0 \\
\int\limits_{\Delta V(1)}^{\Delta V(2)} \Delta V d\Delta V - (\theta(\underline{e})c'(\underline{e}) + \theta'(\underline{e})c(\underline{e})) \int\limits_{\Delta V(1)}^{\Delta V(2)} d\Delta V &= 0 \\
\frac{\Delta V(2)^2 - \Delta V(1)^2}{2} - (\theta(\underline{e})c'(\underline{e}) + \theta'(\underline{e})c(\underline{e}))(\Delta V(2) - \Delta V(1)) &= 0
\end{aligned}$$

and manipulating this expression, we obtain

$$\frac{\Delta V(1)+\Delta V(2)}{2}=\theta(\underline{e})c'(\underline{e})+\theta'(\underline{e})c(\underline{e}),$$

SOC conditions are defined through the following equation obtained by deriving FOC

$$\Delta V(2)\frac{d\Delta V(2)}{d\underline{e}}-\Delta V(1)\frac{d\Delta V(1)}{d\underline{e}}-(\frac{d\Delta V(2)}{d\underline{e}}-\frac{d\Delta V(1)}{d\underline{e}})\theta(\underline{e})c'(\underline{e})+\theta'(\underline{e})c(\underline{e})$$
$$-(\Delta V(2)-\Delta V(1))(2\theta'(\underline{e})c'(\underline{e})+\theta''(\underline{e})c(\underline{e})+\theta(\underline{e})c''(\underline{e}))<0$$

SOC can be rewritten in the following way:

$$\frac{d\Delta V(2)}{d\underline{e}}[\Delta V(2)-\theta(\underline{e})c'(\underline{e})+\theta'(\underline{e})c(\underline{e})]-\frac{d\Delta V(1)}{d\underline{e}}[\Delta V(1)-\theta(\underline{e})c'(\underline{e})+\theta'(\underline{e})c(\underline{e})]$$
$$-(\Delta V(2)-\Delta V(1))(2\theta'(\underline{e})c'(\underline{e})+\theta''(\underline{e})c(\underline{e})+\theta(\underline{e})c''(\underline{e}))<0$$

Note that by the IFT, we can derive

$$\begin{aligned}\frac{d\Delta V(2)}{d\underline{e}} &= \frac{\Delta V(2)-\theta(\underline{e})c'(\underline{e})+\theta'(\underline{e})c(\underline{e})}{e^{SB}(\Delta V(2))-\underline{e}}=\frac{1}{2}[\frac{\Delta V(2)-\Delta V(1)}{e^{SB}(\Delta V(2))-\underline{e}}]>0\\ \frac{d\Delta V(1)}{d\underline{e}} &= \frac{\Delta V(1)-\theta(\underline{e})c'(\underline{e})+\theta'(\underline{e})c(\underline{e})}{e^{SB}(\Delta V(1))-\underline{e}}=\frac{1}{2}[\frac{\Delta V(1)-\Delta V(2)}{e^{SB}(\Delta V(1))-\underline{e}}]>0\end{aligned}$$

where the last equality is obtained by applying FOC. Let us introduce these equations in the SOC and rearranging we obtain

$$\frac{1}{2}[\frac{\Delta V(2)-\Delta V(1)}{e^{SB}(\Delta V(2))-\underline{e}}](\frac{\Delta V(2)-\Delta V(1)}{2})+\frac{1}{2}[\frac{\Delta V(1)-\Delta V(2)}{e^{SB}(\Delta V(1))-\underline{e}}](\frac{\Delta V(2)-\Delta V(1)}{2})$$
$$-(\Delta V(2)-\Delta V(1))(2\theta'(\underline{e})c'(\underline{e})+\theta''(\underline{e})c(\underline{e})+\theta(\underline{e})c''(\underline{e}))<0$$

where FOC has also been introduced in the previous equation. Rearranging we obtain

$$\begin{aligned}\frac{1}{4}\{\frac{\Delta V(2)-\Delta V(1)}{e^{SB}(\Delta V(2))-\underline{e}}+\frac{\Delta V(1)-\Delta V(2)}{e^{SB}(\Delta V(1))-\underline{e}}\} &< (2\theta'(\underline{e})c'(\underline{e})+\theta''(\underline{e})c(\underline{e})+\theta(\underline{e})c''(\underline{e}))\\ \frac{\Delta V(2)-\Delta V(1)}{4}\{\frac{1}{e^{SB}(\Delta V(2))-\underline{e}}-\frac{1}{e^{SB}(\Delta V(1))-\underline{e}}\} &< (2\theta'(\underline{e})c'(\underline{e})+\theta''(\underline{e})c(\underline{e})+\theta(\underline{e})c''(\underline{e}))\end{aligned}$$

which implies that SOC holds as long as the regulator technology as well as the manager's cost are convex enough.

Note also that if the regulator's program has an optimum for this general function, it is also true that the FOC appoints for a maximum also if $\theta(\underline{e})=(1+b\underline{e})$.

(b)We need to prove comparative statics. Regarding the parameter b we can apply IFT which imply that

$$\frac{d\underline{e}}{db} = -\frac{\frac{\partial FOC}{\partial b}}{\frac{\partial FOC}{\partial \underline{e}}}$$

Recall from the part (a) of this proof that $\frac{\partial FOC}{\partial \underline{e}} < 0$, which implies that $sign(\frac{de}{db}) = sign(\frac{\partial FOC}{\partial b})$. Therefore,

$$\frac{\partial FOC}{\partial b} = \frac{1}{2}\{\frac{d\Delta V(2)}{db} + \frac{d\Delta V(1)}{db}\} - (\underline{e}c'(\underline{e}) - c(\underline{e}))$$

We can obtain $\frac{d\Delta V(2)}{db}$ and $\frac{d\Delta V(1)}{db}$ by differentiating totally $\underline{e}\Delta V - (1+b\underline{e})c(\underline{e}) = e^{SB}\Delta V - e^{SB}c'(e^{SB})$. Hence,

$$\frac{d\Delta V(1)}{db} = \frac{\underline{e}c(\underline{e})}{\underline{e} - e^{SB}(\Delta V(1))} > 0 \text{ and } \frac{d\Delta V(2)}{db} = \frac{\underline{e}c(\underline{e})}{\underline{e} - e^{SB}(\Delta V(2))} < 0$$

where $e^{SB}(\Delta V(i))$ is the SB effort evaluated at $\Delta V(i)$ $i \in \{1, 2\}$. This implies that the larger is b the less are the number of firms willing to adopt the Code. This means that we can derive a b large enough such that $\Delta V(1) = \Delta V(2)$ which means that the derivative would have a negative sign. A sufficient condition for this to be true is $\underline{e} \geq \frac{e^{SB}(\Delta V(1))+e^{SB}(\Delta V(2))}{2}$.

Comparative stattics regarding the upper limit bound of the distribution. Consider now that the upper limit of the distribution is low enough. In particular, let us assume that $\overline{\Delta V}$ is so low that the regulator's problem become

$$L(\underline{e};\varphi) = \frac{1}{\overline{\Delta V}}\{\int_{0}^{\Delta V(1)} \pi(e^{SB})d\Delta V + \int_{\Delta V(1)}^{\overline{\Delta V}} \pi(\underline{e})d\Delta V\}\ s.t\ \theta = \theta(\underline{e})$$

then the FOC can also be rewritten as

$$\frac{\Delta V(1) + \overline{\Delta V}}{2} = \theta'(\underline{e})c(\underline{e}) + \theta(\underline{e})c'(\underline{e})$$

where $\overline{\Delta V} < \Delta V(2)$ which in turn imply that the minimum level of effort $\underline{e}$ must be lower than in the previous case. This is true since the RHS is an increasing function of $\underline{e}$. ■