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Abstract

We address one of the cardinal puzzles of European corporate law: the lack of derivate shareholder suits. In the vast majority of European jurisdictions, shareholders can bring a derivative action (for damages) against the management for breach of fiduciary duty. In all of these countries, a derivative lawsuit is the only remedy against managerial misconduct. In spite of corporate fraud by managers there are no such lawsuits. We explain this apparent paradox on the basis of percentage limits. The laws of percentage limits require shareholders to hold a minimum amount of typically 5% to 10% in order to bring an action against the management and they are extremely wide-spread in Europe. Since small shareholders are not entitled to sue, there is an incentive for managers to collude with large shareholders. In a four-stage-model, we show that, given the current percentage limits, managers will misappropriate corporate assets and split the proceeds with large shareholders. Contrary to current and past approaches to agency theory, we find that, in this equilibrium, (1) large shareholders do not monitor the management, (2) small shareholders do not free ride and (3) the residual ownership is not held by the shareholders on the whole but by the managers and the large shareholders. This interpretation of the current situation is consistent with empirical studies that find a more concentrated shareholder structure in Europe than in the United States.

Keywords

Agency Theorey, Derivative Suits, Shareholder Suits, Percentage Limits, Collusion, Residual Owners, Corporate Fraud, Managerial Misconduct, European Law, European Corporations, Europe, Large Shareholders, Free Rider, Collective Action, Settlements, Monitoring, Rent-Seeking

JEL Classification

K22, K42, G30

Introduction

In the vast majority of European jurisdictions minority shareholders can bring a derivative action against the management for breach of fiduciary duty.[1] Surprisingly in spite of corporate fraud, there are practically no such lawsuits in continental Europe. Both the European Jurists Forum as well as the German Jurists Forum have issued experts opinions that include various proposals for a better regulation of management liability.[2] The German law of 2005 (UMAG) has recently amended the corporation act in this regard.[3] The answer to the main puzzle, i.e. the absence of derivative lawsuits in Europe, is crucial to any regulation that seeks to incentivize shareholder suits as a deterrence for managerial misconduct. This will also give us a better understanding of the residual ownership of the corporation.

So far no theoretic models have been developed to explain the absence of derivative suits; however, intuitive reasons have been offered in the legal literature. It was argued that the shareholders are subject to a free rider problem.[4] Derivative suits are brought on behalf of the corporation, so that the damage payments go to the corporation as a whole; however, the litigation costs have to be borne by the plaintiff, in case he loses. These asymmetric payoffs would cause every single shareholder to wait for other shareholders to bring an action and in the end no one would sue the managers.[5] The problem with this argument is if misappropriation of corporate funds is not sanctioned at all, the manager would simply misappropriate as much corporate assets as possible. Then, of course, every single shareholder would be better off by bringing an action which results in an equilibrium where there are some suits and where there is some misappropriation. Even though there may be fewer lawsuits than socially optimal there will always be some suits, which is supported by the fact that are plenty of lawsuits in the United States.[6]

We will offer an alternative explanation for why there are no lawsuits based on percentage limits and explain what happens if we lowered the thresholds. Reform proposals that suggest to decrease the percentage limits[7] argue that a mere decrease will have little or no effect. The argument is, whatever the reason for the lack of suit may be, small shareholders have fewer incentives to bring an action than large shareholders; thus adding small shareholders to the pool of potential plaintiffs would not change the current situation.[8] Consequently, authors propose to provide for plaintiff's reward or contingency fee for the plaintiff shareholder, respectively.[9] We will show that decreasing the percentage limits beyond a certain threshold will itself change the current situation. That is not to argue against plaintiff's rewards; however, plaintiff's rewards may be problematic with respect to national legal capital regimes. Our analysis will also allow

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[1] In greater detail see Kalss (ed., 2005).

[2] Kalss (2005a); Baums (2000). The scholarly discussion includes e.g. Eckert, Grechenig & Stremitzer (2005).

[3] German Law of September 22, 2005, BGBl. I 2005, No. 60., p. 2802 (Sept. 27, 2005), *Gesetz zur Unternehmensintegrität und Modernisierung des Anfechtungsrechts (UMAG)*.

[4] Adams (1997).

[5] This is known as the Volunteers Dilemma, Poundstone (1992) pp. 201-203

[6] Romano (1991).

[7] Apparently, a 1% limit seems to be a popular compromise (see Ulmer (1999) and the Jurists Forum experts opinions cited under FN 2). Accordingly, for the United States Thompson & Thomas (2004) argue that the demand requirement in order to bring a derivate suit shall not apply to 1% shareholders. See also the Amended Proposal of 20 November 1991 for a Fifth Directive, COM (91) 372 final, which provides for a 5 % threshold and an ECU (Euro) face value threshold.

[8] Kalss (2005). The argument that small shareholder have fewer incentives than large shareholders was made *ceteris paribus* (and not generally) by Eckert, Grechenig & Stremitzer (2005) who also explain that decreasing the limits may have an effect.

[9] E.g. Adams (1997); compare also Wenger (1997).

for some implications to show that the current percentage limits allocate the residual ownership of the corporation to the managers and the large shareholders, not to small shareholders.

In a large number of European countries *not all* minority shareholders can bring an action against the management for breach of fiduciary duties. Instead, the right to sue the management is allocated to shareholders with a stake of at least either 5% (Czech Republic, Spain, Slovakia) or 10% (Austria, Bulgaria, Hungary, Slovenia, Sweden).[10] Germany has recently lowered the 10% threshold to 1%, Italy from 5% to 2.5%. Small shareholders could form a group in order to reach the percentage limit which typically is allowed by European national jurisdictions. However, there are no procedural provisions for class actions; consequently, a large number of shareholders would have to incur prohibitively high costs in order to act collectively. Commonly, commentators justify the minimum stock requirement and other limitations on the basis of frivolous suits.[11] They argue that small shareholders would sue more frequently than socially optimal or sue even though they know that the managers have not violated the law. However, under the current regulation, the management can misappropriate corporate assets and split the proceeds with the shareholders that are entitled to bring an action.

Our paper ties in with the scarce game theoretical literature on derivative shareholder suits (Stepanov, 2006) as well as with agency models (see Shleifer & Vishny, 1997). Private benefits are a well known phenomenon absent percentage limits and have been described as an agency problem between the management and the shareholders. It is conventionally believed that large shareholders mitigate the agency problem between the management and the shareholders but they create a new agency problem, namely between large and small shareholders (Black, 1992; Admati, Pfleiderer & Zechner, 1994; Gilson & Gordon, 2003). Empirical evidence, which shows that large blocks trade at a higher price than single shares, supports this theory (Barclay & Holderness, 1989 and 1992; Zingales, 1995). Of course, collusion between large shareholders and managers cannot explain, absent percentage limits, why there are no suits. Small shareholders would monitor and sanction misappropriation by large shareholders; we would expect some misappropriation and some lawsuits. With percentage limits the picture looks different because the manager can bribe the plaintiff-shareholders. Other than most agency models (e.g. Alchian & Demsetz, 1972; Jensen & Meckling, 1976; Grossmann & Hart, 1983; Demsetz, 1986), we find an equilibrium with zero monitoring, where managers, together with large shareholders are the residual owners of the firm. In this equilibrium there are also no lawsuits. Only if percentage limits are decreased beyond a certain threshold the results are consistent with conventional models. The managers will sometimes misappropriate corporate assets and shareholders will sometimes sanction this behavior. Managers will not be the residual owners of the firms anymore.

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[10] Rada & Hanslik (2005); Oelkers (2005); Grechenig (2005); Mašurová (2005); Daskalov (2005); Gálffy (2005); Prelič & Babuder (2005); Zechner (2005) and the whole collected edition. There are other countries with percentage limits and no derivative suits, like China; see Zhang (2007). It is worthwhile noting that Switzerland, France and England do not provide for percentage limits; hence, our analysis does not apply to these countries. We acknowledge that there may be countries without percentage and lawsuits which suggests that there may be other mechanisms (like prohibitively high non-refundable litigation costs) which prevent lawsuits.

[11] E.g. Ulmer (1999) at 327-329; Baums (2000) at F 249-251. With respect to the United States see Loewenstein (1999) arguing that awarding attorneys' fees often results in an over-incentivation of shareholder suits; see also Romano (1991); for Japan: West (2001). A number of studies have analyzed in a general context how plaintiffs can credibly threat to bring a negative NPV suit; e.g. Bebchuk (1988).

A model of shareholder suits

At t=0, in a given firm, there is a manager M and a plaintiff-shareholder P entitled to bring an action with a stake of $\mu \in (0;1)$ which both can observe. The remaining shareholders that hold a stake $1-\mu$ are not entitled to bring an action and thus are not actors in our model. We abstract from collective action problems that may arise if there is more than one plaintiff-shareholder. Under current law, only very few, well coordinated shareholders are allowed to bring an action, so that P could also be a coalition of potential plaintiffs.[12] This is not crucial to our main results as they hold true for *n* plaintiff-shareholders whether or not they are coordinated. The lower the legal percentage threshold to bring an action is, the higher is μ. Clearly, the total share that will be able to bring an action will be larger if the percentage limit is 1% than if it were 10%. Any shareholder that holds between 1% and 10% would only be allowed to bring an action under the first rule.

At t=1, P chooses his monitoring costs $m \in [0;\infty)$ which the manager M can observe. The manager knows how frequently P asks for information and how detailed the information has to be.

At t=2 the manager decides whether (Ψ=1) or not (Ψ=0) to misappropriate a given fraction $\alpha \in (0;1)$ of the corporate assets $A \in (0;\infty)$ to the detriment of all shareholders. αA could be an opportunity of private rent extraction in the course of a takeover or any other self-dealing opportunity. This kind of misappropriation refers to all kinds of wealth transfers with a personal interest of the manager (often refered to as tunneling), including the misappropriation of an investment opportunity that belongs to the corporation, and the employment of an unqualified applicant who is a close friend of the manager. P does not know whether or not M has stolen (that is, $\Psi \in \{0,1\}$ is hidden action). However, we assume that αA is common knowledge and thus also known by P. This reflects the fact that everybody has some minimum information about potential (not actual) misappropriation. Moreover, any investor with a share large enough to bring an action is likely to be respresented in the board and thus has direct access to such information.

Because the manager has to camouflage his actions his gains are somewhat lower, discounted by $\beta \in (0;1)$ where β will be close to 1 if misappropriation is almost costless and close to 0 otherwise. Those concealment costs are common knowledge and may involve the formation of a separate company, bribing the news media, potential criminal sanctions etc. At this point, M can also decide whether or not to offer P a bribe $\Phi \in [0;\infty)$ in order to induce P not to bring a lawsuit (where Φ=0 means no bribe). The payoff of the manager for not stealing is zero. Any reputational gain he may receive for an honest behavior will be captured by β; that is, potential reputational gains increase the opportunity costs of stealing.[13]

At t=3, P receives a signal $S \in \{0,1\}$ that indicates whether or not M has breached the law, where 1 means that he has stolen αA and 0 that he has not stolen αA. We define $s(m) \in [0.5;1)$ as the probability that the signal is correct [$s(m)$ = *prob* (S = 0 | Ψ = 0) = *prob* (S = 1 | Ψ = 1)]. If P

[12] This may also include two shareholders that reach the required percentage limit only if they act together. Due to their relatively small number, those large shareholders do not need a special procedure regulating collective actions, in order to bring a lawsuit. Note, however, that we have assumed (see above p. 4.) that small shareholders cannot act collectively in order to reach the legally required percentage limit due to the high costs associated with a collective action.

[13] Note that this model does not involve a repeated game; we refer to reputation arguments in order to suggest that a repeated game would not yield any different result.

chooses zero monitoring costs [m=0], the signal is random [$s(0)$=0.5]. Shareholders that choose higher monitoring costs will receive a better signal at a marginally decreasing rate [$s(m)'>0$, $s(m)''<0$]. We also assume that S is asymptotically correct [$\lim_{m\to\infty} s(m)=1$] and that the first marginal unit of monitoring is infinitely useful [$\lim_{m\to 0} s'(m)=\infty$].[14] The signal function [$s(m)$] is common knowledge.

At t=4, P decides whether (Θ=1) or not (Θ=0) to bring an action against the manager, depending on the chosen monitoring costs, the observed signal and the offer he may have received. P's information is (m, S, Φ). Since the damage payments go to the corporation as such, P receives only $\mu\alpha A$, if he wins. Instead of bringing a lawsuit, P can decide to accept the bribe or settlement offer, respectively, if M has made one. We assume that P accepts the offer made if he decides not to bring an action. The pre-trial settlement payment would be made to P only and not to the remaining shareholders. Under most European jurisdictions such settlements would be illegal and thus not enforceable. In this case, settlement payments would be considered bribes. P could accept the settlement payment and then bring an action on behalf of the corporation or pass the information on to somebody else etc. However, payments can be made and potential plaintiffs that have received a bribe will not bring an action. If they brought an action subsequently to having received a bribe they will be held liable for their collusive conduct and have to return more than the bribe to the other shareholders. Since parties can credibly commit to abiding by the settlement agreement (bribe), we treat pre-trial settlements as enforceable. If a suit is successful the damages paid go to the corporation, i. e. each shareholder benefits from the action to the extent of his individual participation. Since there are no punitive damages the shareholders cannot end up with a payoff larger than zero. They can only retrieve what has been taken from them. The litigation costs c are borne by the loser (that is, by the plaintiff-shareholder if he loses and not by all shareholders)[15] and include the costs of the winning party.[16]

Note that we could also assume the settlement offer Φ to be made at t=3, that is, after the stealing decision. This makes no difference, since M cannot observe the signal P has received and the offer Φ does not influence the signal. The fact that P could approach M with a settlement offer and that there may be additional time periods where the parties negotiate for a settlement payment is irrelevant because it is always P who has to make the last decision and M is always well off if negotiations are never ending. Moreover, suits are limited to a certain time period after the damage occurs. Consequently, M has the power to make a take-it-or-leave-it-offer which makes all preceeding negotiations irrelevant.

We will exclude settlements after the suit was brought because of procedural obstacles. Typically the majority of shareholders has to approve such a settlement, a certain minority (equivalent to the minority entitled to bring an action) must not dissent and the payment would go to the corporation on the whole. This assumption is irrelevant for explaining the absence of lawsuits, since by definition a suit has been brought in this case; besides, it would simply lower the litigation costs without any substantial change in the results.

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[14] This assumption helps us to distinguish between two cases: one where M does not monitor because of prohibitively high monitoring costs and the case where M decides strategically not to monitor independent of the costs.

[15] This is the law in virtually all European countries; see Eckert, Grechenig & Stremitzer (2005) and the whole collected edition.

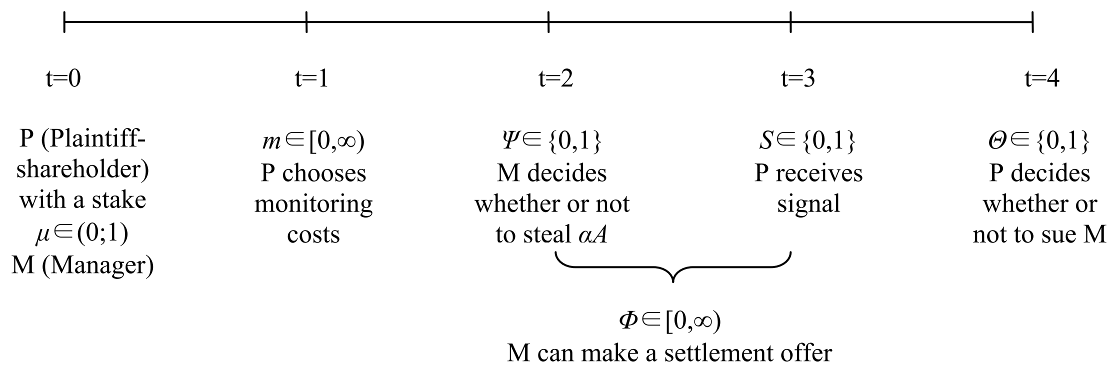
[16] We could distinguish between the total costs of M (c_M) and the total costs of P (c_P), where c_M could include costs that go beyond the costs captured by β (a reputational loss, crimimal sanctions etc for the case that M has lost the lawsuit). However, this does not affect the calculation of equilibria and thus yields the same main results.

In addition to derivative suits, national legislators allow shareholders to bring a direct lawsuit where damages are paid directly to the plaintiff-shareholder. However, this remedy is restricted to extremely few cases and certainly does not apply to a misappropriation of corporate assets; thus, we will exclude this kind of lawsuit from our considerations.[17]

We will assume that M and P are risk neutral.[18] We will also assume that the courts decisions are correct which is not implausible in our setup. Many analyses have focused on business decisions that courts find hard to evaluate. Accordingly, those results are based on the assumption that the courts decisions are not correct but wrong in either a biased or an unbiased way. On this basis the business judgment rule or some European equivalent was justified for cases where the managers were not subject to a conflict of interest. Since the managers are shielded from liability in those cases, we exclude them from our considerations. In recent years, the attention has shifted to transactions where the managers have a personal interest, like the various ways of misappropriating corporate assets. In these cases, it was hardly doubtful whether or not managers acted unlawfully. The fact that judges, other than the shareholders, can observe the manager's decision in our model is due to comprehensive legal powers, including the possibility to request and obtain undisclosed documents.

A strategy of M includes a combination of the stealing decision and the bribing decision for every possible monitoring choice of P: $\{\{\Psi \mid \Psi\in\{0,1\}\}\times\{\Phi \mid \Phi\geq 0\}\}^{\{m \mid m\geq 0\}}$

A strategy of P includes a monitoring choice, and the choice of suing M for every possible information that involves a combination of a signal and a bribe offer: $\{m \mid m\geq 0\}\times\{\Theta \mid \Theta\in\{0,1\}\}^{\{S \mid S\in\{0,1\}\}\times\{\Phi \mid \Phi\geq 0\}}$



Settlement offers (bribes)

We solve the game backwards. We treat *m* as exogenously given, since *m* can be observed by both players. Because the monitoring costs are sunk at this time we will not display them in P's payoffs. Of course, this does not change the strategic behavior of the actors. After solving all subgames we add the monitoring costs to the outcomes and solve the problem of the optimal monitoring choice. We will start with the pre-trial settlement negotiation problem.

[17] The same is true for rights of creditors to bring an action which some European legislators provide for; compare Eckert, Grechenig & Stremitzer (2005) at 126 et seq with a short summary of the economics of these suits.

[18] Risk aversion of M could be modeled through higher opportunity and litigation costs.

Proposition 1. *If M decides to make an offer (depending on the parameters of the model), the offer will always be $\mu\alpha A$ and P will always accept it. M will only offer $\mu\alpha A$ if he has previously stolen αA. (All other strategies are not part of a sequential equilibrium).*[19]

Proof. [see Appendix]

The intuition behind the fact that the only possible offer is $\mu\alpha A$ is the following: $\mu\alpha A$ is the maximum amount P can obtain by bringing a lawsuit (that is the stolen amount αA times the stake of the shareholder μ). Any offer lower than $\mu\alpha A$ would inform P of an illegal conduct; P would reject the offer, bring a lawsuit and obtain full compensation for his loss ($\mu\alpha A$). Any offer larger than that would be accepted by P. Of course, M will only offer the minimum amount that will be accepted by P (which is $\mu\alpha A$).[20]

This will allow us to the define a reduced strategy set of M and P:

Definintion 1. *Define M's reduced set of strategies as $\{M_h, M_d, M_c\}$; where M_h means that the manager acts honestly (Ψ=0) and offers no bribe (Φ=0), M_d that the manager acts dishonestly, that is M misappropriates αA (Ψ=1) without offering a bribe to P (Φ=0), and M_c means that M acts collusively, that is he misappropriates αA (Ψ=1) and offers P a bribe ($\Phi=\mu\alpha A$).*[21]

Definition 2. *Define P's reduced set of strategies as $\{P_a, P_v, P_c, P_b\}$; where, if no offer was made (Φ=0), P_a means that P does not bring an action (Θ=0), whether S=0 or S=1 (apathetic), P_v means that P brings an action (Θ=1) if S=1 and does not bring an action (Θ=0) if S=0 (vigilant), P_c means that P brings an action (Θ=1) if S=0 and does not bring an action (Θ=0) if S=1 (confused), P_b means that he brings an action (Θ=1) whether S=0 or S=1 (belligerent). If an offer $\Phi=\mu\alpha A$ was made, P will accept it in all four strategies (Θ=0).*[22]

This will leave us with the following strategy space: $\{P_a, P_v, P_c, P_b\}\times\{M_h, M_d, M_c\}$. The remaining subgame game starting at t=2 can be displayed in a strategic form, with P's payoffs on the left and M's payoffs on the right. As noted, we abstract from the monitoring costs at this stage, thus *m* is not displayed in the table.

	M_{honest}	$M_{dishonest}$	$M_{collusive}$
$P_{apathetic}$	0, 0	$-\mu\alpha A, \beta\alpha A$	$0, (\beta-\mu)\alpha A$
$P_{vigilant}$	$[1-s(m)](-c)$, 0	$[1-s(m)](-\mu\alpha A)$, $[1-s(m)]\beta\alpha A-s(m)[c+(1-\beta)\alpha A]$	$0, (\beta-\mu)\alpha A$

[19] For sequential equilibria see Kreps & Wilson (1982a).

[20] More precisely, P would be indifferent between accepting the offer and bringing a suit if M offered $\mu\alpha A$, but M's offer $\mu\alpha A$ is only the best response if P always accepts the offer. Otherwise, M would be better off by making an offer slightly above $\mu\alpha A$. [see Appendix]

[21] M_h:=(0,Φ=0), M_d:=(1, Φ=0), M_c:=(1,$\Phi=\mu\alpha A$).

[22] All of P's strategies in the reduced game are elements of the set (P_a,$\mu\alpha A$). Additionally P_a is element of (P_a,0), P_v is element of (P_v,0), P_c is element of (P_c,0), P_b is element of (P_b,0).

$P_{confused}$	$s(m)(-c)$, 0	$s(m)(-\mu\alpha A)$, $s(m)\beta\alpha A-[1-s(m)]\ [c+(1-\beta)\alpha A]$	0, $(\beta-\mu)\alpha A$
$P_{belligerent}$	$-c$, 0	0, $-[c+(1-\beta)\alpha A]$	0, $(\beta-\mu)\alpha A$

The current situation with high percentage limits: $\mu < \beta$

No derivative lawsuits & zero monitoring

Agency theory predicts that the shareholders will invest in monitoring until the marginal utility equals the marginal costs and that the managers will misappropriate corporate assets until his marginal utility equals his marginal costs. Consequently, there will be some monitoring and some stealing.[23] The same should be true for shareholder suits as a form of monitoring. However, with percentage limits the case changes dramatically.

To solve the remaining game we have to distinguish between two cases: $\mu<\beta$ and $\mu>\beta$. The first case ($\mu<\beta$) stands for high percentage limits or low costs of stealing. With high percentage limits the coalition of potential plaintiff shareholders is small (low μ); low costs of stealing imply a high β. As outside observers we may not be able to exactly determine the costs of stealing in order to know which set of parameters represents our current situation. However, we will see that $\mu<\beta$ is the only set of parameters that leads to an equilibrium where there are no lawsuits at all. From our empirical observation that there are no lawsuits we can conclude that this set of parameters best represents the current situation. Consequently, we will first solve $\mu<\beta$ and then see what happens if the legislator decreased the percentage beyond a certain threshold so that $\mu>\beta$.

Proposition 2.1. *With high percentage limits, $\mu<\beta$, M will always steal [prob(Ψ=1)=1] and bribe P ($d_M^*=M_c$). P will always accept the bribe (and play $d_P^*=P_b$ in a sequential equilibrium with justifiable beliefs.) There will be no lawsuits and no monitoring [$l^*,m^*=0$, where l^* is the probability of litigation (prob(Θ=1)) in equilibrium].*

Proof. [see Appendix]

Proposition 2.2. *The results of proposition 2.1 hold true in a game of n uncoordinated plaintiff shareholders.*

Proof. [see Appendix]

The intuition behind the fact that M will always steal and bribe P is the following: M will always extract private benefits because the value of the misappropriated assets to M exceeds the amount that is needed to bribe P [$\mu\alpha A<\beta\alpha A$], thus M's strategy to be honest is strictly dominated by the strategy to act collusively. In anticipation of this fact, P would always bring an action if M made no offer; M will anticipate this and always make a settlement offer $\mu\alpha A$; as noted above, the

[23] E.g. Jensen & Meckling (1976).

shareholder will always accept it. Clearly, if P knows that the manager will misappropriate corporate assets he has no incentives to invest in obtaining this information. In other words, P does not rely on the signal because he knows the action of M.[24] The same argument applies to more than one plaintiff-shareholder because M will always be better off bribing everyone as long as the sum of the shares of the plaintiff-shareholders is not too large ($\sum_{i=1}^{n} \mu_i < \beta$). In both cases the shareholder(s) will choose zero monitoring. Since he (they) know(s) the manager will misappropriate corporate assets it makes no sense for him (them) to invest in that knowledge.

It is conventionally believed that large shareholders monitor the managers and that small shareholders are free riders.[25] Large shareholders have lower monitoring costs per single share; thus, they will have more incentives to monitor.[26] This disadvantage is argued to be offset by private benefits that large shareholders receive in compensation for their costs. In contrast to the dominant view, developed against the background of American law where every single shareholder can bring an action, our model predicts that P (as our large shareholder) has no incentives to incur those monitoring costs. P knows that the manager will misappropriate corporate assets and thus will simply threaten to bring an action should he not be paid a bribe. In our model, the settlement payment is not a compensation for higher monitoring costs and small shareholders are not free riders because there is nothing to free ride. Moreover, these kinds of settlements have no deterrence effect on the manager's decision to misappropriate different from regular settlements that are motivated by the saving of litigation costs. It should be noted that the fact that the manager takes every opportunity for misappropriation does not necessarily mean that there is actually a lot of misappropriation. The size of total misappropriation depends on the amount of the opportunities.

Why small shareholders continue to invest

Our model does not extend to the investors' choice of a specific portfolio, i.e. most importantly the decision of a shareholder to hold more or less than the percentage limit required by law to bring an action. For the analysis of shareholder suits, it is sufficient to observe that there exists a certain distribution of shares. Still, one may argue that our analysis is inconsistent with the empirical observation that investors hold small stakes. We give an intuitive reason for why this is not true.

One could ask why shareholders not entitled to bring an action continue to invest in the stock market. The manager cannot commit to repay the investment, hence, small shareholders would anticipate this commitment problem and refrain from entrusting the manager with their money.

The fact that small shareholders continue to invest in countries with percentage limits may be due to the fact that there are simply no better alternative investments.[27] In order to attract outside capital, the manager builds up a reputation for future dividend payments by paying a sufficiently high return to outside investors. In order to be able to do that, he cannot misappropriate more than a certain amount. Because of this reputational effect, small outside shareholders will

[24] It is worthwhile noting that $\{M_h, P_a\}$ can never be played in equilibrium, not even in a repeated game. The reason is that M can diverge from M_h, and P cannot punish this behavior in the next period, since M has a payoff of zero when playing M_h independent of P's strategy.

[25] Admati, Pfleider & Zechner (1994).

[26] The same argument was made with regard to shareholder suits; see van Aaken (2004), Eckert, Grechenig & Stremitzer (2005).

continue to invest in the corporations.[28] Correspondingly, large investors will not try to buy out all small shareholders. Whoever buys the last remaining stock of diversified shares will not be able to extract private benefits because there is no one left to extract them from (that is the case for μ=1).

Our model is consistent with empirical data that suggests that there is a correlation between high ownership concentration and low investor protection[29] and countries, like the United States and England, where single shareholders can bring an action typically have a more dispersed ownership structure. It is also consistent with the fact that we observe lawsuits in the United States as well as in England.

Moreover, the managers and the shareholders entitled to sue cannot misappropriate the whole corporate value because of potential liability under insolvency law. In most countries, there is a concentrated procedure under which many managers are in fact held liable in the case of bankruptcy.[30] For these reasons, it may make sense for small shareholders to continue to invest.[31]

This argument puts into perspective the seemingly radical result of massive misappropriation of corporate assets. How much exactly the mangers can misappropriate depends on product markets. If product markets are highly efficient, there will be little left to misappropriate (without causing insolvency and trigger subsequent liability) and α must fall within an interval much smaller than [0;1].[32]

Implications for the residual ownership – Shareholders as residual owners?

It is conventionally believed that shareholders are the residual owners of the corporation. They receive whatever is left after the creditors, including the employees, have been paid from the corporate funds and thus bear most of the business risk associated with every corporation.[33] With percentage limits, the case is different.

In our model, the equilibrium payoffs are $U_M^*=(\beta-\mu)\alpha A$ for the manager, $U_P^*=0$ for the plaintiff-shareholder, and $U_{nP}^*=-(1-\mu)\alpha A$ for the non-plaintiff shareholders. That is P receives a share of the benefits according to his participation and M ends up with the remaining part. We assumed that αA is a random opportunity for misappropriating corporate assets. However, we could also think of αA as the corporate profits. The manager could misappropriate this amount without going bancrupt and having to face potential personal liability under insolvency law. In this case, M and P are the residual owners of the firm.

The manager would have to pay both the creditors *and the small shareholders* a fixed "dividend" which will depend on the need to build up a reputation in order to take up new capital in the future. Of course, the claims of shareholders are legally subordinated to the claims of creditors; thus they have to be compensated for that through a larger "dividend". Still for both creditors and small shareholders, their payoffs are independent of the corporate profits as long as the

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27 Compare Shleifer & Vishny (1997) with a useful overview of the literature.

28 Gomes (2000); compare also Diamond (1989) for the debt market. However, reputational effects dissolve through backward induction as soon as the last period is known; for further references see Shleifer & Vishny (1997).

29 La Porta, Lopez de Salinas, Shleifer & Vishny (1998). La Porta, Lopez de Salinas, Shleifer & Vishny (1999). Of course, those studies have been attacked on various accounts; e.g. Spamann (2006).

30 See supra note 10 for references.

31 Of course, ongoing investments by small shareholders may also be explained on behavioral accounts.

32 E.g. Shleifer & Vishny (1997).

33 Hansmann (1996). Easterbrook & Fischel (1991).

corporation does not go bankrupt. The greatest part of the risk is borne by the manager and the plaintiff-shareholder who are the residual owners of the corporation. Even though further analysis would go beyond the scope of this paper, it is worthwhile mentioning that the risk is borne by those that are the least diversified.

One may argue that the benefits are divided between M and P other than in our model. For once, behavioral studies suggest that P will decline an offer close to $\mu\alpha A$ and that M will anticipate this and offer a larger share of the private benefits $\beta\alpha A$ to P than slightly above $\mu\alpha A$[34]. Secondly, P may have a special negotiation power due to the right to replace M by another manager. Whether or not P has a right to remove M depends on his share and on the respective legal regulations which are quite heterogeneous in Europe.[35] In this case, P could be the main residual owner. However, by no means, the small shareholders will hold the residual ownership. Note that the division of benefits does not influence the pure strategy equilibrium ($d_M*=M_c$ and $d_P*=P_b$) under which M will always steal αA and bribe P (with $\Phi\in[\mu\alpha A;\beta\alpha A]$) and under which P chooses zero monitoring costs, which holds true for n uncoordinated plaintiff-shareholders.

Lower percentage limits: $\mu > \beta$

Suits & monitoring

If the percentage limits are decreased beyond a certain threshold, the manager will not be able to bribe the plaintiff-shareholder. The lower percentage limits are, the higher is μ because the coalition of potential plaintiff shareholders has a larger total share; thus, the larger the bribe has to be. At a certain point ($\mu>\beta$) the manager's private benefits $\beta\alpha A$ are simply not large enough to bribe all potential plaintiff-shareholders, so that M's strategy to steal and bribe the plaintiff-shareholder is strictly dominated by M's strategy to act honestly. Clearly, this result cannot only be reached by lowering the percentage limits but also by increasing the costs of stealing (i. e. decreasing β), e. g. through more severe criminal sanctions. For clarification, legislator cannot exactly determine the limiting value $\mu=\beta$ because the legislator does not know the exact costs of stealing (and because μ and β vary across corporations). How far the percentage limits need to be decreased (or the costs of stealing be increased) is an empirical question. Only if percentage limits are abandoned altogether we can be sure that $\mu>\beta$ in all firms (because μ=1 and β<1).

Proposition 3.1. *With low percentage limits, $\mu>\beta$, M sometimes steals ($0<prob(\Psi=1)<1$) but never bribes P (d_M^* is mixed strategy of M_h and M_d). There is some monitoring and there are some lawsuits ($l^*,m^*>0$).*

Proof. [see Appendix]

Proposition 3.2. *The fact that there is some stealing by M, the fact that there is no equilibrium without litigation and no equilibrium without monitoring holds true for n uncoordinated plaintiff-shareholders.*

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[34] See e.g. Güth, Schmittberger & Schwarze (1982).

[35] For an overview see Arlt, Bervoets, Grechenig & Kalss (2002) and Arlt, Bervoets, Grechenig & Kalss (2003). For Spain see Grechenig (2005a).

Proof. [see Appendix]

The intuition behind the fact that there is no equilibrium without lawsuits is that the manager's strategy to steal and bribe the shareholder(s) yields no positive payoff. In other words, the total costs of stealing and bribing are higher than the benefits. This is due to the fact that with low percentage limits the total stake of shareholders that can bring an action increases above the limit where too many shareholders have to be bribed. Since the manager cannot bribe all he will rather not offer bribes anymore. Since M does not offer a bribe there is an equilibrium in mixed strategies.

Implications for the residual ownership

If percentage limits are decreased beyond a certain threshold (so that $\mu>\beta$) the picture changes radically. Independent of the remaining parameters, there are some lawsuits by P and there is clearly less misappropriation by M. The fact that there is some misappropriation by M is what most approaches to agency theory would predict. The equilibrium payoffs are

$$U_P^* = \begin{cases} -\mu\alpha A \dfrac{c(1-s)}{sc+(1-s)\mu\alpha A} - m^* & \text{if} \quad s(m^*) < \dfrac{\beta\alpha A}{\alpha A + c} \\ -\mu\alpha A \dfrac{c(1-s)}{(1-s)c+s\mu\alpha A} - m^* & \text{if} \quad s(m^*) > \dfrac{\beta\alpha A}{\alpha A + c} \end{cases}$$

$$U_M^* = 0$$

$$U_{nP}^* = \begin{cases} -(1-\mu)\alpha A \dfrac{cs}{sc+(1-s)\mu\alpha A} \dfrac{c+(1-\beta)\alpha A}{c+\alpha A} & \text{if} \quad s(m^*) < \dfrac{\beta\alpha A}{\alpha A + c} \\ -(1-\mu)\alpha A \dfrac{c(1-s)}{(1-s)c+s\mu\alpha A} \dfrac{c+(1-\beta)\alpha A}{c+\alpha A} & \text{if} \quad s(m^*) > \dfrac{\beta\alpha A}{\alpha A + c} \end{cases}$$

[See Appendix Proof of Proposition 3.1]

M and P are not the joint residual owners of the corporation anymore as M looses his residual ownership and ends up with a payoff of zero. The residual owners are now the shareholders in general. Shareholders that are not entitled to bring an action are now able to free ride on the monitoring of P as they bear neither the monitoring costs nor the litigation costs.

Discussion

We have argued that the lack of derivative lawsuits in continental Europe is due to percentage limits as provided for in the various jurisdictions. Percentage limits establish that shareholders have to hold a minimum share of typically 5 or 10 % in order to bring an action against the management for breach of fiduciary duty. These widespread legal provisions allows the managers to misappropriate corporate assets and bribe the potential plaintiff-shareholders. In this case, all shareholders choose zero monitoring, the managers choose to misappropriate corporate assets and to offer the potential plaintiff-shareholders a bribe which they accept. This could be interpreted as an allocation of the residual ownership to the management and large shareholders, where small shareholders receive only a fixed "dividend". If percentage limits are decreased beyond a certain threshold, potential plaintiff-shareholders will monitor the managers and the managers will misappropriate corporate assets less often than before. In this case, there will be lawsuits detering the managers from their illegal conduct. The same result will be reached if the costs of stealing are increased beyond a certain threshold (lower β, so that $\mu>\beta$). To increase the costs fo stealing, e.g. by reforming criminal law etc, however, will be much more costly than simply reducing the percentage limits. Yet another possibility for the legislator to switch to the second equilibrium, where there is less stealing ($\mu>\beta$), is to facilitate collective lawsuits. If getting together is less costly for shareholders, the total share of shareholders able to bring an action will be larger (higher μ).

This analysis suggests that percentage limits increase the problem of bribery and misappropriation. However, one cannot conclude without empirical evidence that lower percentage limits would lead to higher social welfare. That is so because with high percentage limits there is more misappropriation and thus higher costs of stealing but no monitoring costs and no litigation costs. In turn, with low percentage limits, the total costs of stealing are clearly lower but costs associated with litigation and monitoring are higher. At this point, we can only say that an equilibrium where managers steal and bribe the large shareholders is unlikely to be socially optimal because it allocates the property right to corporate assets to those who value it the least. This is evident when we assume that the opportunity of misappropriation amounts to the profits a corporation has earned. Large shareholders and managers are likely to value the private benefits less than (small) shareholders because they are not diversified. Private benefits are just another volatile compensation that managers receive instead of regular salary (supposing that higher private benefits will be taken into account when negotiating for the total pay and thus lower the regular salary). However, private benefits are the worst kind of incentive contract because other than stock options and restricted stock (which are also volatile), there is no possibility for indexing, taking into account long term prospects etc. An incentive effect may be due to the fact that the ones that make the decisions (managers and large shareholders) are also the ones that profit if the decisions made are good and lose otherwise.

In any case, by allocating the property right to the managers and large shareholders, capital markets are unlikely to optimally develop because of the mentioned commitment problem. Shareholders will invest less than optimal if they cannot reap the full gains. Corporate charters that offer a contractual right to sue could undo this commitment problem and it is not clear why it is not offered by the large shareholders and the managers. One possible explanation could be that the reallocation of property rights would come at a loss of managers and large shareholders and that it would be too costly for small shareholders to pay managers reallocation due to collective action problems. They would rather invest their money somewhere else. Still, open questions remain for further research. It is, for example, not clear why corporations that have just been established or have publicly offered the shares for the first time would not offer managerial liability. Moreover, it is not clear at what point percentage limits would be so low that potential plaintiff-shareholders cannot be treated as one coalition of shareholders. Potential extensions of our model involve collective actions problems that arise once percentage limits are decreased beyond a certain threshold or abandoned altogether; biased courts; special rules of litigation etc.

All in all, we have tried to spark a discussion on shareholder suits that goes both beyond the verbal arguments offered in the legal literature as well as beyond the empirical studies offered in the economic literature. It emphasizes the importance of the laws on percentage limits that until now have been neglected.

APPENDIX

Proof of Proposition 1. M's full set of strategies (for the subgame starting at t=2) is $D_M=\{\Psi \mid \Psi\in\{0,1\}\}\times\{\Phi \mid \Phi\in[0;\infty)\}$, which includes the misapprobriation decision $\Psi\in\{0,1\}$ and the bribing decision $\Phi\in[0;\infty)$. Note that M can also decide not to bribe P by choosing $\Phi=0$. M's decision of stealing is a hidden action and therefore cannot be observed by P. P has to decide whether or not to bring an action ($\Theta\in\{0,1\}$), where no action means to accept the offer if M has made one.[36] Because P cannot directly observe whether the manager missapropriated αA, he can only form beliefs about the managers action. P's information is Φ and S, and therefore (Φ,S) is an information set with two nodes ($\Psi=0$ and $\Psi=1$). A strategy of P (in the subgame starting at t=2) is a plan of suing or not for every possible information set (Φ,S). Thus the strategy set of P is: $D_P=\{\Theta \mid \Theta\in\{0,1\}\}^{\{S \mid S\in\{0,1\}\}\times\{\Phi \mid \Phi\in[0;\infty)\}}$.
For every given Φ there are two possible information sets, $S=0$ and $S=1$, both with two nodes ($\Psi=0$ and $\Psi=1$). In both information sets P has two possible actions, that is to bring an action or not to bring an action ($\Theta\in\{0,1\}$). We now define plans for a given Φ: P_a means that P does not bring an action ($\Theta=0$) independent of the signal (apathetic), P_v means that P brings an action ($\Theta=1$) if $S=1$ and not ($\Theta=0$) if $S=0$ (vigilant), P_c that P brings an action ($\Theta=1$) if $S=0$ and not ($\Theta=0$) if $S=1$ (confused), P_b that P always brings an action ($\Theta=1$) (belligerent). We could now think of (Φ) as the information sets with two nodes, but with four possible actions for P, $\{P_a,P_v,P_c,P_b\}$. Then we can define the strategy set of P for the whole subgame as follows: $D_P=\{P_a,P_v,P_c,P_b\}^{\Phi\in[0;\infty)}$.[37]

The following table shows the payoffs of the game for a given Φ.

	$\Psi=0$	$\Psi=1$
$P_{apathetic}$	Φ, $-\Phi$	$\Phi-\mu\alpha A$, $\beta\alpha A-\Phi$
$P_{vigilant}$	$s\Phi-(1-s)c$, $-s\Phi$	$(1-s)(\Phi-\mu\alpha A)$, $(1-s)(\beta\alpha A-\Phi)-s[c+(1-\beta)\alpha A]$
$P_{confused}$	$(1-s)\Phi-sc$, $-(1-s)\Phi$	$s(\Phi-\mu\alpha A)$, $s(\beta\alpha A-\Phi)-(1-s)[c+(1-\beta)\alpha A]$
$P_{belligerent}$	$-c$, 0	0, $-[c+(1-\beta)\alpha A]$

Definition 3. *Define (x,Φ), $x\in[0,1]$ as the mixed strategy, where M plays $(\Psi=0,\Phi)$ with probability $(1-x)$ and $(\Psi=1,\Phi)$ with probability x.*[38] *Define y, $y=(y_1,y_2,y_3,y_4)$, $y_1,y_2,y_3,y_4\in[0,1]$ and $y_1+y_2+y_3+y_4=1$, as the following probability distribution: P chooses the action P_a with*

[36] Note that we have excluded P's decision to reject the offer and not sue M because it is strictly dominated by the decision to simply accept the offer, for any $\Phi>0$. There is no difference between accepting and rejecting an offer $\Phi=0$.

[37] There is a bijective function between the two sets $\{0,1\}^{\{0,1\}\times[0;\infty)}$ and $\{P_a,P_v,P_c,P_b\}^{[0;\infty)}$. There is also a bijective function between the two sets of sequential equilibria.

[38] The pure strategies $(\Psi=0,\Phi)$ (not stealing) and $(\Psi=1,\Phi)$ (stealing) are represented as $(0,\Phi)$ and $(1,\Phi)$.

probability y_1, P_v with y_2, P_c with y_3 and P_b with y_4[39]*. Define (y,Ω), as the set of all mixed strategies, which induce y at the information set $\Omega \in [0;\infty)$.*

Of course, all strategies of (y,Φ) must yield the same payoffs against a strategy (x,Φ).

Definition 4. *Define $U_P(\Phi,x,y)$ and $U_M(\Phi,x,y)$ as the expected payoffs of P and M, given the strategy (x,Φ) of M and the set of strategies (y,Φ) of P.*

$U_P(\Phi,0,P_a)>U_P(\Phi,0,P_v)\geq U_P(\Phi,0,P_c)>U_P(\Phi,0,P_b)$ because $\Phi>s\Phi-(1-s)c\geq(1-s)\Phi-sc>-c$, since $1>s\geq0,5$. Therefore (P_a,Φ) is the set of P's best responses to $(0,\Phi)$ for any Φ.

We now distinguish between the three cases $\Phi<\mu\alpha A$, $\Phi>\mu\alpha A$, $\Phi=\mu\alpha A$.

$\Phi<\mu\alpha A$:

Lemma 1. *There is no equilibrium where M plays a pure strategy with $\Phi<\mu\alpha A$ and there is no equilibrium where P's strategy is element of the sets (P_a, Φ) or (P_b, Φ), $\Phi<\mu\alpha A$.*

Proof. (P_a,Φ) is P's best response to $(0,\Phi)$. But then $(1,\Phi)$ is better for M since $U_M(\Phi,1,P_a)>U_M(\Phi,0,P_a)$ because $\beta\alpha A-\Phi>-\Phi$. Since $U_P(\Phi,1,P_b)>U_P(\Phi,1,P_c)\geq$ $\geq U_P(\Phi,1,P_v)>U_P(\Phi,1,P_a)$ because $0>(1-s)(\Phi-\mu\alpha A)\geq s(\Phi-\mu\alpha A)>(\Phi-\mu\alpha A)$, (P_b,Φ) is P's best response to $(1,\Phi)$. Then $(0,\Phi)$ is better for M since $U_M(\Phi,0,P_b)>U_M(\Phi,1,P_b)$ because $0>-[c+(1-\beta)\alpha A]$. □

Lemma 2. *(x,Φ) is not a nash equilibrium strategy for $0<\Phi<\mu\alpha A$.*

Proof: From Lemma 1 follows that $(0,\Phi)$ and $(1,\Phi)$ are not equilibrium strategies. Therefore, if (x^*,Φ) were an equilibrium strategy then for the corresponding set of strategies (y^*,Φ) of P the following condition must hold: $U_M(\Phi,0,y^*)=U_M(\Phi,1,y^*)$. $y^*\neq P_b$ also follows from Lemma 1. $U_M(0,0,y)=0$ for every possible y, since if M does not steal and does not bribe P, he always gets a payoff of zero, independent of P's strategy. If $0<\Phi<\mu\alpha A$, then $U_M(\Phi,0,y)<0$ for all $y\neq P_b$ and therefore $U_M(\Phi,x^*,y^*)<0$. Therefore, (x^*,Φ) cannot be the best response to (y^*,Φ) since M is better off by playing $(0,0)$. □

$\Phi>\mu\alpha A$:

M offers more than P could obtain through a lawsuit. We use the concept of sequential equilibria to rule out unplausible strategies.[40]

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[39] Instead of (1,0,0,0) we write P_a, etc.

[40] We rule out strategies that cannot be part of a sequential equilibrium. Note that we do not give a description of all Nash equilibria including those which are not sequential equilibria. For sequential equilibria see Kreps & Wilson (1982a).

Definition 5. *Define $b(\Phi) \in[0,1]$ (beliefs) as the probability with which P expects to be at node $\Psi=1$, given that he is at information set Φ. Define $U^b(\Phi,y,b(\Phi))$ as the expected payoff of P for the strategies of the set (y,Φ) given he is at information set Φ with the beliefs $b(\Phi)$.*

Lemma 3. *The strategy (x,Φ) of M, $\Phi>\mu\alpha A$, cannot be part of a sequential equilibrium. A sequential equilibrium strategy of P must be element of the sets (P_a,Φ), $\Phi>\mu\alpha A$.*

Proof. If $\Phi>\mu\alpha A$, then $U_P(\Phi,1,P_a)>U_P(\Phi,1,P_v)\geq U_P(\Phi,1,P_c)>U_P(\Phi,1,P_b)$ because $(\Phi-\mu\alpha A)>s(\Phi-\mu\alpha A)\geq(1-s)(\Phi-\mu\alpha A)>0$, since $1>s\geq 0,5$. Since we have already shown that $U_P(\Phi,0,P_a)>U_P(\Phi,0,P_v)\geq U_P(\Phi,0,P_c)>U_P(\Phi,0,P_b)$ it follows that $U^b(\Phi,P_a,b(\Phi))>U^b(\Phi,y,b(\Phi))$ for every $y\neq P_a$, every $\Phi>\mu\alpha A$ and every $b(\Phi)$. Therefore every strategy of P which is part of a sequential equilibrium must be element of the sets (P_a,Φ), $\Phi>\mu\alpha A$. P will accept every offer higher than $\mu\alpha A$, every other strategy would include inferior actions. Now $U_M(\Phi,1,P_a)>U_M(\Phi,0,P_a)$ since $\beta\alpha A-\Phi>-\Phi$. Therefore (x,Φ), $\Phi>\mu\alpha A$ *and* $x\neq 1$, cannot be a sequential equilibrium strategy. For every $\Phi>\mu\alpha A$ there exists an Ω with $\mu\alpha A<\Omega<\Phi$ thus $U_M(\Omega,1,P_a)>U_M(\Phi,1,P_a)$ since $\beta\alpha A-\Omega>\beta\alpha A-\Phi$. Therefore $(1,\Phi)$, $\Phi>\mu\alpha A$, is not a sequential equilibrium strategy. □

Only the strategies $(x,0)$ and $(x,\mu\alpha A)$ remain for M.

***$\Phi=\mu\alpha A$*:**

Lemma 4. *The strategies $(x,\mu\alpha A)$, $x\neq 1$, of M cannot be part of a nash equilibrium. The strategies $(y,\mu\alpha A)$, $y\neq P_a$, of P cannot be part of a sequential equilibrium.*

Proof. $U_P(\mu\alpha A,1,y)=0$ for all y. If M steals and offers $\mu\alpha A$, P will always retrieve $\mu\alpha A$, by means of either bringing a suit or accepting the bribe. $U_P(\mu\alpha A,x,P_a)>U_P(\mu\alpha A,x,y)$ $y\neq P_a$ and $x\neq 1$, if it is not sure that M had stolen it is better for P to accept the bribe. $U_M(\mu\alpha A,1,P_a)>U_M(\mu\alpha A,x,P_a)$ $x\neq 1$. $(P_a,\mu\alpha A)$ is P's best response to M's $(x,\mu\alpha A)$ $x\neq 1$. M's best response to this is $(1,\mu\alpha A)$. Therefore $(x,\mu\alpha A)$, $x\neq 1$, is not a nash equilibrium strategy. Moreover, $U_M(\mu\alpha A,1,P_a)=\beta\alpha A-\mu\alpha A>U_M(\mu\alpha A,1,y)$, $y\neq P_a$, because $(\beta\alpha A-\Phi)>s(\beta\alpha A-\Phi)-(1-s)[c+(1-\beta)\alpha A]>$ $>(1-s)(\beta\alpha A-\Phi)-s[c+(1-\beta)\alpha A]>-[c+(1-\beta)\alpha A]$ since $\Phi=\mu\alpha A$. Therefore $U_M(\mu\alpha A,1,y)=$ $=\beta\alpha A-\mu\alpha A-\varepsilon$, $\varepsilon>0$ and $y\neq P_a$. For every $\varepsilon>0$ there exists an Ω with $\mu\alpha A<\Omega<\mu\alpha A+\varepsilon$ and thus $U_M(\Omega,1,P_a)=\beta\alpha A-\Omega>\beta\alpha A-\mu\alpha A-\varepsilon=U_M(\mu\alpha A,1,y)$. Therefore $(y,\mu\alpha A)$, $y\neq P_a$, cannot be part of a sequential equilibrium. □

The remaining possible strategies of M for a sequential equilibrium are $(x,0)$, $x\neq 0,1$ and $(1,\mu\alpha A)$.[41] The equilibrium strategy of P is element of all sets (P_a,Φ), $\Phi\geq\mu\alpha A$, which means he will always accept an offer larger than or equal $\mu\alpha A$. Now for a sequential equilibrium the following conditions must hold: $U_M(\Phi,0,y^*),U_M(\Phi,1,y^*)\leq U_M(\Phi^*,x^*,y^*)$ and $U^b(\Phi,y^*,b^*(\Phi))\geq U^b(\Phi,y,b^*(\Phi))$, for every Φ, and every y. $b^*(\Phi)$ are the sequential equilibrium beliefs. Since $0<\Phi<\mu\alpha A$ is off the equilibrium path, thus played with probability zero in equilibrium, we could form any beliefs in that information sets and find the corresponding

[41] If we mix over Φ, we can exclude strategies that have a positive probability of $\Phi\neq 0,\mu\alpha A$ with the same line of arguments like for a pure choice of Φ.

equilibrium strategies. Since if $(x,0)$ is an equilibrium strategy then $U_M(0,1,y)=U_M(0,0,y)=0$ must hold (Lemma 1) and since $U_M(\mu\alpha A,1,P_a)=(\beta-\mu)\alpha A$ could be bigger, equal or smaller zero, depending on the parameters β and μ, we can make no further analyses without information about them. □

Proof of Proposition 2.1. $\mu<\beta \Rightarrow (\beta-\mu)\alpha A>0 \Rightarrow M_c$ strictly dominates M_h. To M_d P's best response is P_b, and to this M_c is M's best response. When M plays M_c P is indifferent, since he will accept the offer $\mu\alpha A$ in all four strategies. Thus M's equilibrium strategy is M_c.

For all sequential equilibria the following conditions hold true: $d_M{}^*=M_c=(1,\mu\alpha A)$, $U_M(\Phi=0,1,y^*)\leq U_M(\Phi=\mu\alpha A,1,y^*)$, $U^b(0,y^*,b^*(0))\geq U^b(0,y,b^*(0))$ for every y. Since $\Phi=0$ is off the equilibrium path we can form any beliefs and find the corresponding equilibrium strategy of P. Note that in all of these sequential equilibria M steals and offers a bribe, and P accepts. They only differ in possible actions that are off the equilibrium path. If we consider the whole subgame (before defining a reduced strategy space) we see that in the case of $\beta>\mu$, $(\Psi=1,\mu\alpha A)$ strictly dominates $(\Psi=0,\Phi)$, $\Phi<\mu\alpha A$. Therefore the only justifiable beliefs in the case $\Phi<\mu\alpha A$ are $b(\Phi)=1$. Thus, a justifiable equilibrium strategy must be element of all sets (P_b,Φ), $\Phi<\mu\alpha A$ (Lemma 1). Thus, we have a unique justifiable equilibrium in the case of $\beta>\mu$.[42]. This equilibrium corresponds to the intuitive result that, if M made an offer smaller than $\mu\alpha A$, P would reject it and sue. $Prob(\Psi=1)=1$ since M always steals and offers a bribe and $l^*=0$ since P always accepts the offer.
The outcomes are:

$$U_P^* = -\mu\alpha A + \mu\alpha A - m = -m$$
$$U_M^* = (\beta-\mu)\alpha A$$
$$U_{nP}^* = -(1-\mu)\alpha A$$

Clearly, P chooses $m^*=0$ to maximize the payoff, so that $U_P^*=0$.□

Proof of Proposition 2.2. With n uncoordinated plaintiff-shareholders, M's strategy set depends on n, since M can steal and bribe one, some, or all plaintiff-shareholders. Define $M_{c,k}$, $k=0,1,\ldots,n$ as a set of strategies, where M bribes k shareholders. The set of all possible strategies is $D_M=M_h \cup M_{c,0} \cup M_{c,1} \cup \ldots \cup M_{c,n}$[43], where $M_{c,0}$ means that M steals but does not bribe anybody ($M_{c,0}=M_d$). Each of the the shareholders $P^1,P^2,\ldots,P^n$ has the same set of strategies $\{P_a,P_v,P_c,P_b\}$[44].
Mainly, the payoffs are the same as in the basic model with one plaintiff-shareholder. The only difference is that multiple shareholders have to share the litigation costs in the case that they sue the manager and lose. We assume that they bear the litigation costs according to their stock. That is, for example two shareholders with the shares μ_1, μ_2 have to bear the costs

$$\frac{\mu_1}{\mu_1+\mu_2}(-c), \frac{\mu_2}{\mu_1+\mu_2}(-c).$$

Similar to the main model, if $\beta>\mu$ then M_h is strictly dominated by $M_{c,n}$. Independent of the plaintiffs' strategies, M is always better off stealing and bribing everybody than to be honest

[42] For justifiable beliefs see McLennan (1985).
[43] Since M_h, $M_{c,0}$ and $M_{c,n}$ are sets of strategies with one element we disregard the difference between the element and the set itself.
[44] The strategy space is reduced like in the one plaintiff game.

because $(\beta-\mu)\alpha A>0$. After eliminating M_h, P_b weakly dominates all other strategies. Independent of P^k's signal, he will always bring an action if he did not receive an offer; consequently, M will bribe all shareholders. As in the main model we have $d_M^*=M_{c,n}$ in a sequential equilibrium.

Since this equilibrium is independent of the signal, all plaintiff-shareholders choose $m^*=0$. □

Proof of Proposition 3.1 M_c is strictly dominated, since $(\beta-\mu)\alpha A<0$.

Definition 6. *Define q as the probability of M's choice M_d. (M_c will be played with probability zero, since it is strictly dominated.)*

Definition 7. *Define $U_{P,a}(q), U_{P,v}(q), U_{P,c}(q), U_{P,b}(q)$ as the expected utility of P's strategy (excluding m), given that M chooses a mixed strategy with q as defined in Definition 1.*

$$U_{P,a}(q) = q(-\mu\alpha A)$$
$$U_{P,v}(q) = (1-q)(1-s)(-c) + q(1-s)(-\mu\alpha A)$$
$$U_{P,c}(q) = (1-q)s(-c) + qs(-\mu\alpha A)$$
$$U_{P,b}(q) = (1-q)(-c)$$

Lemma 5. *There is one and only one pair $\underline{q}, \overline{q} \in (0;1)$, $\underline{q} \le \overline{q}$ ($\underline{q} = \overline{q}$ if and only if m=0) where*

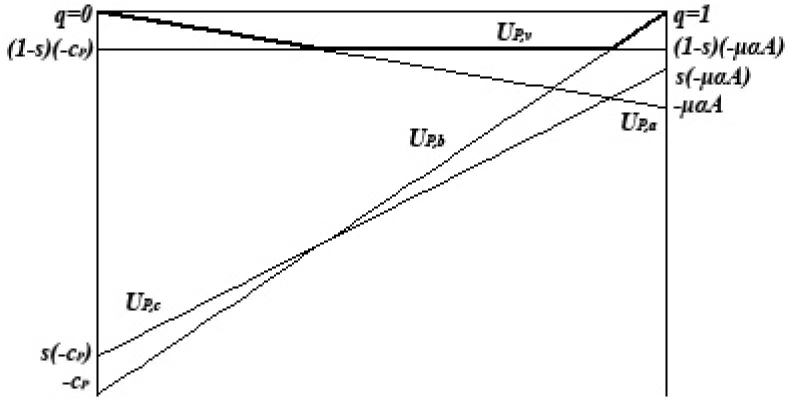
for $q < \underline{q}$	*P_a is the best response of P*
for $q = \underline{q}$	*P is indifferent between P_a and P_v*
for $\underline{q} < q < \overline{q}$	*P_v is the best response of P*
for $q = \overline{q}$	*P is indifferent between P_v and P_b*
for $\overline{q} < q$	*P_b is the best response of P*

Proof. $m \ge 0 \Leftrightarrow s(m) \ge \frac{1}{2} \Rightarrow U_{P,v} \ge U_{P,c}$, because

$$s \ge \frac{1}{2} \Leftrightarrow 2s \ge 1 \Leftrightarrow s \ge 1-s \Leftrightarrow s[(1-q)(-c) + q(-\mu\alpha A)] \le$$
$$\le (1-s)[(1-q)(-c) + q(-\mu\alpha A)] \Leftrightarrow U_{P,c}(q) \le U_{P,v}(q) \forall q \in [0,1]$$

Equality given if and only if $m=0$. If $m>0$, P_c is strictly dominated and can be eliminated. If $m=0$ then $U_{P,c}(q)=U_{P,v}(q)\ \forall q \in [0;1]$, since the signal is random.

Applying q on the horizontal axis and the expected utility of P, U_P, on the vertical axis, $U_{P,a}(q)$, $U_{P,v}(q)$, $U_{P,b}(q)$, $U_{P,c}(q)$ define straight lines in a two-dimensial-coordinate system. The following figure shows the best response function given a certain set of parameters. The bold line displays P's best response to M's choice of q in mixed strategies.



$U_{P,a}(0) > U_{P,v}(0) > U_{P,b}(0)$ since $0 > (1-s)(-c) > -c$

$U_{P,a}(1) < U_{P,v}(1) < U_{P,b}(1)$ since $-\mu\alpha A < (1-s)(-\mu\alpha A) < 0$

Accordingly, there is an interval $[0;\underline{q}]$, where P_a is best response, and an interval $[\overline{q};1]$, where P_b is best response, with $\underline{q} \le \overline{q}$. Finally we have to show that $\underline{q} < \overline{q}$ for *m*>0. We do this by disproving $\underline{q} = \overline{q}$. When $\underline{q} = \overline{q}$ then the lines $U_{P,a}(q), U_{P,b}(q)$ meet at $\underline{q} = \overline{q}$ and $U_{P,a}(\underline{q}) = U_{P,b}(\underline{q}) = U_{P,a}(\overline{q}) = U_{P,b}(\overline{q})$ must be higher or at least equal to $U_{P,v}(\underline{q}) = U_{P,v}(\overline{q})$. If not, P_a would not be the best response in the whole interval $[0;\underline{q}]$, which is a contradiction to the definition of $\underline{q}$. The same holds true for P_b.

$$U_{P,a}(q) = U_{P,b}(q) \Leftrightarrow q(-\mu\alpha A) = (1-q)(-c) \Leftrightarrow q = \frac{c}{c+\mu\alpha A}$$

$$U_{P,a}\left(\frac{c}{c+\mu\alpha A}\right) = U_{P,b}\left(\frac{c}{c+\mu\alpha A}\right) = \frac{-\mu\alpha A c}{c+\mu\alpha A}$$

$$U_{P,v}\left(\frac{c}{c+\mu\alpha A}\right) = (1-s)\left[\frac{\mu\alpha A}{c+\mu\alpha A}(-c) + \frac{c}{c+\mu\alpha A}(-\mu\alpha A)\right] =$$

$$= 2(1-s)\left(\frac{-\mu\alpha A c}{c+\mu\alpha A}\right) > \frac{-\mu\alpha A c}{c+\mu\alpha A} = U_{P,a}\left(\frac{c}{c+\mu\alpha A}\right) = U_{P,b}\left(\frac{c}{c+\mu\alpha A}\right),\ \text{if } s > \frac{1}{2} \Leftrightarrow m > 0$$

Consequently, $\underline{q} < \overline{q}$ holds true and P_v is best response on the interval $[\underline{q};\overline{q}]$, *m*>0. (Note that if *m*=0 then $U_{P,a}\left(\frac{c}{c+\mu\alpha A}\right) = U_{P,v}\left(\frac{c}{c+\mu\alpha A}\right) = U_{P,c}\left(\frac{c}{c+\mu\alpha A}\right) = U_{P,b}\left(\frac{c}{c+\mu\alpha A}\right)$, $\underline{q} = \overline{q} = \frac{c}{c+\mu\alpha A}$ and P is indifferent between P_a, P_v, P_c and P_b)

Calculating $\underline{q}, \overline{q}$:

$$U_{P,a}(\underline{q}) = U_{P,v}(\underline{q}) \Leftrightarrow \underline{q}(-\mu\alpha A) = (1-s)\left[(1-\underline{q})(-c) + \underline{q}(-\mu\alpha A)\right] \Leftrightarrow$$
$$\Leftrightarrow \underline{q} = \frac{(1-s)c}{(1-s)c + s\mu\alpha A}$$

$$U_{P,b}(\overline{q}) = U_{P,v}(\overline{q}) \Leftrightarrow (1-\overline{q})(-c) = (1-s)\left[(1-\overline{q})(-c) + \overline{q}(-\mu\alpha A)\right] \Leftrightarrow$$
$$\Leftrightarrow \overline{q} = \frac{sc}{sc + (1-s)\mu\alpha A}$$

$$\underline{q} < \overline{q} \Leftrightarrow \frac{(1-s)c}{(1-s)c + s\mu\alpha A} < \frac{sc}{sc + (1-s)\mu\alpha A} \Leftrightarrow$$
$$\Leftrightarrow (1-s)c\left[sc + (1-s)\mu\alpha A\right] < sc\left[(1-s)c + s\mu\alpha A\right] \Leftrightarrow$$
$$\Leftrightarrow (1-s)\,\mathrm{csc} + (1-s)c(1-s)\mu\alpha A < (1-s)\,\mathrm{csc} + scs\mu\alpha A \Leftrightarrow$$
$$\Leftrightarrow (1-s)^2 c\mu\alpha A < s^2 c\mu\alpha A \Leftrightarrow (1-s)^2 < s^2 \Leftrightarrow (1-s) < s \Leftrightarrow \frac{1}{2} < s$$

If $q = \underline{q}$ then P is indifferent between P_a and P_v.
If $q = \overline{q}$ then P is indifferent between P_v and P_b.□

As a consequence of Lemma 1 & 5, M's equilibrium strategy must involve a $q \in [\underline{q}; \overline{q}]$. In all of P's equilibrium strategies, P will choose P_v with some (positive) probability, if *m*>0. The remaining strategies of P (for *m*>0) are

a pure strategy P_v,
a mixed strategy P_v and P_a,
and a mixed strategy P_v and P_b

Due to Lemma 1, P's equilibrium strategy is one under which M is indifferent between M_h and M_d. Since $U_{M,h} = 0$, independent of P's strategy, P's equilibrium strategy is one where $U_{M,d} = 0$.

Definition 8. *Define* $\overline{U}_{M,d}(p)$ *as M's expected utility for* M_d*, when P chooses* P_v *with probability p and* P_b *with probability (1–p). Define* $\underline{U}_{M,d}(p)$ *as M's expected utility for* M_d*, when P chooses* P_v *with probability p and* P_a *with probability (1–p).*

$$\overline{U}_{M,d}(p) = p\left[(1-s)\beta\alpha A + s\,(-c_M - (1-\beta)\alpha A)\right] + (1-p)(-c_M - (1-\beta)\alpha A)$$
$$\underline{U}_{M,d}(p) = p\left[(1-s)\beta\alpha A + s\,(-c_M - (1-\beta)\alpha A)\right] + (1-p)(\beta\alpha A)$$

Definition 9. *Define* $\overline{p}$ *on the basis of* $\overline{U}_{M,d}(\overline{p}) = 0$ *and* $\underline{p}$ *on the basis of* $\underline{U}_{M,d}(\underline{p}) = 0$.

$$\overline{U}_{M,d}(\overline{p}) = 0 \Leftrightarrow \overline{p}\left[(1-s)\beta\alpha A + s(-c-(1-\beta)\alpha A\right] + (1-\overline{p})(-c-(1-\beta)\alpha A) = 0 \Leftrightarrow$$
$$\Leftrightarrow \overline{p} = \frac{c+(1-\beta)\alpha A}{(1-s)(c+\alpha A)}$$
$$\underline{U}_{M,d}(\underline{p}) = 0 \Leftrightarrow \underline{p}\left[(1-s)\beta\alpha A + s(-c-(1-\beta)\alpha A\right] + (1-\underline{p})(\beta\alpha A) = 0 \Leftrightarrow$$
$$\Leftrightarrow \underline{p} = \frac{\beta\alpha A}{s(\alpha A + c)}$$

The payoff of M_d is $\beta\alpha A > 0$, if P chooses P_a, and $(-c-(1-\beta)\alpha A) < 0$, if P chooses P_b. Depending on whether the payoff of M_d is smaller, equal, or larger than zero, given that P chooses P_v, the equilibrium strategy of P is either a mixed strategy with P_v and P_b, a pure strategy P_v or a mixed strategy with P_v and P_a. More precisely:

(1) $$(1-s)\beta\alpha A + s(-c-(1-\beta)\alpha A) > 0 \Leftrightarrow s < \frac{\beta\alpha A}{\alpha A + c}$$

$$s < \frac{\beta\alpha A}{\alpha A + c} \Leftrightarrow 1 < \frac{\beta\alpha A}{s(\alpha A + c)} = \underline{p}$$

$$s < \frac{\beta\alpha A}{\alpha A + c} \Leftrightarrow 1 - s > 1 - \frac{\beta\alpha A}{c + \alpha A} = \frac{c+(1-\beta)\alpha A}{c+\alpha A} \Leftrightarrow 1 > \frac{c+(1-\beta)\alpha A}{(1-s)(c+\alpha A)} = \overline{p} > 0$$

Accordingly, there is only one equilibrium: P plays a mixed strategy of P_v and P_b with

$$p^* = \overline{p} = \frac{c+(1-\beta)\alpha A}{(1-s)(c+\alpha A)}$$

The equilibrium strategy for M is a mixed strategy between M_h and M_d with

$$q^* = \overline{q} = \frac{sc}{sc + (1-s)\mu\alpha A}$$

The probability of suit is

$$l^* = (1-\overline{p}) + \overline{p}[\overline{q}s + (1-\overline{q})(1-s)] > 0$$

and equilibrium outcomes are (*m* included)

$$U_P^* = -\mu\alpha A \frac{c(1-s)}{sc+(1-s)\mu\alpha A} - m$$
$$U_M^* = 0$$
$$U_{nP}^* = -(1-\mu)\alpha A q^*(1-s)p^* = -(1-\mu)\alpha A \frac{cs}{sc+(1-s)\mu\alpha A}\frac{c+(1-\beta)\alpha A}{c+\alpha A}$$

(2) $(1-s)\beta\alpha A + s(-c-(1-\beta)\alpha A) < 0 \Leftrightarrow s > \frac{\beta\alpha A}{\alpha A + c}$

$$s > \frac{\beta\alpha A}{\alpha A + c} \Leftrightarrow 1-s < 1-\frac{\beta\alpha A}{c+\alpha A} = \frac{c+(1-\beta)\alpha A}{c+\alpha A} \Leftrightarrow 1 < \frac{c+(1-\beta)\alpha A}{(1-s)(c+\alpha A)} = \overline{p}$$

$$s > \frac{\beta\alpha A}{\alpha A + c} \Leftrightarrow 1 > \frac{\beta\alpha \mathrm{A}}{s(\alpha A + c)} = \underline{p} > 0$$

Accordingly there is only one equlibrium: P plays a mixed strategy of P_v and P_a with

$$p^* = \underline{p} = \frac{\beta\alpha A}{s(\alpha A + c)}$$

The equilibrium strategy for M is a mixed strategy between M_h and M_d with

$$q^* = \underline{q} = \frac{(1-s)c}{(1-s)c + s\mu\alpha A}$$

The probability of suit is

$$l^* = \underline{p}[\underline{q}s + (1-\underline{q})(1-s)] > 0$$

The equilibrium outcomes are (*m* included)

$$U_P^* = -\mu\alpha A \frac{c(1-s)}{(1-s)c + s\mu\alpha A} - m$$

$$U_M^* = 0$$

$$U_{nP}^* = -(1-\mu)\alpha A q^*(1-s+s(1-p^*)) = -(1-\mu)\alpha A \frac{c(1-s)}{(1-s)c + s\mu\alpha A} \frac{c+(1-\beta)\alpha A}{c+\alpha A}$$

(3) $(1-s)\beta\alpha A + s(-c-(1-\beta)\alpha A) = 0 \Leftrightarrow s = \frac{\beta\alpha A}{\alpha A + c}$

On the limiting value, there is an infinite number of equilibria.
The pure strategy P_v is the only equilibrium strategy of P.

$$p^* = 1$$

$$q^* \in [\underline{q}; \overline{q}]$$

$$l^* \in [\underline{q}s + (1-\underline{q})(1-s); \overline{q}s + (1-\overline{q})(1-s)] > 0$$

$$U_P^* \in \left[-\frac{\mu\alpha A(1-s)}{(1-s)c+s\mu\alpha A} - m; -\frac{\mu\alpha A(1-s)}{sc+(1-s)\mu\alpha A} - m \right]$$
$$U_M^* = 0$$
$$U_{nP}^* \in -(1-\mu)\alpha A \frac{c+(1-\beta)\alpha A}{c+\alpha A} \left[\frac{cs}{sc+(1-s)\mu\alpha A}; \frac{c(1-s)}{(1-s)c+s\mu\alpha A} \right]$$

Note that if m=0*,* then $q^* = \underline{q} = \overline{q} = \frac{c}{c+\mu\alpha A}$ is the equilibrium strategy of M. For P, any mixed strategy*,* for which $U_{m,d}$=0*,* is an equilibrium strategy. For the strategies $\underline{p}$ or $\overline{p}$ this condition is satisfied, since we did not need the condition m>0 for the calculation of $\underline{p}, \overline{p}$.

In all cases we have $l^* > 0$ and $0<q^*=P(M_d)=P(\Psi=1)<1$.[45]
After solving all subgames, we determine the optimal monitoring choice of P.

Definition 10. *Define* $U_P^*(m)$ *the expected utility function of P, depending on the monitoring costs m.*

$$U_P^*(m) = \begin{cases} -\mu\alpha A \frac{c(1-s)}{sc+(1-s)\mu\alpha A} - m & \text{if} \quad s(m) < \frac{\beta\alpha A}{\alpha A + c} \\ -\mu\alpha A \frac{c(1-s)}{(1-s)c+s\mu\alpha A} - m & \text{if} \quad s(m) > \frac{\beta\alpha A}{\alpha A + c} \end{cases}$$

If $s(m) = \frac{\beta\alpha A}{\alpha A + c}$ then $U_P(m)$ is discontinuous. Any value inbetween could be the outcome, depending on the strategy of M. But if M does not choose the eqilibrium strategy with the best payoff for P in this case, then P could be better off by choosing m slightly above or below $s(m) = \frac{\beta\alpha A}{\alpha A + c}$. Therefore only the maximum at the discontinuity remains, since the other strategies are not part of a sequential equilibrium.

Now $m^* = \arg\max_{m\in[0;\infty)} U_P^*$ holds.

Definition 11. *Define* U_1 *and* U_2 *as follows.*

$$U_1(m) = -\mu\alpha A \frac{c(1-s)}{sc+(1-s)\mu\alpha A} - m$$
$$U_2(m) = -\mu\alpha A \frac{c(1-s)}{(1-s)c+s\mu\alpha A} - m$$

Then the payoffs and the first derivatives are:

[45] Note that for a sequential equilibrium in the case $\beta\leq\mu$, $U_M(\Phi,x,y^*)\leq 0$ and $U^b(\Phi,y^*,b^*(\Phi))\geq U^b(\Phi,y,b^*(\Phi))$ for every Φ, x, y must hold true. As we already showed a strategy of P must be an element of the sets (P_a,Φ), $\Phi\geq\mu\alpha A$. For $0<\Phi<\mu\alpha A$ we find different equilibria depending on the beiliefs. The concept of justifiable beliefs does not rule out any of those equilibria.

$$U_P^*(m) = \begin{cases} U_1(m) & \text{if} \quad s(m) < \dfrac{\beta\alpha A}{\alpha A + c} \\ \max\{U_1(m), U_2(m)\} & \text{if} \quad s(m) = \dfrac{\beta\alpha A}{\alpha A + c} \\ U_2(m) & \text{if} \quad s(m) > \dfrac{\beta\alpha A}{\alpha A + c} \end{cases}$$

$$U_1' = \left(-\frac{\mu\alpha Ac(1-s)}{sc+(1-s)\mu\alpha A} - m\right)' = -\mu\alpha Ac\left(\frac{1-s}{sc+(1-s)\mu\alpha A}\right)' - 1 =$$

$$= -\mu\alpha Ac\left(\frac{-s'(sc+(1-s)\mu\alpha A) - (1-s)(s'c - s'\mu\alpha A)}{(sc+(1-s)\mu\alpha A)^2}\right) - 1 =$$

$$= \frac{\mu\alpha A(c)^2}{(sc+(1-s)\mu\alpha A)^2} s' - 1$$

$$U_2' = \left(-\frac{\mu\alpha Ac(1-s)}{(1-s)c+s\mu\alpha A} - m\right)' = -\mu\alpha Ac\left(\frac{1-s}{(1-s)c+s\mu\alpha A}\right)' - 1 =$$

$$= -\mu\alpha Ac_P\left(\frac{-s'((1-s)c+s\mu\alpha A) - (1-s)(-s'c + s'\mu\alpha A)}{((1-s)c+s\mu\alpha A)^2}\right) - 1 =$$

$$= \frac{(\mu\alpha A)^2 c}{((1-s)c+s\mu\alpha A)^2} s' - 1$$

$m^*<\infty$ since $\lim_{m\to\infty} U_2 = -\infty$.

If $\dfrac{\beta\alpha A}{\alpha A + c} > \dfrac{1}{2}$ $m^*>0$ since $\lim_{m\to 0} U_1' = \infty$.

If $\dfrac{\beta\alpha A}{\alpha A + c} < \dfrac{1}{2}$ $m^*>0$ since $\lim_{m\to 0} U_2' = \infty$.

If $\dfrac{\beta\alpha A}{\alpha A + c} = \dfrac{1}{2}$ $m^*>0$ since $U_1(0) = U_2(0) = \dfrac{-\mu\alpha Ac}{\mu\alpha A + c}$ and $\lim_{m\to 0} U_1' = \lim_{m\to 0} U_2' = \infty$.

Accordingly $m^*>0$ holds true in all three cases. □

Proof of Proposition 3.2. If M_h was played with zero probability, then the best response of all shareholders would be P_b, since, by definition, M would always be stealing and M's expected payoff would be somewhere between $(\beta-\mu)\alpha A<0$ and $-c-(1-\beta)\alpha A<0$, depending on the probability of playing $M_{c,n}$. In all cases M would be better off by playing M_h, where his expected payoff would be zero; thus, M_h must be part of an equilibrium. However, there cannot be an equilibrium where M chooses M_h with a positive probability and where, at the same time, there is no litigation. If there were, then every shareholder would have chosen P_a. Clearly, if all shareholders chose P_a then M's best response would be M_d to which, every single shareholder's best response would be P_b. □

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