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Moral hazard, insurers' non-performance and the captive alternative

Abstract

This paper examines the influence of legal costs on the decision of insurers to either effect or refuse claims payments to their insureds. This may lead to inefficiency in the insurance market. In order to overcome this problem an industrial company could alternatively form a single-parent captive instead of insuring with a traditional insurance company.

For our two sequential complete information game theoretical models the authors assume the following two cases: Firstly, an insurance contract is considered between an insurer and an industrial company, secondly, between a single-parent captive and its parent company (industrial company). The two scenarios differ in the way that the parent company receives dividends from its captive insurer. In addition, the parent is also given the means to influence the captive's decisions by imposing discipline. We demonstrate that both, the insurer as well as the captive will show moral hazard behavior. However, albeit legal costs and dividend payments introduce a principal-agent conflict also in the case of a captive insurer, the parent company's power to give binding instructions and impose disciplines on the captive and its managers appears to be an effective means to resolve such inefficiencies and moral hazard problems.

Keywords: captive, insurance, non-performance, moral hazard, litigation, legal costs, bad faith.

Introduction

We analyze the decision situation of a parent company to insure either with a traditional insurer or with its wholly-owned single-parent captive. Using a sequential game theoretical model with complete information we demonstrate, that under fairly general conditions in both cases, traditional and captive insurance contracts, the insurer/captive may have an incentive to act in bad faith to the insured[1]. The argumentation is primarily based on legal costs associated with contract disputes and on the organizational relationship between the parent and its captive. We consider the cost of litigation, dividend payments as well as disciplining effects and argue that a captive is a better device – in comparison to a traditional insurer – to overcome principal-agent and moral hazard problems inherent to such interrelations.

Insurance contracts base on the principle that both sides, insurance company and insured, act in good faith. It is the insurer's duty to make claims payments due to the insured under the policy. In return, the insured is obligated to not withhold relevant information influencing the insurer's decisions regarding contract terms and conditions as well as claims payments.

But literature and practice regularly point out that information asymmetries and principal-agent conflicts can lead to the breach of this implied convenant of mutual trust. As soon as coverage is given, insureds tend to lag behind applying possible risk mitigation or prevention measures. Also the behavior of actuarial managers might not always be consistent with the shareholders' objectives or with policyholders' needs. These conflicts of interest may finally lead to the litigation over insurance contract disputes[2].

Beside the broad literature analyzing the moral hazard problem on the part of the insured (see Lee and Ligon, 2001; Ligon and Thistle, 2005; Eisenhauer, 2004; Smith and Stutzer, 1995), several papers focus on the issue of non-performance on the part of the insurer.

Doherty and Schlesinger (1990), Agarwal and Ligon (1998) and Mahul and Wright (2004) address this issue thereby mainly discussing the effects of the risk of non-performance on the demand for insurance and the optimal contract design. These papers base the reasoning of non-performance primarily on the insurer's insolvency, but also on delays in compensation payments, on clauses that might not completely be understood and controlled by the insureds, and finally on claims that are rendered invalid by the court. Also partial default of the insurer is considered, leading to changes in the optimal insurance contract design in the three-state models suggested by Doherty and Schlesinger (1990) and Mahul and Wright (2004). In addition, Wakker et al. (1997) investigated changes in the decision making behavior in case of probabilistic insurance, which means that the demanders of insurance coverage are informed about the probability of default or non-performance of the insurance company before entering into an insurance contract.

[1] Acting in bad faith means that the insurer withholds the benefits of the policy from its insured without a comprehensible reason, or just because claims payments are expected to be lower in the case of an amicable arrangement or a court decision.

[2] See Sykes (1996) for a general discussion of economic effects of bad-faith-law on insurance premiums and settlements; Browne et al. (2004), who find a positive effect of bad-faith law on overall settlements paid to insureds – also leading to unnecessarily high insurance premiums.

Insurance companies have a natural incentive to refuse payments when an insured had suffered a loss. The reason may be simply that a somewhat incomplete insurance contract leaves some room for interpretation, in and out of court. This is a kind of moral hazard which reduces the expected payments in the case of a loss from the viewpoint of an insured. We analyze such a principal agent-conflict between an insurance company and an insured firm and show that alternative institutional arrangements may help to solve this problem. As Arrow (1963, p. 947), put it long ago: "I propose here the view that, when the market fails to achieve an optimal state, society will, to some extent at least, recognize the gap, and nonmarket social institutions will arise attempting to bridge it". We hypothesize that captive insurers emerged as a cost-efficient solution in the sense of Arrow, helping to mitigate an inefficient market outcome. The parent company can impose discipline on the captive's management, which basically solves the moral hazard problem and helps to avoid costly renegotiations and/or court costs. Moreover, a captive may be a flexible way to reduce taxes. But there are some shortcomings. The setup and the operation of a captive are costly, especially in comparison to large scale insurance companies. In contrast to the traditional insurance relationship, the parent company not only transfers but also carries risk via the captive (in the form of external self-insurance) as the parent holds the captive shares and participates in good as well as bad capital performance. This decisively changes the situation. In the case of a (massive) loss the captive could even go bankrupt, implying a shortfall.

Several empirical studies have aimed at analyzing companies' reasoning behind single-parent captive formation. For example, Loy and Pertl (1982) analyze US-based Fortune-500 companies with single-parent captives. Against their expectations they cannot find certain structural characteristics among these parent companies, which make a captive an attractive alternative for them. Taking a different approach, Smith (1986), Hofflander and Nye (1984), Lai and Witt (1995) as well as Han and Lai (1991) discuss the risk transfer and diversification issues associated with captive insurance companies. They come to diverging conclusions and suggestions regarding the actual intertwining of risk shifting, risk distribution and tax benefits and, thus, regarding the appropriate tax treatment of captive insurance premiums. Tax issues were considered one of the main reasons for captive formation until stricter regulations and rulings (of the IRS and the U.S. Tax Court) in the mid-1980s partly reduced benefits arising from favorable tax treatment in captive domiciles.

Beside structural or fiscal arguments, also shareholder value maximization forms part of empirical investigations regarding the attractiveness of single-parent captives. But, when analyzing the impact of captive formation on the shareholder value and the stock price of the parent company, Cross et al. (1986, 1988), Diallo and Kim (1989) and Adams and Hillier (2000, 2002) cannot find a significant relationship. They explain this fact by potential manager-owner conflicts between the parent company (i.e., shareholders) and captive managers. Due to conflicts of interest they assume the positive effects of captive formation to be weakened or even eliminated, as is also argued by May (1995) and Scordis and Porat (1998). However, according to Smith and Stutzer (1995) and Lee and Ligon (2001) captives should actually help parent companies to reduce moral hazard costs because of the parents' full participation in the loss experience of their captives. One of the most recent papers in this field of research by Scordis et al. (2007) aims at analyzing the potential impact of a captive's formation on the shareholder value of the parent company in more detail by using Monte-Carlo simulations. They are able to identify drivers generating positive shareholder value by means of a captive. According to their findings the attractiveness of captives primarily depend on factors such as the presence of soft/hard insurance market conditions, the choice of a domicile with less complex regulation, tax treatment, reduction of operating costs or also parsimonious use of reinsurance.

The pros and cons discussed above should be taken into account to answer the question why captives exist at all. Thus, the paper adds to the literature of the origins of financial intermediaries. We proceed in analyzing the conflict of an insurance company and an insured company deploying a game theoretic model and show that the incentive of the insurance company to refuse payments lowers the expected payout and introduces a kind of inefficiency into the insurance market, which can be resolved by using a (single-parent) captive structure[1]. It is important to note that in our models the captive is treated as separate corporate entity in order to make its decisions comparable with those of a traditional insurer. The captive, being a wholly-owned subsidiary of the parent company, is organized in the form of an individual profit center, i.e., its managers are responsible for a profitable development and performance of the captive. In practice, the captive might be more

[1] In our analysis reputational issues, which might reduce moral hazard of the insurer, are not taken into account. We choose a single-event approach not considering rollover effects. Thus, we implicitly focus on rather low frequency – moderate/high severity events, where long-term reputation is assumed to be of minor interest.

or less bound to the parent's decisions. Nevertheless, it must be assumed that in general the captive insurer is able and willing to act according to its own economic objectives.

We show that, albeit legal costs and dividend payments introduce a principal-agent coflict also in the case of a captive insurer, the parent company's power to give binding instructions and impose disciplines on the captive and its managers appears to be an effective solution in order to overcome inefficiencies.

1. The basic model

Two sequential complete information game theoretical models are set up with the following players: (1) industrial company[1] against traditional insurer; and (2) parent company against its single-parent captive[2]. The decision trees will be based on the net cash flows at time T, when the damaging has occurred and loss inspection is already completed, and differ in respect of dividends paid from captive to parent company, a potential discipline in the captive case and legal costs. The insurance policy is written between a parent company and a captive or a traditional insurance company as direct insurance contract without reinsurance and with equal insurance tax for the insurers[3]. In general, the captive company would avail of the possibility of reinsuring and of using alternative funding techniques. However, for the purpose of this paper, reinsurance is excluded, as in this case the captive would again be bound to a traditional reinsurance contract with all its consequences, i.e., moral hazard. Note that premium payment and insured sum are fixed for both insurers, i.e., the policy is written on equal terms for both, captive and insurance company. This assumption implies that we do not consider the potential impact of probabilistic insurance contracts between insured and insurer/captive on the amount of the premium payment.

Legal costs are divided into out of court settlement costs and court costs, both consisting of a percentage of the insured sum. These costs arise as both parties will usually be supported by legal consultants, also in the case of an amicable arrangement. Court costs have to be paid completely by the losing party of the lawsuit, whereas the legal costs in case of an amicable arrangement are borne by each party respectively. In addition, the legal costs in case of a lawsuit are assumed to be higher than the sum of the out of court costs of both parties.

All variables used in the calculations and figures are assumed to be common knowledge. The parent company is denoted by PC, the captive company by C and the insurance company by IC. Note again that in all models the parent/industrial company is the insured. In the captive case the insured additionally participates in the profits of its wholly-owned insurance subsidiary.

For the basic model (2.1) the decision tree results as depicted in Figure 1 for the insurance company. In contrast to this we assume for the captive that the parent company first only receives dividend payments (model 2.2, Figure 2), in order to assess whether the introduction of such connections between the captive and the parent company have an impact on the decision of the insuring party. In a further step (model 2.3) the parent company is given the possibility to instruct the captive to fully compensate losses by imposing discipline (see decision tree in Figure 3).

As this paper aims at analyzing moral hazard incentives of insurance and captive companies, a full treatment of all equilibria would exceed the scope of this paper. Thus, in the calculations (models 2.1, 2.2 and 2.3) we primarily focus on the equilibrium which gives us conclusions regarding the initial refusal of compensation payments of the insurance/captive company.

1.1. Parent company versus traditional insurance company. The parent company is now in the situation that loss event and damages have occurred.

Loss inspection is completed and losses/claims have already been reported to the insurer. The decision tree in Figure 1 depicts all cash flows (cumulative premiums up to time T, P_T, claims payments/insured sum S, the percentage of the insured sum paid out in the case of an amicable arrangement $\lambda^{IC}S$, legal costs in court $CC = xS$ and out of court $OCC^i = y^iS$, where $x; y \in [0; 1]$ and $i \in \{PC; C; \mathrm{IC}\}$) linked to the insured event at time T. After this event, the insurer faces the decision whether to pay or to refuse claims payments.

The final decision depends on the circumstances formalized in the decision tree. If the insurer refuses to compensate the insured for the losses, the insured parent company can either abandon the claim or demand payment through "out of court" proceedings and in case of failing, through a lawsuit. If the amicable arrangement is not successful and the parent is not willing to sue the insurer, it can principally also abandon the claim at this point. However, in the decision tree this branch is neglected, as this deci-

[1] For the purpose of clarity the industrial company will be denoted as "parent company" and abbreviated by "PC" throughout the whole paper.
[2] Single-parent captives are most commonly used in the captive market, as the link between the parent company and its wholly-owned subsidiary is very clear and, thus, advantageous from an organizational perspective. For better comparability, we assume that captives have to meet the same regulatory requirements as traditional insurance companies, as for example, in most domiciles in the European Union.
[3] In this paper we do not analyze tax mitigation strategies of the parent company.

sion will never be made by the insured due to the costs that have already been caused by the attempt to come to an amicable arrangement[1].

It is assumed that in court nature chooses the prevailing party with a certain probability. The probability that the parent company wins in case of a lawsuit is denoted by θ.

The decision scheme and the findings will be illustrated by a numerical example, under the following assumptions: legal costs in court $CC = xS = 0.10 \cdot S$ (in total for both parties) and out of court $OCC^{PC} = y^{PC}S = 0.04 \cdot S$ for the parent company, $OCC^{IC,C} = y^{IC,C}S = 0.03 \cdot S$ on the part of the insurer. The legal costs in case of an amicable arrangement are assumed to be the same for the traditional and the captive insurer. In Model 2.2 and 2.3 the captive pays dividends ($d = 0.05$) to the parent company.

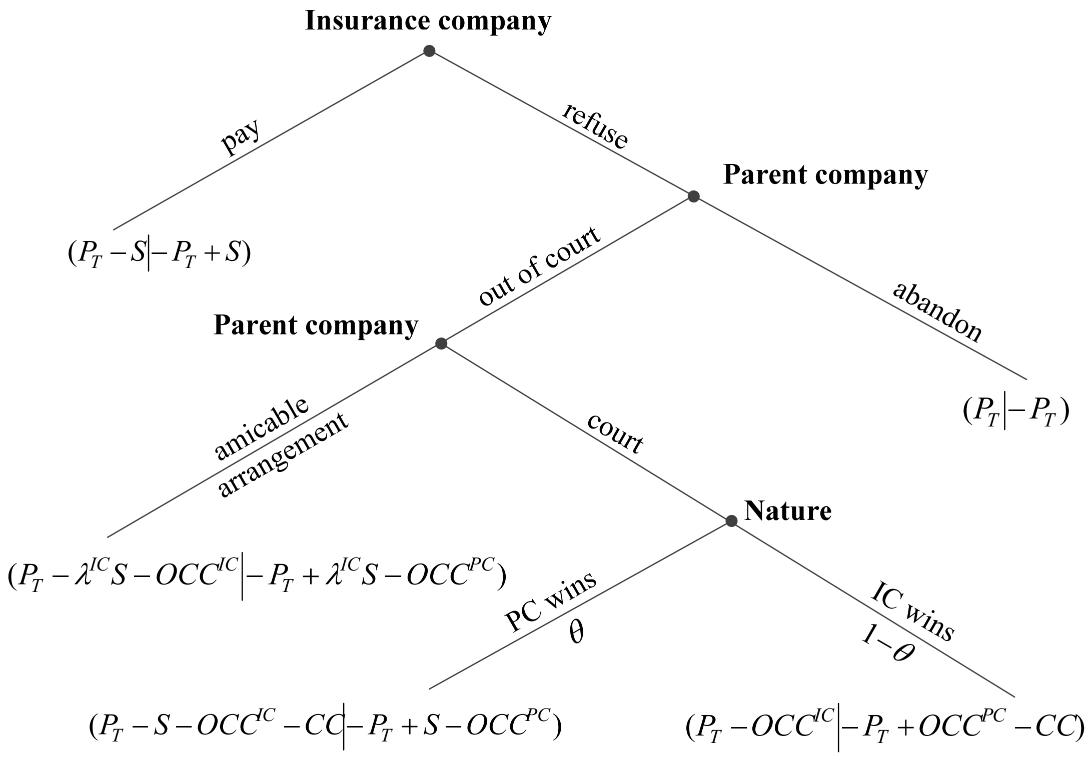

Fig. 1. Decision tree of insurance company vs. parent company (model 2.1) showing net cash flows of the insurer (lhs) and the parent/industrial company (rhs)

Solving the models with backward induction yields in both cases the equilibrium which only depends on the additional costs arising if the parent company does not abandon the claim, as well as on the probability of winning in case of a lawsuit. The parent company abandons the claim against the insurance company if

$$y^{PC}S \ge \max(\lambda^{IC}S, \theta S - xS(1-\theta)), \qquad (1)$$

i.e., when the out of court costs $y^{PC}S$ exceed both, the expected payout $\lambda^{IC}S$ in the case of an amicable arrangement and also $\theta S - xS(1-\theta)$ in case of a lawsuit[2].

The insurance company will immediately pay if the additional costs of not paying at first step exceed the instantaneous payment, i.e. if

$$\begin{cases} \lambda^{IC} = \theta - x(1-\theta), \\ \theta \ge \max\left(\dfrac{y^{PC}+x}{1+x}, \dfrac{1-y^{IC}}{1+x}, \dfrac{1-y^{IC}+x}{1+x}\right) \le 1. \end{cases} \qquad (2)$$

This equilibrium, i.e. the case that the insurer pays out immediately, follows by backward induction from the cases[3] that:

1. The parent company will not abandon the claim but is willing to have an amicable arrangement.
2. The parent company will neither abandon the claim nor agree out of court.

[1] The outcome of the neglected branch is $\lambda \cdot S < 0$, which is not true as neither the probability nor the insured sum can be a negative value. For this reason, this decision will never be made by the insured.

[2] As all the terms used in equation (1) – x, y^{PC}, λIC, θ – are percentages of the insured sum, they can be normalized by S. Therefore, equation (1) can also be written as $y^{PC} \ge \max(\lambda^{IC}, \theta - x(1-\theta))$.

[3] The maximum values of θ in (2) result from the first two inequalities in (3) and (4). In equilibrium, λ^{IC} in the _rst inequality in (3) can be replaced by the term $\theta - x(1-\theta)$ resulting in the third condition of the maximum function for θ in (2).

Case (1), i.e., the amicable arrangement, is determined by the three inequalities

$$\begin{cases} y^{IC} + \lambda^{IC} \geq 1, \\ \lambda^{IC} \geq y^{PC}, \\ \lambda^{IC} \geq \theta - x(1-\theta). \end{cases} \quad (3)$$

while for case (b), i.e. the court branch

$$\begin{cases} y^{IC} + \theta x \geq 1-\theta, \\ \theta - x(1-\theta) \geq y^{PC}, \\ \lambda^{IC} \geq \theta - x(1-\theta). \end{cases} \quad (4)$$

has to be fulfilled.

From the perspective of the insurance company the resulting net payout $y^{IC}S + \lambda^{IC}S$ at refusal is more costly than the immediate payment S, which is indicated by the first inequality of (3) (again normalized by S). Consequently, the insurer will immediately pay claims knowing the preference of the parent company for the amicable arrangement branch.

The second and the third inequalities in (3) describe the parent company's willingness to call in claims payments on the basis of an amicable arrangement. This decision is realized if the paid-out percentage λ^{IC} of the insured sum exceeds both, the out of court costs y^{PC} as well as the expected value resulting from the court branch, which is expressed by $\theta - x(1-\theta)$. As the parent company aims at maximizing the total net payout (i.e., claims payments − costs), it will not be willing to generally abandon its claims as long as the payout in case of the amicable arrangement is higher than the out of court settlement costs. In addition, the lawsuit must be unattractive due to a lower expected outcome in comparison to the out of court branch. Thereby, the term $\theta - x(1-\theta)$ is, again, the parent company's expectation of the total net payout for the two possible cases of winning or losing the lawsuit.

Regarding the preference of the parent company for claiming the payments in a lawsuit, the insurance company has to consider again all follow-up costs. The parent company will take the claims to court, whenever the second and third inequalities of (4) are satisfied. In other words, the lawsuit will bring benefits to the parent company, if the expected value resulting from the court branch exceeds both, the paid-out percentage of the insured sum λ^{IC} as well as the out of court costs associated with an amicable arrangement. Therefore, expected earnings in the court case are higher than the costs associated with an amicable arrangement (a) and legal assertion (b).

Again, from the perspective of the insurance company the expected savings $1-\theta$ in case of winning the lawsuit fall behind the sum of OCC costs (y^{IC}) and CC costs (θx). As the parent company favors the lawsuit, the immediate claims payments are again more attractive for the insurance company. Therefore, from the two conditions the overall equilibrium in (2) suggesting immediate claim payment of the insurance company can be derived, comprising the two cases "court" and "out of court".

Table 1 illustrates these findings using the numerical example introduced above. According to the equilibrium (2) in model 2.1 the insurer will pay immediately if the probability of losing the lawsuit against the parent company is larger than 97.27%, which is the marginal θ. In this case the resulting λ^{IC} amounts to 97.00%. Regarding inequality (1) the parent company would only abandon the claim if y^{PC} was larger than 97.00%. Thus, the parent is not willing to give up its claim in this example (y^{PC} = 4%). In order to show what happens in case that the probability θ is lower, we assume θ to be 95%. In this case the first inequality in (3) is not fulfilled, i.e. an amicable arrangement will be more attractive from the perspective of the insurer. For the parent company the situation remains the same (all inequalities fulfilled), also for the case that θ is assumed to be 98%. In this case, again, all inequalities in (3) and (4) are true and the insurer will pay immediately.

Table 1. Numerical example: parent vs. traditional insurance company

Model 2.1	θ = 0.6000	θ = 0.9500	θ^* = 0.9727
(1) $y^{PC}S \geq \max(\lambda^{IC}S, \theta S - xS(1-\theta))$	False	False	False
(2) $\lambda^{IC} = \theta - x(1-\theta)$	0.5600	0.9450	0.9750
(3) $y^{IC} + \lambda^{IC} \geq 1$	False	False	True
(3) $\lambda^{IC} \geq y^{PC}$	Frue	True	True
(3) $\lambda^{IC} \geq \theta - x(1-\theta)$	True	True	True
(4) $y^{IC} + \theta x \geq 1-\theta$	False	True	True
(4) $\theta - x(1-\theta) \geq y^{PC}$	True	True	True
(4) $\lambda^{IC} \geq \theta - x(1-\theta)$	True	True	True

We would also like to briefly consider the decision situation, when the equilibrium condition for θ in (2) is not fulfilled and even lower than 95%, e.g., θ = 60%. In this case the insurer prefers both, amicable arrangement and a lawsuit, to immediate payment taking all costs into acccount. This results from the first two inequalities in (3) and (4), which are not fulfilled any more. Comparing the net outcome for the court and the out of court branch, the insurer will only agree to an amicable arrangement if

$$\lambda^{IC} \leq \theta(1+x), \tag{5}$$

i.e., if the percentage of the insured sum, which the insurer has to pay in the case of an amicable arrangement, does not exceed $\theta(1 + x)$. As we already know from (2) the parent will agree to such an arrangement if λ^{IC} amounts to at least $\theta - x(1 - \theta)$. If λ^{IC} is lower, a lawsuit is more attractive to the parent. Thus, the parent and the insurer will come to an amicable arrangement as long as λ^{IC} lies within the following interval

$$\lambda^{IC} \in [\theta - x(1-\theta, \theta(1+x)], \tag{6}$$

which consequently leads to $\lambda^{IC} \in [0.56; 0.66]$ in our numerical example[1]. As soon as the insurer offers less than 56% of the insured sum, the parent will go to court. At the same time the insurer will not offer more than 66% of the insured sum in an amicable arrangement, because in this case a lawsuit promises a more attractive net payout.

1.2. Parent company versus captive (considering dividends). As benchmarking case we suppose that the parent company insures with its captive, i.e., its wholly owned subsidiary. In contrast to the insurance company the captive pays dividends to its parent. This approach is chosen in order to assess the impact of – solely – dividend payments on the incentive structure, i.e., moral hazard, if the parent company cannot discipline the captive (see next section)[2]. Dividend payments are denoted by d, where $d \in [0; 1]$. The higher claims payments are made, the more the absolute dividend payments to the parent are reduced.

Figure 2 shows the new decision tree, amended by dividend payments. Again, net cash flows related to a certain loss event are considered. The captive faces the decision to either pay or refuse the claims. In the case of refusal the parent reacts by either abandoning the claims or trying to obtain an amicable arrangement with the captive (potentially resulting in the payment of λ^C, causing out of court costs OCC for both parties). If no solution can be achieved by this means, the parent company has two more possibilities: abandon the claim or assert the claim in a lawsuit. In contrast to model 1.1 (Figure 1) claims payments and legal costs affect dividend payments which is shown in the decision tree (Figure 2).

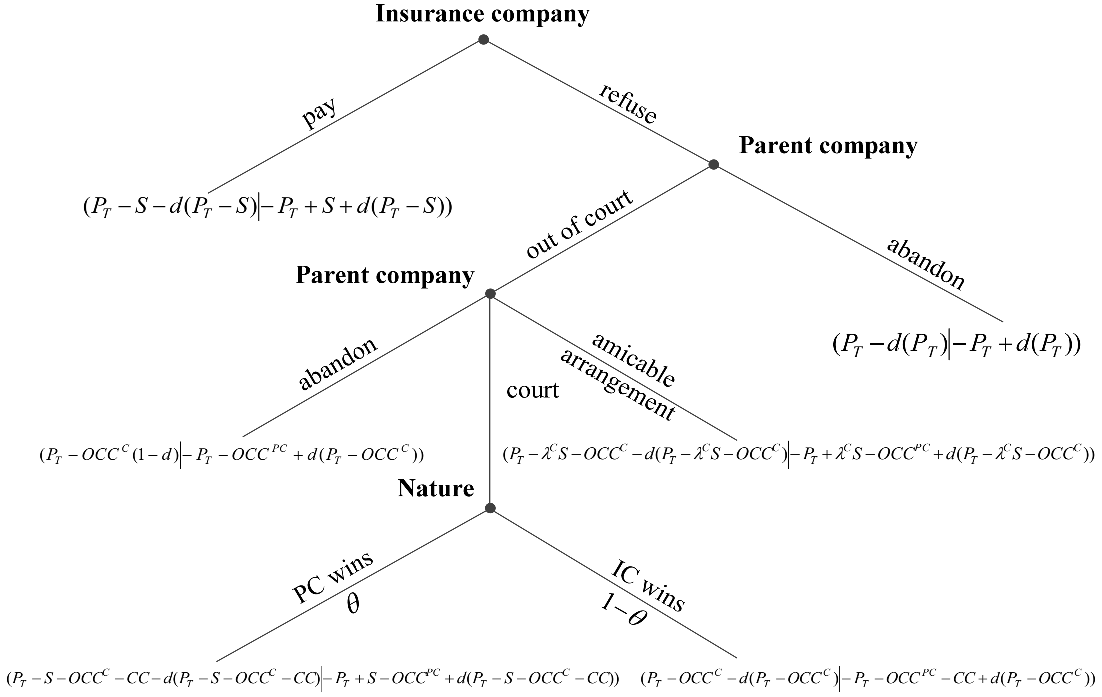

Fig. 2. Decision tree of captive vs. parent company considering only dividends (model 2.2) showing net cash flows of the captive (lhs) and the parent (rhs)

[1] Given that $x = 0.1$, $y^{PC} = 0.04$, $y^{IC} = 0.03$.
[2] Direct disciplining might not be possible in all legal structures of corporate groups.

The decision scheme can be pictured as follows. The parent company abandons the claim against the captive in case of

$$y^{PC} \geq \max(\lambda^{C}(1-d) - dy^{C}, \\ \theta - x(1-\theta) - d\theta(1+x) - dy^{C}). \tag{7}$$

Inequality (7) differs from inequality (1) in the way that the claims payments (either S or $\lambda^C S$) and legal costs (y^C and x) indirectly reduce dividend payments and consequently the net payout of the captive to its parent. Thus, when the out of court costs y^{PC} exceed both, the expected net payout $\lambda^C(1 - d) - dy^C$ in the case of an amicable arrangement and also $\theta - x(1 - \theta) - d\theta(1 + x) - dy^C$ in case of a lawsuit, the parent company will decide to abandon the claim.

Following the same calculation techniques for the captive the following inequalities are derived with slight differences in comparison to the insurance company case due to the implications of dividends. The captive will pay the claim at once if neither amicable arrangement

$$\begin{cases} y^{C} + \lambda^{C} \geq 1, \\ \lambda^{C} \geq \dfrac{y^{PC} + dy^{C}}{1-d}, \\ \lambda^{C} \geq \theta - \dfrac{\theta - x(1-\theta) - d\theta(1+x)}{1-d}. \end{cases} \tag{8}$$

nor court

$$\begin{cases} y^{C} + \theta x \geq 1-\theta, \\ \theta - x(1-\theta) - d\theta(1+x) \geq y^{PC} + dy^{C}, \\ \lambda^{C} \leq \theta - \dfrac{\theta - x(1-\theta) - d\theta(1+x)}{1-d}. \end{cases} \tag{9}$$

will give additional benefits or savings. Satisfying the inequalities (8) and (9) yields the following interval for the considered equilibrium of immediate payment by the captive.

$$\begin{cases} y^{C} = \dfrac{\theta - x(1-\theta) - d\theta(1+x)}{1-d}, \\ \theta \geq \max\left(\dfrac{y^{PC} + x + dy^{C}}{(1+x)(1-d)}, \dfrac{1-y^{C}}{1+x}, \dfrac{1-y^{C}(1-d)+x-d}{(1+x)(1-d)}\right) \leq 1. \end{cases} \tag{10}$$

Now, from the perspective of the insuring party, the same argumentation can be used for the captive company as above in the case of the traditional insurance contract with outcomes slightly varying regarding the dividend payments to the parent company as shown in equations (8) and (9). Assuming the same out of court costs for the captive and the insurance company, the insurer/captive's constraints for payment or refusal of claims payments are the same. At first sight this result may not appear to be obvious, but it can be justified in the following way. In absolute terms the dividend payments reduce the total net payout of the captive, but as dividends are a fixed element in every branch, i.e., they reduce every payment by the same percentage, the decision remains the same if relative terms are considered.

In contrast to this, the decision of the parent company is actually influenced by the captive's dividend payments, as the parent company's expectation of the total net value is reduced by the dividend amount paid out by the captive to the parent company. This argumentation can be seen when comparing captive and insurance company, i.e., equations (8) and (3) as well as (9) and (4). These equations finally lead to the equilibria (2) and (10), which will be explained in more detail in section 3. Finally, note again, that these equilibria do not only depend on additional costs in case of delayed or refused payments, but in particular on the probability of winning/losing the lawsuit.

Table 2 aims at illustrating the above findings using our numerical example. According to the equilibrium conditions (10) in model 2.2 the captive will pay immediately, if θ is larger than 97.7512%, which is the marginal θ. Setting θ at 97.7512%, λ^C amounts to 97.00%, given that x = 0.10 and d = 0.05. Comparing the actual decision situations in model 2.1 and 2.2, the marginal θ in model 2.2 is higher. Assuming that θ is 97.22% which leads to immediate payment of the insurer in model 2.1, the captive does not pay immediately, as the probability of losing the lawsuit is still too low in order to change the captive's decision. This example shows, that there is a discrepancy between the marginal θ in the two models, leading to different decisions for the interval between the marginal thetas, i.e. $\theta \in [0{,}9727, 0{,}977512]$. For all $\theta \geq 0{,}977512$ the captive will not argue against claims payments any more, i.e., all inequalities in (8) and (9) are true[1].

[1] The figures for θ and λ are rounded.

Table 2. Numerical example: parent vs. insurer/captive (considering dividends)

Model 2.2	θ = 0.6000	θ = 0.9727	θ* = 0.977512
(7) $\lambda^C = \frac{\theta - x(1-\theta) - d\theta(1+x)}{1-d}$	0.5547	0.9647	0,9700
(8) $y^C + \lambda^{IC} \geq 1$	False	False	True
$\lambda^C \geq \frac{y^{PC} + dy^C}{1-d}$	True	True	True
$\lambda^C \geq \frac{\theta - x(1-\theta) - d\theta(1+x)}{1-d}$	True	True	True
(9) $y^C + \theta x \geq 1-\theta$	False	True	True
$\theta - x(1-\theta) - d\theta(1+x) \geq y^{PC} + dy^C$	True	True	True
$\lambda^C \geq \frac{\theta - x(1-\theta) - d\theta(1+x)}{1-d}$	True	True	True
(10) $y^{PC} \geq \max(...)$	False	False	False

Again, we also consider the decision situation for the two parties, when the equilibrium condition for θ is not fulfilled, i.e., when θ = 60%. In this case also the captive prefers both, amicable arrangement and lawsuit, to immediate payment taking all costs into account. The first two inequalities in (8) and (9) are no more "true". Comparing the net outcome for the court and the out of court branch, the captive will agree to an amicable arrangement as long as

$$\lambda^C \leq \theta(1+x), \tag{11}$$

i.e., if the percentage of the insured sum, which is the insurer's obligation in the case of an amicable arrangement, does not exceed $\theta(1+x)$. At the same time the parent demands at least $\lambda^C \geq \frac{\theta - x(1-\theta) - d\theta(1+x)}{1-d}$ for an arrangement. If λ^C is lower than that, litigation is preferable from the parent's perspective. Thus, the parent and the captive will come to an amicable arrangement as long as λ^C lies within the following interval

$$\lambda^C \in \left[\frac{\theta - x(1-\theta) - d\theta(1-x)}{1-d}, \theta(1+x)\right], \tag{12}$$

which consequently leads to $\lambda^C \in$ [0.5547; 0.6600] in our numerical example. An offer of less than 55.47% of the insured sum by the captive would lead to litigation as the parent would not be willing to come to an arrangement any more. At the same time the captive cannot offer more than 66% of the insured sum, as in this case litigation would promise a more attractive net payout on the part of the captive.

1.3. Parent company versus captive (considering dividends and discipline). A constitutional element of captive insurance companies is that the parent avails of certain means to impose its will on the captive management due to its equity holding. Then the situation changes substantially. In the following we focus on the decision option "discipline" in order to find out more about the effect of the interdependence between captive and parent company which is mainly depicted by this additional branch.

The decision tree of model 1.2 (Figure 2) is adapted in respect of the discipline (*D*), which can be imposed upon the captive by its parent company, resulting in a new decision tree (Figure 3). The discipline consists of (non-)financial costs imposed by the parent at refusal of payment, for example personnel turnover in the captive management or a fixed cash amount. In the case of the refusal of payments by the captive, the parent might either abandon the claim, choose the out of court branch or immediately discipline the captive. If no amicable arrangement can be achieved, the parent has to decide whether to abandon the claim, to enter a lawsuit or to discipline the captive after the unsuccessful negotiations. All legal costs and net cash flows in relation with the claims after a loss event are depicted in the decision tree. Again solving the model by backward induction results in the following findings.

The captive company always pays out immediately, whenever the parent company will choose to discipline the captive for the case of refusal, as this is the parent's dominant strategy (see below). For the captive, this is formalized by

$$D - dD \geq 0 \tag{13}$$

which will always be the case as long as any discipline is imposed.

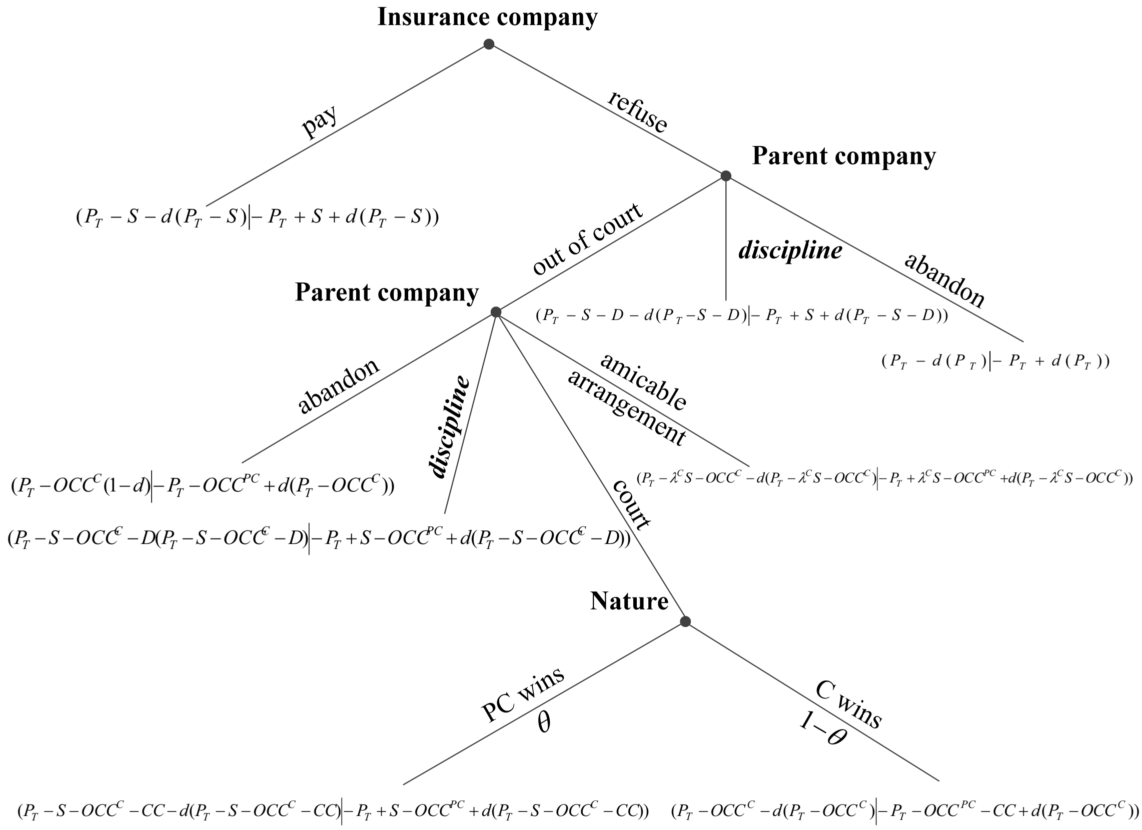

Fig. 3. Decision tree of captive company vs. parent considering dividends and discipline (model 2.3) showing net cash flows of the captive (lhs) and the parent (rhs)

For the parent company "discipline" will be a dominant strategy over "out of court" and "abandon" whenever

$$\begin{cases} S(1-d) - dD \geq 0, \\ y^{PC}S + dy^{C}S \geq 0, \end{cases} \tag{14}$$

is fulfilled. "Discipline" also dominates the option of disciplining the captive one step later, i.e. after having entered into discussions for attaining an amicable arrangement − but without success. In addition, "abandon", "court" and "amicable arrangement" are dominated strategies whenever

$$\begin{cases} S(1-d) \geq dD, \\ S(1-d) - dD \geq \lambda^C S(1-d), \\ S(1-d) - dD \geq \theta S(1-d)(1+x) - xS. \end{cases} \tag{15}$$

The first inequality in (15) compares the decision options "abandon" and "discipline" from the parent's perspective. The net payout for the parent in the case of disciplining is greater than the reduction of dividend payments due to the cost of disciplining the captive. Also, the option "amicable arrangement" will not be chosen by the parent, if the net payout in the case of disciplining remains greater than the expected net payout in the case of an amicable arrangement taking dividend reductions due to claims payments $\lambda^C S$ into account. The third alternative – a lawsuit – to the branch "discipline" will not become attractive for the parent company as long as the net payout of "discipline" is greater than the expected payout in the case of a lawsuit, again considering dividend reductions. The equilibrium follows from (13), (14) and (15) resulting in the interval

$$D < \left(\frac{S(1-d)}{d}, \frac{S(1-\lambda^C)(1-d)}{d}, \frac{S(1-d+x) - \theta S(1-d)(1+x)}{d} \right). \tag{16}$$

As long as the discipline does not exceed the level determined in inequality (16), "discipline" dominates all other branches from the perspective of the parent company. Thus, the captive will immediately accomplish the claims payments expected by the parent company.

Again, these findings shall be explained further using our numerical example. As can be seen in Table 3, the captive will pay out immediately as long as inequality (13) is fulfilled – independently from the probability of winning/losing the lawsuit. On the part of the parent, disciplining is the dominant strategy. If θ is set at 97,2727% (compare model 2.1 and 2.2) and the insured sum at EUR 1 mio the discipline must be lower than EUR 560.909, which follows from (16). Otherwise "discipline" is not the most attractive strategy for the parent any more. For example, a discipline set at EUR 450.000 will lead to immediate payment.

If we assume that the parent expects to win in a lawsuit with a probability of 97.7512%, the second inequality in (15) is only fulfilled if the discipline is set below EUR 480.048[1]. Otherwise, the parent will choose an alternative option, i.e., litigation. In comparison, the parent company can impose a discipline up to EUR 6.860.000 if the probability of winning in court is 60%.

Table 3 demonstrates that the larger the probability of winning a lawsuit for the parent, the lower the marginal discipline. If a higher discipline was chosen by the parent, the net payout of this strategy would be lower than the net payout of an alternative strategy. Moreover, more costly disciplining would crucially reduce dividend payments to the parent. However, from the captive's perspective immediate payment is the preferred strategy as long as "discipline" is the most attractive branch for the parent.

Table 3. Numerical example: parent company vs. captive (considering dividends and discipline)

Model 2.3 (S = EUR1 mio., d = 0.05)	θ = 0.6000	θ = 0.9727	θ = 0.977512
(13) $D - dD \geq 0$	True	True	True
(14) $S(1-d) - dD \geq 0$	True	True	True
(14) $y^{PC}S + dy^{C}S \geq 0$	True	True	True
(15) $S(1-d) \geq dD$	True	True	True
(15) $S(1-d) - dD \geq \lambda^{C}S(1-d)$	True	True	True
(15) $S(1-d) - dD \geq \theta S(1-d)(1+x) - xS$	True	True	True
(16) $D < \min(...)$	6.860.000	590.909	480.048

2. Discussion

The aim of this section is to compare and explain the equilibria presented above, namely (2.1) insurance company versus parent company; (2.2) captive company versus parent company (considering only dividends); (2.3) captive company versus parent company (considering dividends and discipline) in an intuitive way.

First, the cases insurance (2.1) versus captive company with dividends (model 2.2) are compared in order to derive suggestions for the parent company's decision to close an insurance contract. Based on the equilibria one can see that $\lambda^{IC} \geq \lambda^{C}$, i.e., the percentage of claims payments in case of an amicable arrangement is higher for a contract with an insurance company than for a contract concluded with a captive. Intuitively the contrary is expected because of the interdependence[2] between the captive and its parent which does not exist between the traditional insurance and the parent company.

Nevertheless, the payment of λ^{C} by the captive reduces the dividend payment for the parent by λ^{C}. Thus, the parent company receives $\lambda^{C}(1 - d)$ in real terms. The higher λ^{C} is chosen, the higher also the reduction of the total payment in absolute terms. Therefore, the actual claim payment λ^{C} of the captive tends to be lower than the one of the insurance company.

In fact, neither the amicable arrangement nor the court branch will preferably be realized by the parent company with the captive as counterpart as long as there is no threat of discipline. Referring to the equations (1) and (7), which determine the decision pro/contra the claim refusal, the right hand side in case of the insurance company is always higher than the one of the captive, because the latter is reduced by the dividend terms. Consequently, the interval for y^{PC} starts at a lower level for the captive case which makes the total interval larger. Hence, the parent company will be more likely to abandon the claim against the captive than against the insurance company.

Thus, it can be shown that the parent company's decision will differ depending on the contractual partner. Although the parent company regularly receives a higher total net payout when being insured with a captive rather than with an insurer, it must take into account that if the dividend is the only connection between the captive and the parent, then c.p. the captive has a higher incentive (moral hazard) to refuse claims payments. In practice, of course, the disciplining effect must not be neglected (see below).

Assuming that the out of court settlement costs are equal for the insurance and the captive company, the interval for θ in the equilibrium (10) (model 2.2) of the captive becomes smaller in comparison to the equilibrium (2) of the insurance company. This interval

[1] λ^{C} is calculated by $\frac{\theta(1-d-dx)+x(1-\theta)}{1-d}$, resulting from the equilibrium between the branches "court" and "amicable arrangement".

[2] The relationship between captive and parent company is considered in (model 2.3) by giving the parent company the possibility of disciplining the captive.

determines the decision of the insurance/captive company to pay immediately after the loss incidence. The smaller the interval, the stronger is the tendency of the insurance/captive company to refuse claims payments which yields higher moral hazard.

It is also important to note that when dividends d paid to the parent are very high, then θ also increases and might even become greater than 100%. In this case, the equilibrium condition is no more fulfilled and, thus, the captive will always refuse immediate claims payments as alternative options become more attractive from the perspective of the captive. Beside dividends, the marginal θ also depends on the legal costs (x, y^{PC}, y^{C}).

However, in reality the out of court settlement costs (including administration costs) tend to be higher for the captive, as it cannot benefit from economies of scale in contrast to insurance companies. Hence, the comparison of the maxima elements in equations (2) and (10) shows changes in two opposite directions and therefore a mathematically clear statement is no more possible. However, as we know from above, the payment λ^{C} of the captive at an amicable arrangement will be lower than in the insurance company case, and furthermore, the parent company will abandon the claims payments more often against the captive. This knowledge of the captive will incentivise it again to refuse payments at the very beginning.

Taking the parent's ability of disciplining the captive into account, the situation changes substantially. Moral hazard diminishes completely in model (2.3) as the immediate payment becomes the dominant strategy. As soon as the parent clearly demonstrates its willingness to impose a discipline, i.e., giving binding instructions, initiating personnel turnovers or even liquidation, if the claims payments are refused, the captive will always pay immediately. These results from the inequalities (14) and (15) which show the inferiority of the branches "abandon", "amicable arrangement" and "court" respectively in comparison to "discipline". The net payout for the parent company regarding the insured sum as well as the reduction on the dividend payments through disciplining costs still exceeds the outcome including costs in the case of the three alternative options.

Again, the parent company will prefer the branch "discipline" as its net pay out is still favorable. Finally, the parent company will always be better off when disciplining the captive. As the parent's preference is known by the captive, immediate payment is the best strategy from the captive's perspective. Therefore, the model clearly shows that the possibility and willingness to discipline the captive results in the absence of moral hazard.

In order to minimize deadweight costs, which also reduce dividend payments in absolute terms, the parent will choose the lowest but still effective discipline. According to inequality (13) even a discipline amounting to only EUR 1 would be suficient to force the captive to pay out immediately, albeit dividends might be close to 100% at the same time. The pure fact, that the parent is obviously willing to enforce its claims by means of a discipline leads to immediate claims payments. On the other hand, disciplines exceeding a certain threshold make other branches more attractive to the parent or may even result in the liquidation of the captive. However, for the parent company the (single-parent) captive structure is preferable to a traditional insurance contract, when the disciplining effect is taken into account.

Moreover, the preferences of parent and captive are expected to differ from those discussed above, if we look at the decision situation from the perspective of the corporate group. In this case the captive is not treated as a separate corporate entity pursuing its own interests, but rather as a completely subordinate company. Thus, model 1.2 would already lead to immediate payment without moral hazard problems, as both, parent and captive company, would be interested in obtaining the best solution for the entire corporate group. Therefore, both companies aim at avoiding legal and other deadweight costs, which are nonconstructive for the corporate group in total.

Consequently, the best solution is cooperative behavior between parent and captive having the same economic objectives. But if the companies act independently from each other, model 1.3 demonstrates that the threat of discipline also leads to a – in comparison to traditional policies – favorable solution and helps to eliminate moral hazard.

Finally, another remarkable aspect favoring the use of single-parent captive structures – not considered in our formal model – needs to be mentioned. In practice, tax mitigation strategies of the parent company also have an impact on its decision regarding the reporting of damages and assertion of claims. Different tax regimes in the domiciles of the parent and the captive company as well as the actual financial situation of the parent company at the occurrence of a certain event insured may influence its decision crucially. Whenever the economic situation of the parent is favorable, its decision makers may rather tend to abandon claims as the payments are not urgently needed at that point in time. In addition, the funds are usually taxed at a very low rate (or not taxed at all) in the domicile of the captive. On the other hand, if the parent suffers losses in economically critical times, it avails about the possibility of enforcing claims payments by imposing a discipline on its captive (see model 2.3). The parent can be (almost) sure about losses being compensated if this complies with its corporate interest. The advantage of such flexibility in corporate decisions must not be neglected.

Conclusion

In this paper the decision of a parent company to conclude an insurance contract either with a traditional insurance company or a captive insurer is analyzed by using a sequential game theoretical model with complete information. In both cases the policy conditions (premiums, insured sum) are assumed to be equal and taxes are neglected. The argumentation is based upon legal costs (out of court costs and litigation costs) arising at the assertion of claims payments after an initial refusal, and also upon dividends paid by the captive to the parent company. Behavioral aspects concerning the relationship between the captive and the parent company are only considered by means of a – monetary or other – discipline which the parent can impose upon the captive in the case of refusal.

We develop our model by successively discussing three variants of the fundamental decision situation between an insured company (referred to as parent company in this paper) and its insurer. By backward induction we firstly derive the equilibrium conditions for immediate payment of a traditional insurance company in case that the parent company suffers damages. This equilibrium depends on legal costs (at amicable arrangement or in case of litigation) and on the probability (θ) that the parent company would win in case of a lawsuit.

Secondly, we assume that the parent company insures with its own captive insurer. The two companies are treated as separate entities, just as in the case of a traditional insurance policy. But in contrast to the traditional model, the captive insurer pays dividends to the parent on a regular basis.

As can be concluded from the equilibria in these two models, the parent company abandons claims against the captive more often than against a traditional insurance company, as there is a certain discrepancy between the marginal θ in the two models. If claims are not abandoned by the parent company, the payout level at an amicable arrangement is even lower for the captive case. Consequently, the captive has a higher incentive, i.e., moral hazard, to refuse immediate payments than the insurance company if only dividend payments are taken into account. In addition, we also discuss the situation when the captive does not pay immediately, i.e., when the equilibrium conditions are not fulfilled. Within a certain interval an amicable arrangement can be obtained. Otherwise the two parties prefer litigation.

In our final model, the situation changes substantially. If the parent company can impose its will on the captive by means of discipline, immediate claims payments become the dominant strategy for the captive and moral hazard diminishes completely. Therefore, taking all relevant aspects – legal costs, the probability of winning/losing the lawsuit, dividend payments and disciplining – into account, the single-parent captive structure offers higher flexibility to its insured. The parent company is given a "guarantee" for compensation in critical times as well as more possibilities of intervening according to the company's needs. Thus finally, the paper adds to the literature of the origins of financial intermediaries, demonstrating that captives can be used as an appropriate means to resolve inefficiencies in the insurance market.

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