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Abstract

This paper analyzes the adverse incentive effects produced by money injections of benefactors (sugar daddies SD). We show that the existence of a SD induces the club to choose a riskier investment strategy and the more the SD commits to bailout the club, the more the clubs' optimal level of riskiness increases. Moreover, a private SD bails out the club less often than a public SD. Our model further shows that a "too-big-to-fail" phenomenon exists because it is optimal to always bailout a club if its market size is sufficiently large.

Keywords: Regulation, sports, UEFA, risk, bailout

JEL Classification: L83, D4, L1

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1 Introduction

At the start of the 2004/05 season, the Union of European Football Associations (UEFA) introduced the Club Licensing System. To be admitted to UEFA's club competitions, each club must fulfil a series of defined quality standards falling into five principal categories: sporting, infrastructure, personnel, legal and financial. In 2010, a new and enhanced set of regulations was approved advancing the idea of "financial fair play". A slightly revised edition is in place since 2012 (UEFA, 2012b). We will refer to the new set of regulations as FFP regulations.

One major effect of the successful implementation of the FFP regulations will be the abrogation of the typical "money injection" mechanism, where a benefactor (sugar daddy) steps in and pays the open bills at the end of the season after the club overspend on player salaries and transfers in a gamble on success, which ultimately went wrong. Conn (2011) speaks of "staggering £ 2.3 bn" which current English football owners "injected" into their football clubs in order to keep them in business. But the injection of new funds to avoid insolvency is not only common in regulatory environments where clubs are governed as private firms like in the English case. Clubs governed as members associations are often perceived as "community projects", where in the eyes of their supporters local governments have an obligation to step in and inject new money in case of a potential shutdown due to the inability of the club to pay the open bills.[1]

Provided that the FFP regulations will work, the option that private or public sugar daddies step in to pay the open bills of European football clubs will be severely restricted, almost abrogated. Based on a simple game-theoretical model, this paper makes a first step to analyze the consequences of the abrogation of money injections from sugar daddies on the riskiness of the club's investment strategy. In our model, the club chooses a level of riskiness to produce a stochastic club value. A higher level of riskiness increases the expected club level, but it also increases the variance in the club value. Moreover, the club's likelihood of bankruptcy increases with a higher level of riskiness. If the club goes bankrupt, a risk neutral (private or public) sugar daddy bails out the club with a certain probability. In the case of a non-bailout, the club must bear shutdown costs and a certain collateral damage of the club's bankruptcy incurs for society, while in the case of a bailout, the sugar daddy must bear the bailout costs.

Our model shows that the existence of a sugar daddy induces the club to choose a riskier investment strategy as compared to the scenario without bailout possibilities. Particularly, a higher willingness of the sugar daddy to bailout the club results in a higher level of riskiness of the club. Moreover, a private sugar daddy bails out the club less often than a public sugar daddy. We also find that a "too-big-to-fail" phenomenon

[1] The prominent example of a non-profit association, which is operating in an environment with "soft public budget constraints" is Real Madrid (see Downie 2009 for more detail).

exists because it is optimal to always bailout a club if its market size is sufficiently large. Finally, we derive conditions under which the FFP and the pre-FFP regulations, respectively, are desirable from a welfare perspective.

The paper proceeds as follows. After a short look at the related literature in Section 2, we provide a detailed explanation of the FFP regulations in Section 3. Section 4 presents the model. First, we introduce the notation and assumptions. Second, we solve our two-stage game and then present the results. In Section 5, we discuss other potential inefficiencies induced through money injections. Finally, Section 6 summarizes our main findings and concludes the paper.

2 Related Literature

Despite the topicality of the issue, the FFP regulations have received little attention in the academic literature. Exceptions are Madden (2012*b*), Vöpel (2011), Drut and Raballand (2012) and Storm (2012). Madden (2012*b*) studies the consequences of the FFP regulation based on an economic model of a sports league, which determines endogenously team qualities, ticket prices, salaries as well as the utilities accruing to fans, owners and players. His model shows that FFP regulations will have negative welfare consequences if the supply of talent is sufficiently elastic. The main argument is that the missing money injections "lead to a reduction in all team qualities, and this will lead to a Pareto dis-improvement for all fans of the league, as well as a fall in owner utilities and player wages" (Madden 2012b, p.18).

In a conceptual paper, Vöpel (2011, p. 59) argues that the FFP regulations might produce a more unbalanced league rather than making it more balanced because 'a tighter regulation might turn out to be dynamically inefficient as it unintentionally protects well-established clubs from being challenged by non-established clubs."

In another conceptual paper Storm (2012) adapts the concept of "soft budget constraints" introduced by Kornai (1980) in the context of post-socialist transition economies to the specific environment of European football clubs. Building on many interesting observations about the political, social and economic environment of football clubs, the paper provides intuitive insights into the process that leads to the development of "soft budget constraints" and interprets FFP as an important countermeasure.

Finally, Drut and Raballand (2012) analyze the influence of financial regulation for European football clubs. Based on an analytical model of a professional sports league with win-maximizing clubs, they show that clubs which are allowed to run deficits hire better players and have better sportive results compared to clubs that have a strict budget constraint as imposed by UEFA's FFP regulations.

However, neither of these papers analyzes the mechanisms through which the money injections of (private or public) benefactors adversely affect the incentives of decisionmakers in football clubs. Our paper makes a first step in order to partly fill this gap.

Franck (2010) deals with some possible reasons for benefactors to invest great sums of money in football clubs. First, there are positive spillovers to their other businesses. Second, sugar daddies might seek social and political acceptance or legitimacy after having accumulated great wealth in questionable ways. Third, sugar daddies might launder money by using the club as an access to high value cash transactions and finally, they might be interested in consumption as sportsman owners.

Based on a contest model, Lang et al. (2011) analyze how the appearance of a benefactor (”sugar daddy”) changes the competition in the league. They show that the effect on competitive balance depends on the market sizes of the clubs and the win preference of the sugar daddy.[2] If the sugar daddy invests in a large club, social welfare in a sugar daddy league can be higher, as compared to a league without a sugar daddy. On the other hand, social welfare will always be lower if the sugar daddy invests in a small club. However, Lang et al. (2011) do not consider the adverse incentive effects of bailouts through sugar daddies.

Our paper is also related to the finance literature which studies the so-called ”lender of last resort” (LLR). The LLR such as the central bank of a country provides liquidity assistance during a financial crisis to avoid the bankruptcy of other financial institutions that are considered to be systemically important and therefore “too-big-to-fail” (see e.g., Rochet and Tirole 1996, Holmstrom and Tirole 1998, Repullo 2000, Rochet and Vives 2004 and Goodhart and Huang 2005).

Based on a model of incomplete contracts, Repullo (2000) examines the conditions under which the central bank or the deposit insurance corporation should act as a LLR and finds that the latter should deal with large liquidity shocks, while the former should take care of small shocks (relative to the size of the bank). Goodhart and Huang (2003) examine the central bank's optimal rescue policy whether to support or not a bank that requires help. In a dynamic setting, they find that time-varying variables such as the likelihood of a contagious risk influence the optimal rescue policy. In a static setting, they show that the central bank will only provide assistance to banks whose size is above a certain threshold and thus are systemically important and therefore “too-big-to-fail”. Moreover, Ennis and Malek (2005) claim that ”a bank tends to become larger and riskier if its uninsured creditors believe that they will benefit from too-big-to-fail (TBTF) coverage.” Thus, an unintended consequence of the too-big-to-fail policy is the creation of a moral hazard problem (Stern and Feldman 2004).

It should be noted that theses models feature elements that are specific to the financial

[2]According to the so-called “uncertainty of outcome hypothesis,” fans prefer to attend games with an uncertain outcome (”competitive balance”) and enjoy close championship races (Rottenberg 1956 and Neale 1964). For theoretical studies that deal with competitive balance in team sports leagues, see e.g., Késenne (2000), Vrooman (1995), Lenten (2008), Dietl et al. (2009), Grossmann et al. (2010) and Dietl et al. (2011).

sector (e.g., interbank lending, supply of liquidity and liquidity shocks, bank runs, default risks, portfolio optimization and so on). In contrast, our model, which is specifically tailored towards the sports sector, focuses on a sports club and a benefactor (sugar daddy). Similar to the models in finance, our paper is able to show that a sugar daddy - like a central bank - always bails out clubs above a threshold size. In addition, we also identify a moral hazard problem because clubs will choose a riskier strategy in a scenario with a sugar daddy than without one. However, the FFP regulations will render the bailout possibilities of SD more difficult or even impossible.

3 Details of Financial Fair Play Regulations

The background against which the amendment of the regulations was approved is a picture of financial distress, which has been typical for European football since many years:[3] Of the 734 European top division clubs 56% reported net losses in the financial year 2010. The reported total income of the 734 clubs amounted to € 12,797 billion, whereas the costs totalled € 14,389 billion. In sum the 734 European top division clubs dissipated financial value equalling € 1,641 billion. Net losses increased by 760% compared to the financial year 2006. A group of 78 clubs spent more than 100% of their revenues on wages alone. The percentage of clubs with negative net equity facing a situation with debts larger than reported assets is 36%.[4]

The cornerstone of the FFP regulations is the break-even requirement defined in UEFA (2012b, Article 58 ff). It basically requires that a club entering UEFA competitions lives within its own means by balancing "relevant income" and "relevant expenses" in the "monitoring period". Both, relevant income and relevant expenses, are defined in great detail in the regulations. The monitoring period assessed for the license 2013/14 covers the two previous seasons 2011/2012 and 2012/13. From then onwards the three previous seasons will be assessed for every new license season, for example the 2014/15 license will be granted based on an assessment of the 2013/14, 2012/13 and 2011/12 seasons. By demanding that the break-even requirement must be fulfilled on average in the three years covering the monitoring period of every license season, club management is left with some discretion to react to unpredictable events.

In the future, contributions from equity participants and/or related parties can only be used up to certain limits that decrease over time as an instrument to balance relevant expenses. The latter include player wages and transfer expenditures as their presumably most important sub-categories. Despite their exclusion from relevant income the contributions of benefactors yet are still possible as a closer look at relevant expenses reveals.

[3]For recent studies of the European football leagues, see e.g., Frick (2007), Vrooman (2007), Dietl et al. (2008) and Peeters (2012).

[4]See UEFA (2012a), p. 16-18, p. 54-90.

It shows that for example depreciation/impairment of tangible fixed assets, expenditure on youth development activities or expenditure on community development activities are not counted as relevant expenses and therefore do not enter the calculation of the break-even. Benefactors can still support the club financially under the new regime, yet no longer in order to cover the losses from ongoing wage and transfer payments. Instead, they can contribute to the construction of new infrastructure (e.g., stadia) and invest in the development of young players and fan networks.

Moreover, there will be a soft implementation of the break-even requirement on a sliding scale: Article 61 defines the acceptable aggregate deviation from the break-even requirement at € 5m. In the first two license seasons 2013/14 and 2014/15 the deviation is allowed to exceed € 5m up to a limit of € 45m. This upper limit will be reduced to € 30m for the license seasons 2015/16, 2016/17 and 2017/18. A lower amount will be decided by the UEFA Executive Committee for the monitoring periods assessed in the following years.

4 Model

4.1 Notation and Assumptions

We consider a representative club that chooses a certain level of riskiness $x \in \mathbb{R}^+$ to produce a stochastic club value given by $v(x, m)$, where $m \in \mathbb{R}^+$ is the market size of the club. We assume that the club value is normally distributed with $v(x, m) \sim N(\mu_C, \sigma_C^2)$. The expected club value is given by $E[v] = \mu_C(x) < \infty$ and the variance in the club value is $V[v] = \sigma_C^2(x) < \infty$. We assume that $v(x, m)$ satisfies the following assumptions:

A1. $\frac{\partial \mu_C(x)}{\partial x} > 0$ and $\frac{\partial \sigma_C^2(x)}{\partial x} > 0$

A2. $\frac{\partial v(x,m)}{\partial m} > 0$

From A1, it follows that the club's risk choice x has two effects: on the one hand, a higher value of x increases the expected club value $\mu_v(x)$, but on the other hand, it also increases the variance in the club value $\sigma_v^2(x)$. That is, the "cost" of the higher expected club value is the increase in the variance. In other words, the club can choose a strategy with a low expected return and low risk, or it can choose a strategy with a high expected return and high risk. A2 implies that given a certain level of riskiness, a higher market size m produces a higher club value. If the club chooses zero risk, then the club value is assumed to be $\pi \in \mathbb{R}^+$, i.e., $\mu_C(0) = \pi$.

Moreover, the club's expected utility function is given by $E[u_C(v(x, m), r)]$ where r is the club's risk parameter. We assume that the club can either be risk-averse $(r > 0)$

or risk-seeking ($r < 0$). We impose the following standard assumption on the club's expected utility:[5]

A3. $\frac{\partial u_C}{\partial v} > 0 \; \forall v \geq 0$ and $\text{sign}\left[\frac{\partial^2 u_C}{\partial v^2}\right] = -\text{sign}[r]$

A4. $\text{sign}\left[\frac{\partial u_C}{\partial r}\right] = -\text{sign}[r]$

A3 implies that a higher club value increases the club's utility, while it depends on the club's preferences regarding risk whether utility is concave or convex in the club value, i.e., $\text{sign}\left[\frac{\partial^2 u_C}{\partial v^2}\right] = -\text{sign}[r]$. If the club is risk-averse (risk-seeking) its utility is concave (convex) in v, while it is linear in v if the club is risk neutral. A4 shows that the effect of a higher risk parameter on utility depends on the club's preferences regarding risk. Moreover, we assume that if the club value is zero the club utility is zero as well, i.e., $u_C(0, r) = 0$.

Moreover, we assume that the level of riskiness x influences the club's likelihood of bankruptcy. For example, a club like Borussia Dortmund, winner of the German championship in the seasons 2010/2011 and 2011/2012, had revenues of €138m in season 2010/2011. Compared to the European revenue giants Real Madrid (€480m), FC Barcelona (€451m), Manchester United (€367m) or Bayern Munich (€321m), Dortmund is a small or medium sized competitor at the Champions League level (see Deloitte 2012, Appendix 21a for all numbers). If the management of Dortmund acts responsibly, it accepts Champions League mediocrity and restrains from bidding for star players like Ronaldo, Messi, Kakà or Ribéry. However, the management of Dortmund could pursue the same risky strategy as in the seasons 2003-2005 and spend a large fraction of or even more than their revenues on salaries and transfers in an attempt to win the Champions League against rivals with much larger revenue potential. If the gamble goes wrong and the team fails to qualify or survive the group stage for consecutive seasons, the situation of February 2005, where Dortmund ended up on the verge of bankruptcy 8 years after having won the Champions League title, may soon reoccur.

Denote by $p_l(x) \in [0, 1]$ the probability that the club loses the gamble on success and becomes insolvent, while $1 - p_l(x)$ is the probability that the club wins the gamble. We assume that $p_l(0) = 0$ and a higher level of riskiness increases the club's probability to become insolvent with a non-decreasing rate, i.e., $\frac{\partial p_l}{\partial x} \equiv p_l'(x) > 0 \; \forall x \geq 0$ and $\frac{\partial^2 p_l}{\partial x^2} = p_l''(x) \geq 0$. We refer to $p_l(x)$ as the bankruptcy function and to $p_l'(x)$ as the responsiveness of the bankruptcy function with respect to the club's risky behavior.

In the case of a successful gamble, the club receives its expected utility u_C. In the case of an unsuccessful gamble, we introduce a new actor into our model to which we refer to as the "sugar daddy" (SD). The SD is assumed to be risk neutral because s/he is well

[5] Note that for notational simplicity, we omit the expectations operator E and we henceforth write for the expected utility u instead of $E[u]$.

diversified.[6] The SD has the possibility to bailout the club in the case of an unsuccessful gamble. We denote the likelihood of a bailout by $p_b \in [0, 1]$, and hence, the likelihood that SD does not bailout the club is given by $1 - p_b$. The FFP regulations render the bailout possibilities of SD more difficult (reflected by a decrease in p_b) or even impossible ($p_b = 0$).

In the case of a non-bailout, the club goes bankrupt and it faces the shutdown costs $s \in \mathbb{R}^+$. Additionally, we assume that the collateral damage of the club's bankruptcy amounts to $d \in \mathbb{R}^+$. A lot of elements add up to collateral damage: Fans and supporters lose their joint object of identification in case of a shutdown and therefore would have to at least temporarily write off emotional and social capital, leading to a "wave" of unhappiness with potential spillovers to the local economy. Additionally, employees of the club lose their job, thus raising unemployment in the city, supplier bills remain unpaid, which might cause other bankruptcies, the municipal stadium loses its most important tenant, an important leisure opportunity disappears at least temporarily, the image of the city deteriorates which might discourage investors.

In the case of a bailout, the SD has to bear the bailout costs, which are given by $b \in \mathbb{R}^+$ and the expected club value is assumed to be zero. This assumption reflects that the expected club value decreases in the case of an unsuccessful gamble. In the extreme case, the club value is zero.[7] In practice sugar daddies avoid the insolvency of their clubs by either injecting new equity, swapping debt into equity, or providing additional soft loans. The latter are either non-interest bearing, at below-market rates of interest, or characterized by long repayment periods with interest holidays. For example, according to Deloitte (2012, p. 62), Roman Abramovich injected equity at Chelsea amounting to £60m in 2003, followed by the provision of another £820m of interest-free loans in the following years, summing up to a total money injection of £880m as of 2012. In contrast Sheikh Mansour Bin Zayed Al Nahyan preferred pure equity injections after his purchase of Manchester City in 2008, which totaled £800m as of 2012. In essence the bailout costs are opportunity costs: Instead of providing an interest-free loan to Chelsea, Mr. Abramovich could have invested the £820m at market-rate.

Next, we introduce the SD's objective function, which is given by

$$\Phi_{SD}(p_b) = -p_l(x)p_b b + (1 - p_l(x))\mu_C(x, m). \tag{1}$$

With probability $p_l(x)$ the club goes bankrupt and the SD bails out the club with probability p_b yielding bailout costs of b. If s/he does not bail out the club, the club goes

[6] However, our results would remain qualitatively the same if we assumed that the SD is risk averse. In this case, the SD objective function would include u_C instead of μ_C.

[7] For tractability, we normalize the expected club value after a bailout in the case of a bankruptcy to zero. However, our results would remain qualitatively the same if we assumed that the expected club in such a case is given by $\widetilde{\mu}_v(x, m) \in [0, \mu_v)$.

bankrupt and its value is zero. With probability $1 - p_l(x)$ the club gamble is successful and the SD enjoys the expected club value $\mu_C(x, m)$. Even though the direct effect of a higher bailout probability on the SD's objective function is negative, the SD has incentives to bail out the club due to the indirect effects via a higher expected club value induced through a riskier investment strategy.

The objective function of the club is given by

$$\Phi_C(x) = -p_l(x)(1 - p_b)s + (1 - p_l(x))u_C(x). \tag{2}$$

With probability $p_l(x)$ the club goes bankrupt. If the SD bails out the club (which occurs with probability p_b), the club value is zero. If the SD does not bail out the club (which occurs with probability $1-p_b$), the club must bear the shutdown costs s. With probability $1 - p_l(x)$ the club does not go bankrupt and enjoys expected utility $u_C(x)$.

Social welfare is given by the sum of the objective functions of the SD and the club as well as the collateral damage d caused by the club's bankruptcy in case of a non-bailout:

$$\Phi_W = \Phi_C + \Phi_{SD} - p_l(1 - p_b)d. \tag{3}$$

The timing follows a two-stage structure:

- In Stage 1, the SD chooses the probability p_b to bailout the club in case of bankruptcy.
- In Stage 2, given p_b, the club chooses a certain level of riskiness x.

4.2 Analysis and Results

We solve for the subgame perfect equilibria via backward inductions. First, we analyze the club's optimal behavior regarding risk taking in Stage 2 and then, we derive the optimal behavior of the SD regarding the bailout probability in Stage 1.

4.2.1 The club's optimal behavior in Stage 2

In Stage 2, the club maximizes its objective function Φ_C and thus solves the problem:

$$\max_{x \in \mathbb{R}^+} \{\Phi_C(x) = -p_l(x)(1 - p_b)s + (1 - p_l(x))u_C(x)\}. \tag{4}$$

By rearranging the corresponding first-order condition, the club-optimal level of riskiness x^C is then implicitly defined by

$$p_l'(x^C)\left[(1 - p_b)s + u_C(x^C)\right] = (1 - p_l(x^C))u_C'(x^C), \tag{5}$$

with $u'_C(x^C) = \frac{\partial u_C(x^C)}{\partial x}$. We establish the following proposition.[8]

Proposition 1 *The club-optimal level of riskiness x^C is increasing in the bailout probability p_b, i.e., $\frac{\partial x^C}{\partial p_b} > 0$. Hence, the appearance of a SD induces the club to choose a riskier strategy as compared to a scenario without a SD.*

Proof. See Appendix. ■

The club's optimality condition (5) has an intuitive interpretation. The left-hand side (lhs) is the marginal costs of a riskier strategy. A higher x increases the likelihood of going bankrupt, which induces costs $(1 - p_b)s$ and, at the same time, it decreases the likelihood of a successful gamble, which implies a foregone utility of $u_C(x^C)$. The right-hand side (rhs) is the marginal revenues of a riskier strategy because increasing x produces a higher expected club value and therefore it has a direct positive effect on the club's utility $u_C(x^C)$. In equilibrium, the club chooses a strategy x^C which exactly balances out these effects.

Due to the possibility of a bailout, marginal costs of a higher level of riskiness (lhs) decrease. As a result, the optimal level of riskiness x^C increases with a higher bailout probability p_b and therefore the club always chooses a riskier strategy in a scenario with a sugar daddy than without one. Put differently, our model suggests that the club decreases its level of riskiness after the successful implementation of FFP because these regulations make it more difficult for a SD to bail out the club.

Based on the less general model exposed in Appendix A.3, we analyze how the club's market size and the variance in the club value affect the club's risk-taking behavior in Corollary 1.[9]

Corollary 1 *(i) The optimal level of riskiness x^C increases with the club's market size m if and only if the responsiveness p'_l of the bankruptcy function is not too large, i.e., $\frac{\partial x^C}{\partial m} > 0 \Leftrightarrow p'_l < \widehat{p'_l}(x) \equiv \frac{1}{2x^C}$.*

(ii) For risk-averse clubs, the optimal level of riskiness x^C decreases with the variance σ^2_ε in the club value, while x^C increases for risk-seeking clubs, i.e., $\frac{\partial x^C}{\partial \sigma^2_\varepsilon} < 0\ \forall r > 0$ and $\frac{\partial x^C}{\partial \sigma^2_\varepsilon} > 0\ \forall r < 0$.

Proof. See Appendix. ■

Part (i) of the corollary shows that a large club chooses a riskier strategy than a small risk-averse club if the level of riskiness has a sufficiently low influence on the probability of bankruptcy. This result is intuitively clear. A larger market size m increases both the

[8]Note that the existence and uniqueness of the equilibrium x^C is ensured as long as the shutdown costs of the club in case of bankruptcy are sufficiently small, i.e., $s < s' \equiv \frac{u'_C(0)}{p'_l(0)(1-p_b)}$ (see Appendix A.1). Otherwise, the club has no incentives to participate in the game.

[9]Note that we are not able to provide Proposition 1 in the general setting and therefore we must further specify the model. Henceforth, we use corollaries for results that are based on the specific model.

marginal costs and the marginal revenues of a riskier strategy.[10] If the responsiveness of the bankruptcy function is sufficiently small, i.e., $p_l' < \widehat{p}_l'(x)$, then marginal revenues increase stronger than marginal costs and the club increases its level of riskiness. The reverse is true if $p_l' > \widehat{p}_l'(x)$ so that a small club chooses a riskier strategy than a large club.

According to part (ii) of the corollary, a more uncertain economic environment characterized by a larger variance in the club value induces risk-seeking clubs to choose an even riskier strategy. For risk-averse clubs, a more uncertain economic environment induces a less risky strategy. A higher Champions League prize might produce a larger variance in the club value and therefore can be interpreted as a more uncertain economic environment. The reason for this result goes along the same lines as above. If the club is risk averse, a higher variance σ_ε^2 of the club value induces a decrease in both the marginal costs and the marginal revenues of a riskier strategy.[11] Because marginal revenues decrease stronger than marginal costs, the club reacts with a decrease in its level of riskiness. The reverse is true if the club is risk seeking.

Turning now back to the general model again, we recall that the successful implementation of FFP and thus the abrogation of money injections from SDs is expected to induce the club to reduce its level of riskiness. Next, we examine whether a less risky investment strategy of the club is desirable also from a welfare perspective. To maximize its objective function Φ_W, the social planer would solve the problem:

$$\max_{x \in \mathbb{R}^+} \{\Phi_W = \Phi_C + \Phi_{SD} - p_l(1 - p_b)d\}. \tag{6}$$

We denote by x^W the level of riskiness which maximizes social welfare Φ_W and establish Proposition 2.

Proposition 2 *The welfare-optimal level of riskiness x^W increases with a higher bailout probability p_b if bailout costs are lower than combined shutdown costs and collateral damage. Otherwise, the welfare-optimal level of riskiness decreases with a higher bailout probability p_b. Formally, i.e., $\frac{\partial x^W}{\partial p_b} \gtrless 0 \Leftrightarrow b \lessgtr s + d$.*

Proof. See Appendix. ■

First of all, it is worth noting that a certain level of riskiness is desired from a welfare perspective. The proposition shows that if the SD commits to bailout the club more often, i.e., p_b increases, then the effect on the welfare-optimal level of riskiness depends on the relationship between bailout costs and the combined shutdown costs and collateral

[10] From the club's optimality condition in Appendix A.3, we derive that marginal costs increase by φx and marginal revenues increase by $1 - \varphi x$.

[11] From the club's optimality condition in Appendix A.3, we derive that marginal costs decrease by $-1/2r\varphi x^2$ and marginal revenues decrease by $-(1 - \varphi x)rx$.

damage. Interestingly, it can be the case that through the implementation of FFP (i.e., p_b decreases), the welfare-optimal level of riskiness increases. This result is true if the bailout costs are higher than the sum of shutdown costs and collateral damage. To understand the intuition behind this result, we compute the welfare-optimal level of riskiness x^W which is implicitly defined by

$$\begin{aligned} & p_l'(x^W)\left[p_b b + (1-p_b)(d+s) + (\mu_C(x^W) + u_C(x^W)\right] \\ = \; & (1-p_l(x^W))\left(\frac{\partial \mu_C(x^W)}{\partial x} + \frac{\partial u_C(x^W)}{\partial x}\right). \end{aligned} \tag{7}$$

Similar to above, the lhs represents the marginal costs of a riskier strategy, while the rhs is the marginal revenues of a riskier strategy. Marginal costs decrease with a lower bailout probability p_b if $b > s + d$. In this case, a lower p_b induces the welfare-optimal level of riskiness x^W to increase. If, however, $b < s + d$, marginal costs increase and x^W decreases with a lower bailout probability. In addition, as shown in Appendix A.2, there are conditions under which a critical bailout probability p_b^* exists that induces the club to implement the welfare-optimal level of riskiness x^W, i.e., $x^C(p_b^*) = x^W(p_b^*)$.[12] In other words, an instrument can exist inducing the club to implement the welfare-maximizing level of riskiness: namely, through an appropriate choice of the bailout probability p_b^*.

In the next section, we switch to Stage 1 and analyze the optimal behavior of the SD.

4.2.2 The SD's optimal behavior in Stage 1

In Stage 1, the SD anticipates the optimal club behavior x^C in Stage 2 and thus s/he solves the maximization problem

$$\max_{p_b \in [0,1]} \{\Phi_{SD}(p_b) = -p_l(x^C)p_b b + (1-p_l(x^C))\mu_C(x^C)\}. \tag{8}$$

We establish the following proposition.

Proposition 3 *Suppose that $\Phi_{SD}(p_b)$ is quasi-concave and that there are multipliers $\lambda_k \in \mathbb{R}^+$, $k \in \{1,2\}$.*[13] *Then, p_b^{SD} is the unique global maximizer of problem (8), characterized by:*

$$[1-p_l(x^C)]\,\frac{\partial \mu_C}{\partial x}\frac{\partial x^C}{\partial p_b} - \left(p_l(x^C)b + p_l'(x)\frac{\partial x^C}{\partial p_b}\left[p_b^{SD}b + \mu_C(x^C)\right]\right) + \lambda_1 - \lambda_2 = 0 \tag{9}$$

$$\lambda_1 p_b^{SD} = 0 \text{ and } \lambda_2(p_b^{SD} - 1) = 0. \tag{10}$$

Proof. See Appendix. ■

[12] Necessary conditions for the existence of p_b^* are $b > s + d$ and $x^W > x^C$ for $p_b = 0$.

[13] Under reasonable conditions, i.e., if b is not too large, $\Phi_{SD}(p_b)$ is quasi-concave in p_b.

The first-order condition (9) implicitly defines the SD's optimal choice with respect to the bailout probability p_b^{SD} and has an intuitive interpretation. The first term $(1 - p_l(x^C))\frac{\partial \mu_C}{\partial x}\frac{\partial x^C}{\partial p_b}$ is the marginal revenue of a higher bailout probability p_b^{SD} and characterizes the gain in utility through a higher level of riskiness x^C (induced through a higher p_b) conditional on a non-bankruptcy of the club. The term in round brackets is the marginal costs of a higher p_b: increasing the probability of a bailout results in direct costs $p_l(x^C)b$ but it also induces indirect negative effects through a higher risk-taking behavior of the club. The bailout-induced riskier club strategy increases the bankruptcy probability, which in turn yields higher expected bailout costs $p_b^{SD}b$ and at the same time implies a foregone utility of $\mu_C(x^C)$.

Basic intuition might suggest, that the SD never bails out the club ($p_b^{SD} = 0$) or always bails out the club ($p_b^{SD} = 1$). However, as shown in Appendix A.4, the optimal bailout probability p_b^{SD} for the SD is not necessarily a corner solution, i.e., it can be optimal for the SD to bailout the club with a probability $p_b^{SD} \in (0, 1)$. Moreover, the optimal bailout probability can be larger than zero even if the bailout costs exceed the collateral damage. Finally, it is not necessarily the case that if the collateral damage exceeds the bailout costs, then the optimal bailout probability is zero.

As mentioned above, the SD does not take into account that the club's bankruptcy in the case of a non-bailout produces a collateral damage of size d. We can interpret such a SD as a "private" SD, who does not care for any externality on society caused by the club's bankruptcy. However, one might argue that a "public" SD actually takes this collateral damage into account. Hence, the objective function for a public SD slightly changes and it becomes

$$\Phi_{SD}^{pub}(p_b) = -p_l(x)\left[p_b b + (1 - p_b)d\right] + (1 - p_l(x))u_c(x). \tag{11}$$

By comparing the optimal bailout probabilities of a private and public SD, we establish the following proposition.

Proposition 4 *A public SD has a higher optimal bailout probability than a private SD if the responsiveness of the bankruptcy function is not too large, i.e.,* $p_l'(x^C) < \widehat{p_l'}(x^C) \equiv \frac{p_l(x^C)}{(1-p_b)\partial x^C/\partial p_b}$.

Proof. See Appendix. ■

The proposition shows that a public SD bails out the club more often than a private SD if a higher level of riskiness only weakly increases the club's probability to become bankrupt. The result is mainly driven by the additional concern of the public SD with respect to the collateral damage in the case the club is shut down. To understand the intuition behind this result, consider the public SD's optimality condition:

$$(1 - p_l(x^C))\frac{\partial \mu_C}{\partial x}\frac{\partial x^C}{\partial p_b} = p_l(x^C)\,(b-d) + p_l'(x^C)\frac{\partial x^C}{\partial p_b}\left[p_b^{SD} b + (1-p_b)d + \mu_C(x^C)\right] \quad (12)$$

The marginal revenue $(1 - p_l(x^C))\frac{\partial \mu_C}{\partial x}\frac{\partial x^C}{\partial p_b}$ of a higher bailout probability p_b^{SD} is not directly affected by changes in the collateral damage d. However, changes in d directly affect marginal costs of a higher p_b. On the one hand, a higher d decreases direct costs $p_l(x^C)\,(b-d)$ induced through a higher bailout probability. On the other hand, a higher d increases costs in case the club is not bailed out which are given by $(1-p_b)d$. If the responsiveness of the bankruptcy function is not too large, the indirect negative effects through a higher risk-taking behavior of the club are dominated by the cost-saving effect such that the SD increases the bailout probability p_b^{SD}. Formally, $\partial p_b^{SD}/\partial d > 0 \Leftrightarrow p_l'(x^C) < \widehat{p}_l'(x^C)\ \forall d \geq 0$. We conclude that a public SD has a higher optimal bailout probability than a private SD because the private SD is a special case of a public SD with $d = 0$.

In a next step, we are interested in the optimal bailout probability in Stage 1 from a welfare perspective. For this analysis, we again use the less general model from Appendix A.3 and denote by p_b^W, the bailout probability which maximizes social welfare Φ_W. To determine p_b^W, we substitute x^C into Φ_W and solve the maximization problem $\max_{p_b \in [0,1]} \Phi_W(p_b)$. Although it is possible to derive the welfare-optimal bailout probability p_b^W in closed form, the comparative statics are analytically not tractable. We therefore rely on numerical simulations and derive the following results.

Corollary 2 *(i) If the bailout costs are sufficiently low, then the welfare-optimal bailout probability p_b^W increases with a larger market size, i.e., $\frac{\partial p_b^W}{\partial m} > 0$ if $b < b'$. It follows that the social planer would always bailout a club whose market size is sufficiently large, i.e., $p_b^W = 1$ if $m > m'$ and $b < b'$.*

(ii) The welfare-optimal bailout probability p_b^W decreases with a higher variance σ_ε^2 in the club value if clubs are risk seeking, while p_b^W increases if clubs are risk averse, i.e., $\frac{\partial p_b^W}{\partial \sigma_\varepsilon^2} < 0\ \forall r < 0$ and $\frac{\partial p_b^W}{\partial \sigma_\varepsilon^2} > 0\ \forall r > 0$.

Part (i) shows that a "too-big-to-fail" phenomenon exists. From a welfare perspective, a sufficiently large club should always be bailed out if the bailout costs are under a certain threshold. The intuition for this result is as follows. Consider the optimality condition of the social planer. A larger market size increases both the marginal costs and the marginal revenues of a higher bailout probability. The bailout costs b have a direct effect only on the marginal costs. Hence, if b is sufficiently low, the increase in marginal revenues induced by a larger market size overcompensates for the decrease in marginal costs and as a result, the bailout probability p_b^W increases in m. If the market size is sufficiently large, the bailout probability reaches its maximum value of 1, which means that the social planer would always choose to bailout the club.

Part (ii) posits that a more uncertain economic environment characterized by a larger variance in the club value would induce the social planer to bailout the club more often (contrary to the result regarding the optimal level of riskiness above) if the club is risk averse and less often if it is risk seeking. To understand the intuition behind this result, we consider the social planer's optimality condition once again. Suppose that the club is risk averse. From Proposition 1, we know that a higher variance σ_ε^2 reduces the club's level of riskiness x^C and thus decreases the bankruptcy probability $p_l(x^C)$. Hence, a higher variance σ_ε^2 increases the marginal revenues of a higher bailout probability and decreases marginal costs. As result, the social planer would have an incentive to increase the bailout probability p_b^W. The reverse is true if the club is risk seeking.

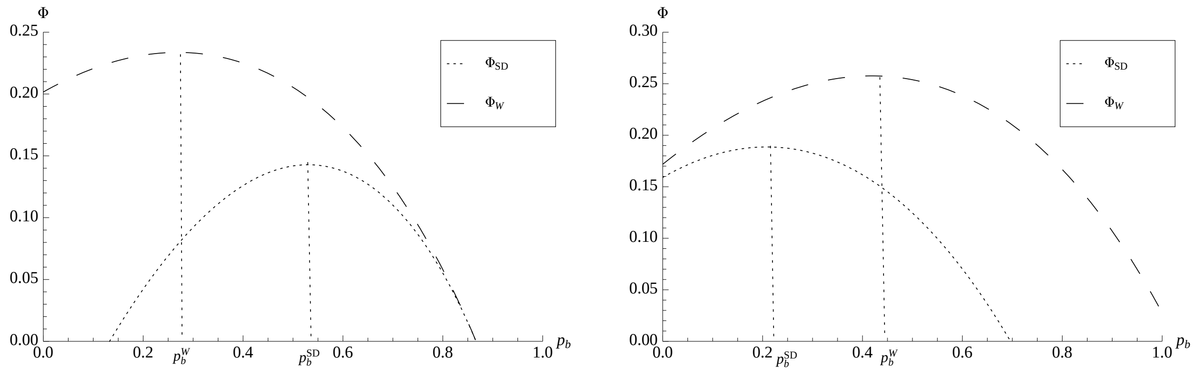
According to Pawlowski et al. (2010), the payments to the participating teams in the UEFA Champions League have experienced a large increase since the extension of the participating teams from 24 to 32 in the 1999-2000 season combined with a change in the payout structure. As mentioned above, an increase in the Champions League prize can be interpreted as an increase in the variance of the club value. Hence, part (ii) of Result 2 suggests that it depends on the risk preference of the clubs whether the FFP regulations are desirable from a welfare perspective. If the clubs are risk seeking, then according to our model the abolition of the bailout mechanisms through the new FFP regulations are welfare-enhancing, while the reverse is true if clubs are risk averse.

Finally, we show that a conflict with respect to the appropriate bailout probability between the social planer and the SD can exist.

Corollary 3 *The incentives of the SD and the social planer are not aligned. There are constellations under which (a) the social planer would choose a lower bailout probability than the SD, i.e.,* $p_b^W < p_b^{SD}$*, and (b) the social planer would choose a higher bailout probability than the SD, i.e.,* $p_b^W > p_b^{SD}$*.*

We illustrate this result in Figure 1 by depicting $\Phi_{SD}(p_b)$ and $\Phi_W(p_b)$ as functions of the bailout probability for the following parameter constellation: $r = 1$, $b = 2$, $d = 0.1$, $s = 1,5$, $\sigma_\varepsilon^2 = 0.5$, and $p_l' = 0.5$. Panel (a) reports the case where the club's market size is small with $m = 0.1$ and in Panel (b), the club's market is large with $m = 1$. The figure shows that in the case of a small market size, the social planer would choose a lower bailout probability than the SD, while the opposite is true if the market size of the club is large. From Result 1, we know that the social planer would bailout a large club ($m = 1$) with a higher probability than a small club ($m = 0.1$) if the bailout costs are sufficiently small. However, under the same parameter constellations, the SD decreases the bailout probability from $p_b^{SD} \approx 0.55$ for a small club to $p_b^{SD} \approx 0.22$ for a large club.

Figure 1: The Objective Function of the SD and the Social Planer



(a) Small Club (b) Large Club

5 Other Potential Effects of Money Injections

At first sight, the new FFP regulations seem to be counter-productive. Why should a regulation aim to limit available funds, rather than allowing entry of as much funding as possible and instead only pursuing the regulatory target of ensuring sound financial use of the available funds?[14] However, the above analysis has shown that the existence of a sugar daddy paying the open bills of a club when the gamble on success went wrong may induce the club to choose a riskier investment strategy as compared to the scenario in which the sugar daddy is not present. The more the sugar daddy commits himself to bailout the club – or the less the sugar daddy is able to commit not to bailout the club – the more the clubs' optimal level of riskiness is expected to increase. In this section, we shed further light on how money injections of sugar daddies may contribute to some other potential inefficiencies in football leagues.[15]

5.1 Contagion of other clubs due to increased risk-taking

It seems plausible that a riskier investment strategy of a club with a sugar daddy leads to contagion inducing clubs without sugar daddies to pursue riskier strategies too. However, a proper analysis would require a model with at least two clubs. To further elaborate on this issue, we develop a simple contest model of two profit-maximizing clubs and show

[14]We are very much indebted to our colleague Paul Madden for formulating this important question in direct communication with Egon Franck. See also Madden (2012*b*) for a detailed analysis.

[15]UEFA invited a group of sports economists to Geneva in January 2012 to discuss the expected impact of the new FFP regulations. The following potential inefficiencies are taken from a (subjective) summary of the discussion proposed by Egon Franck. Wladimir Andreff deserves to be mentioned for strongly advocating that bailouts induce clubs to take excessive risk and Jamie Oliver for bringing up the issue of non-virtuous competitive imbalance.

that increasing the investment level y_i of club i induces the other club j to increase its investment level y_j too.[16] By assuming a positive correlation between a riskier investment strategy and a higher investment level, this result suggests that under certain conditions a contagion effect might emerge.

We base our analysis on a widely-used profit function in the sports economics literature. Specifically, the profit function of club $i = 1, 2$ is given by

$$\begin{aligned} \pi_i(y_i, y_j) &= R_i(y_i, y_j) - C(y_i) \\ &= \frac{m_i}{4}\left(2w_i(y_i, y_j) - w_i(y_i, y_j)^2\right) - cy_i, \end{aligned} \tag{13}$$

where $w_i(y_i, y_j) = \frac{y_i}{y_i+y_j}$ is the win percentage of club i and $m_i \in \mathbb{R}^+$ represents the market size parameter of club i. We assume that clubs are heterogeneous with respect to their market size or drawing potential. Without loss of generality, we assume that $m_1 = m > m_2 = 1$. This profit function is consistent with the revenue functions used e.g. in Hoehn and Szymanski (1999), Szymanski (2003), Szymanski and Késenne (2004), Késenne (2006, 2007), Vrooman (2007, 2008), and Dietl et al. (2009).

We compute the equilibrium investment levels as

$$(y_1^*, y_2^*) = \left(\frac{m^{3/2}}{2c(\sqrt{m}+1)^3}, \frac{m}{2c(\sqrt{m}+1)^3}\right). \tag{14}$$

The reaction functions of club 1 and 2 are given by

$$R_1(y_2) = \left(\frac{m}{2c}\right)^{1/3} y_2^{2/3} - y_2 \text{ and } R_2(y_1) = \left(\frac{1}{2c}\right)^{1/3} y_1^{2/3} - y_1 \tag{15}$$

and we derive

$$\left.\frac{\partial R_1}{\partial y_2}\right|_{y_2=y_2^*} = \frac{1}{3}(2\sqrt{m}-1) > 0 \text{ and } \left.\frac{\partial R_2}{\partial y_1}\right|_{y_1=y_1^*} = -\frac{1}{3} + \frac{2}{3\sqrt{m}} > 0 \Leftrightarrow m < 4 \tag{16}$$

Hence, the large club 1 increases its investments in response to a marginal increase of the small club 2's investments. The same is true for the small club's investments as long as the large club's market size m is not too large.

Now we turn back to our analysis where a benefactor (SD) injects money into a club in case of a bankruptcy. Suppose that only the small club is owned by a SD. According to our analysis in Section 4, the appearance of a SD induces the small club to choose a riskier investment strategy as compared to a scenario without a SD. What is the effect on the large club, which is not owned by a SD? By assuming a positive correlation between

[16] Besides profit-maximizers, the sports economics literature has modeled sports clubs as win-maximizers (Késenne 2006), utility-maximizers (Madden and Robinson 2012) and fan-utility maximizers (Madden 2012a).

a riskier investment strategy and a higher investment level, we know from equation (16) that there is a contagion effect on the large club in the sense that it reacts with a higher investment level and thus a riskier strategy. As a consequence, the appearance of a SD yields higher investment levels and riskier strategies for both clubs compared to the initial equilibrium. This simple analysis implies that riskier strategies of clubs with a sugar daddy can increase the contagion risk in the entire industry.

5.2 Increased volatility due to less financial diversification of income streams

If the money injections of benefactors are more volatile than other sources of revenue (e.g. broadcasting or attendances), then increasingly relying on the sugar daddy finance model introduces more volatility into the financial structure of football. It becomes more difficult to plan and to manage a club in a way that it reaches break-even in this scenario, where the instantaneous introduction or withdrawal of large amounts of money produce demand shocks in the player market. It seems plausible to assume more volatility in a sugar daddy finance model. First, the provision of funds stems from the decision and motivation of a single individual, which makes it more easily reversible than the thousands of dispersed and therefore more independent decisions of spectators to buy tickets, fans to buy merchandise etc. Second, the business of a single individual may be more vulnerable to risk than a multitude of smaller streams of income originating from diverse sources (attendance, broadcasting, sponsoring etc.).

5.3 Increased non-virtuous competitive imbalance

Money injections by new owners entering the football business from outside and “buying success” by investing large amounts of “external” funds into the creation of a competitive team may be perceived as sources of non-virtuous competitive imbalance, which at the end reduce the acceptance of the game. Fans of (other clubs) may simply turn away and look for alternatives if “some foreigner” comes around and simply buys success in their eyes by spending “external” money on players.

Against this background the FFP rules can be seen as limiting these three potential inefficiencies. By abrogating systematic bailouts the FFP rules induce club managers to take less risk, which also reduces the likelihood of contagion. By channeling sugar daddy investment into stadia, infrastructure etc., the FFP rules transform volatile sources of income into more stable income from gate attendance, merchandising, sponsoring and so on. By inducing sugar daddies to invest into infrastructure, community and youth development, they gain legitimacy and are transformed into virtuous owners, who are then not seen as a source of non-virtuous competitive imbalance any longer.

However, so far the discussion has been taking place without any stringent theoretical or empirical proof of the claims presented. Here our paper intended to make a first contribution by analyzing the relationship between money injections by a sugar daddy and risk-taking at the club level.

6 Conclusion

This paper has developed an analytical model of a representative club and a sugar daddy to study the consequences of the FFP regulations on the riskiness of the club's investment strategy. Our model clearly shows that the money injections of sugar daddies induce the club to implement a riskier investment strategy. With the limitations of the "one-club model" setting in mind, we have nevertheless tried to incorporate some basic welfare-tradeoffs in our analysis. A certain level of riskiness is desirable from a welfare perspective. Whether the club-optimal level of riskiness is higher than the corresponding level from a welfare perspective depends on the bailout probability as well as the relationship between bailout costs versus combined shutdown costs and collateral damage. We find that a certain bailout probability can exist that induces the club to implement the welfare-optimal level of riskiness. Moreover, our model shows that a small-market club chooses a riskier investment strategy than a large-market club if the club's investment strategy has a sufficiently large influence on the club's bankruptcy probability. A more uncertain economic environment characterized, e.g., through a larger Champions League prize, induces risk seeking clubs to implement a riskier investment strategy and risk averse clubs to implement a less risky strategy.

Regarding the optimal behavior of the sugar daddy, we find that the optimal bailout probability is not necessarily a corner solution. Additionally, it can be optimal for a sugar daddy to bailout the club even if the bailout costs exceed the collateral damage. Differentiating between public and private sugar daddies, we derive that the former have incentives to bail out the club with a higher probability than the later. Moreover, we identify a "too-big-to-fail" phenomenon because, from a welfare perspective, it can be optimal to always bailout a club if its market size is sufficiently large. By comparing the welfare-optimal bailout probability with the respective probability for the sugar daddy, we deduce that the incentives of the social planer and the sugar daddy are not aligned such that the social planer can choose a lower bailout probability than the sugar daddy, and vice versa. Finally, we derive conditions under which the FFP and the pre-FFP regulations, respectively, are desirable from a welfare perspective. For example, an increase in the Champions League prize renders the new FFP regulations less desirable from a welfare perspective if clubs are risk averse, while the new FFP regulations are welfare-enhancing if clubs are risk seeking. Provided that 56% of the 734 European top division clubs reported net losses in the financial year 2010 and dissipated financial value equaling almost € 1.7 billion, risk aversion at least doesn't seem to be a widespread phenomenon in this industry.

We are aware of the fact that the our model is designed to handle only a limited and singular aspect of the potential effects of money injections in football clubs, their effect on risk taking at the club level. Already the extension in welfare analysis is more speculative, as it is constrained by the "one-club model" setting. It goes without saying that an overall assessment of the consequences of FFP might only be possible in a much more sophisticated model that captures all potential inefficiencies.

A Appendix

A.1 Proof of Proposition 1

The first-order condition for the maximization problem (1) is given by

$$\frac{\partial \Phi_C}{\partial x} = -p_l'(x^C)\left[(1-p_b)s + u_C(x^C)\right] + (1-p_l(x^C))u_C'(x^C) = 0, \tag{17}$$

with $u_C'(x^C) = \frac{\partial u_C(x^C)}{\partial x}$. The second-order condition yields

$$\frac{\partial^2 \Phi_C}{\partial x^2} = -p_l''(x^C)\left[(1-p_b)s + u_C(x^C)\right] - 2p_l'(x^C)u_C'(x^C) + (1-p_l(x^C))u_C''(x^C) < 0, \tag{18}$$

with $u_C''(x^C) = \frac{\partial^2 u_C(x^C)}{\partial x^2}$. If $r > 0$, then according to A.3 it holds $u_C''(x^C) < 0$, and hence, the second-order condition is always satisfied. If $r < 0$, then $u_C''(x^C) > 0$, and as a result, the second-order condition is satisfied if only if $\zeta \equiv (1 - p_l(x^C))u_C''(x^C)$ is sufficiently small.

To show that the club-optimal level of riskiness x^C is increasing in the bailout probability p_b, i.e., $\frac{\partial x^C}{\partial p_b} > 0$ we proceed as follows. Define

$$F := -p_l'(x^C)\left[(1-p_b)s + u_C(x^C)\right] + (1-p_l(x^C))\frac{\partial u_C(x^C)}{\partial x} = 0. \tag{19}$$

The implicit function theorem gives us $\frac{\partial x^C}{\partial p_b} = -\frac{\partial F/\partial p_b}{\partial F/\partial x^C}$.Because $\frac{\partial F}{\partial x^C}$ is the second-order condition, we know that $\frac{\partial F}{\partial x^C} < 0$ and hence $\text{sign}\left[\frac{\partial x^C}{\partial p_b}\right] = \text{sign}\left[\frac{\partial F}{\partial p_b}\right]$. We compute $\frac{\partial F}{\partial p_b} = p_l'(x^C)s > 0$, which proves the claim.

Next, we examine the conditions under which the existence and uniqueness of the equilibrium x^C is ensured. We denote the lhs and rhs of the optimality condition (5) as

$$\kappa_l(x) = p_l'(x)\left[(1-p_b)s + u_C(x)\right] \text{ and } \kappa_r(x) = (1-p_l(x))\frac{\partial u_C(x)}{\partial x}, \tag{20}$$

respectively. We compute

$$\frac{\partial \kappa_l(x)}{\partial x} = p_l''(x)\left[(1-p_b)s + u_C(x)\right] + p_l'(x)\frac{\partial u_C(x)}{\partial x} > 0 \text{ and} \tag{21}$$

$$\frac{\partial \kappa_r(x)}{\partial x} = -p_l'(x)\frac{\partial u_C(x)}{\partial x} + (1-p_l(x))\frac{\partial^2 u_C(x)}{\partial x^2}. \tag{22}$$

To prove the existence and uniqueness of the equilibrium x^C, we need the following additional assumption:

$$s < s' \equiv \frac{\partial u_C(0)/\partial x}{p_l'(0)(1-p_b)} \tag{23}$$

Under this assumption, we will show that $\exists!\ x^* > 0 : \kappa_l(x^*) = \kappa_r(x^*)$. Suppose that $x = 0$.

In this case, $\kappa_l(0) = p_l'(0)(1-p_b)s > 0$ and $\kappa_r(0) = \frac{\partial u_C(0)}{\partial x} > 0$. Because (23) holds, we derive $\kappa_r(0) > \kappa_l(0)$. Recall from the discussion about the second-order conditions that $\zeta = (1-p_l(x^C))\frac{\partial^2 u_C(x^C)}{\partial x^2}$ is sufficiently small and hence, $\frac{\partial \kappa_l(x)}{\partial x} > \left|\frac{\partial \kappa_r(x)}{\partial x}\right|$. Because $\frac{\partial \kappa_l(x)}{\partial x}$ and $\frac{\partial \kappa_r(x)}{\partial x}$ are well-defined and continuous functions in x, there exists a value $x^* = x^C$ such that $\kappa_l(x^*) = \kappa_r(x^*)$. This point of intersection characterizes the unique equilibrium.

We conclude that the existence and uniqueness of the equilibrium x^C is ensured as long as the shutdown costs of the club in case of bankruptcy are sufficiently small with $s < s' \equiv \frac{u_C'(0)}{p_l'(0)(1-p_b)}$.

A.2 Proof of Proposition 2

The first-order condition for the maximization problem (6) is given by

$$\frac{\partial \Phi_W}{\partial x} = -p_l'(x^W)\left[p_b b + (1-p_b)(d+s) + (\mu_C(x^W) + u_C(x^W)\right] + (1-p_l(x^W))\left(\frac{\partial \mu_C(x^W)}{\partial x} + \frac{\partial u_C(x^W)}{\partial x}\right) = 0. \tag{24}$$

We assume that the second-order condition is satisfied, i.e., $\frac{\partial^2 \Phi_W}{\partial x^2} < 0$. To show that $\frac{\partial x^W}{\partial p_b} > 0 \Leftrightarrow b < s+d$, we define $G = \frac{\partial \Phi_W}{\partial x} = 0$. The implicit function theorem gives us

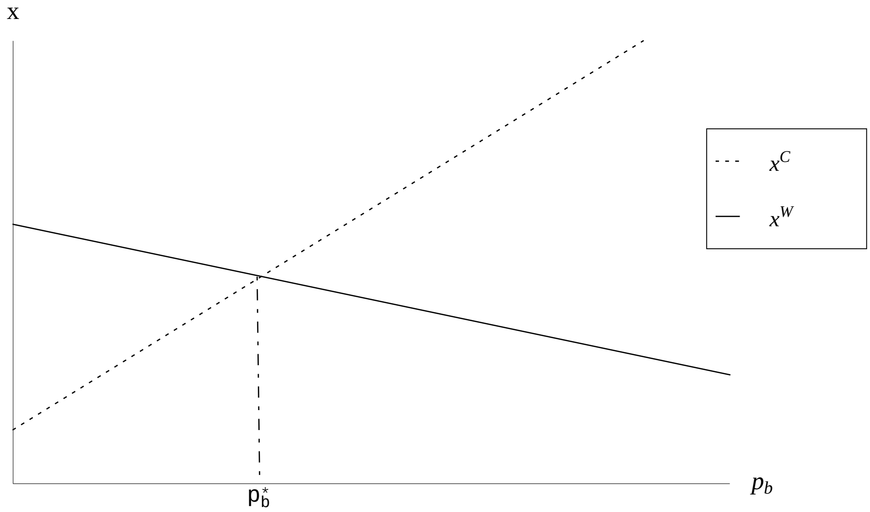
$$\frac{\partial x^W}{\partial p_b} = -\frac{\partial G/\partial p_b}{\partial G/\partial x^W} = -\frac{(d+s-b)p_l'(x^W)}{\partial^2 \Phi_W/\partial x^2} > 0 \Leftrightarrow b < s+d, \tag{25}$$

which completes the proof of the proposition.

In the discussion of the proposition, we claimed that there are conditions under which a bailout probability p_b^* exists so that the club implements the welfare-optimal level of riskiness x^W. Necessary conditions for such a critical bailout probability p_b^* to exist are $b > s+d$ and $x^W > x^C$ for $p_b = 0$. That is, bailout costs are higher than combined shutdown costs and collateral damage. Additionally, the welfare-optimal level of riskiness must be higher than the club-optimal level in the absence of a SD. (I) Suppose that $b > s+d$. According to part (i) of Proposition 2, the welfare-optimal level of riskiness x^W decreases in p_b, i.e., $\frac{\partial x^W}{\partial p_b} < 0$. (II) Suppose that $x^W > x^C$ for $p_b = 0$ (2). Together with the fact that the club-optimal level of riskiness x^C increases in p_b (i.e., $\frac{\partial x^C}{\partial p_b} > 0$), assumptions (I) and (II) are necessary conditions for the claim that a critical bailout probability p_b^* exists so that $x^W(p_b^*) = x^C(p_b^*)$. Figure 2 qualitatively illustrates this result by depicting the welfare- and club-optimal levels of riskiness x^W and x^C, respectively, as functions of the bailout probability p_b.

The assumption (II) makes sense if the collateral damage d is sufficiently small. Note that changes in the value of the collateral damage d have no effect on the club-optimal level of riskiness x^C, i.e., $\frac{\partial x^C}{\partial d} = 0$, whereas the welfare-optimal level of riskiness x^W is

Figure 2: Implementation of the Welfare-optimal Level of Riskiness



decreasing in the collateral damage d, i.e., $\frac{\partial x^W}{\partial d} < 0$. To see this, we derive with the help of the implicit function theorem $\frac{\partial x^W}{\partial d} = -\frac{\partial G/\partial d}{\partial G/\partial x^W} = \frac{(1-p_b)p_l'(x^W)}{\partial^2 \Phi_W/\partial x^2} < 0$. Hence, a lower d induces a higher welfare-optimal level of riskiness x^W.

A.3 Proof of Corollary 1

To analyze how the club's market size and the variance in the club value affect the club's risk-taking behavior, we further specify the model and assume that the club value is given by $v(x) = x \cdot (m + \varepsilon) + \pi$,with a normally distributed error term $\varepsilon \sim N(0, \sigma_\varepsilon^2)$. The parameter $\pi \in \mathbb{R}^+$ is deterministic and represents the club value if the club chooses no risk. From this value function, we derive the expected club value $\mu_C(x) = mx + \pi$ and the variance in the club value $V[v] = \sigma_\varepsilon^2 x^2$. We assume that the club's expected utility is given by $u_C(x) = mx + \pi - \frac{r}{2}\sigma_\varepsilon^2 x^2$. Moreover, we assume that the bankruptcy function yields $p_l(x) = \varphi x$ with $\varphi > 0$ sufficiently small to ensure that $p_l(x) \leq 1$. This specification of our model satisfies Assumptions A1-A4.

We solve for the subgame perfect equilibria via backward inductions. In Stage 2, the club maximizes its objective function Φ_C and thus solves the problem:

$$\max_{x \in \mathbb{R}^+} \{\Phi_C(x) = -\varphi x(1 - p_b)s + (1 - \varphi x)(mx + \pi - \frac{r}{2}\sigma_\varepsilon^2 x^2)\}. \tag{26}$$

The first-order and second-order conditions for the club's maximization problem are given by

$$\begin{aligned} \frac{\partial \Phi_C}{\partial x} &= -\varphi \left[(1 - p_b)s + mx + \pi - \tfrac{r}{2}\sigma_\varepsilon^2 x^2\right] + (1 - \varphi x)(m - r\sigma_\varepsilon^2 x) = 0, \\ \frac{\partial^2 \Phi_C}{\partial x^2} &= -2\varphi(m - r\sigma_\varepsilon^2 x) - (1 - \varphi x)r\sigma_\varepsilon^2 < 0. \end{aligned} \tag{27}$$

The club-optimal level of riskiness is then given by

$$x^C = \frac{1}{3r\sigma_\varepsilon^2\varphi}\left(r\sigma_\varepsilon^2 + 2m\varphi - \left(r^2\sigma_\varepsilon^4 + 4(m\varphi)^2 - 2r\sigma_\varepsilon^2\varphi(m - 3\varphi[\pi + s(1-p_b)]\right)^{1/2}\right). \quad (28)$$

Part (i). To show how the club-optimal level of riskiness x^C reacts to changes in m, we define

$$F := -\varphi\left[(1-p_b)s + mx + \pi - \frac{r}{2}\sigma_\varepsilon^2 x^2\right] + (1-\varphi x)(m - r\sigma_\varepsilon^2 x) = 0. \quad (29)$$

The implicit function theorem gives us $\frac{\partial x^C}{\partial m} = -\frac{\partial F/\partial m}{\partial F/\partial x^C}$. Because $\frac{\partial F}{\partial x^C}$ is the second-order condition, we derive $\text{sign}\left[\frac{\partial x^C}{\partial m}\right] = \text{sign}\left[\frac{\partial F}{\partial m}\right]$. We compute $\frac{\partial F}{\partial m} = 1 - 2\varphi x^C \gtreqless 0 \Leftrightarrow \varphi \lesseqgtr \frac{1}{2x^C}$, which proves the claim.

Part (ii). To show how the club-optimal level of riskiness x^C reacts to changes in σ_ε^2, we define

$$G := -\varphi\left[(1-p_b)s + mx + \pi - \frac{r}{2}\sigma_\varepsilon^2 x^2\right] + (1-\varphi x)(m - r\sigma_\varepsilon^2 x) = 0. \quad (30)$$

The implicit function theorem gives us $\frac{\partial x^C}{\partial \sigma_\varepsilon^2} = -\frac{\partial G/\partial \sigma_\varepsilon^2}{\partial G/\partial x^C}$. Because $\frac{\partial G}{\partial x^C}$ is the second-order condition, we derive $\text{sign}\left[\frac{\partial x^C}{\partial \sigma_\varepsilon^2}\right] = \text{sign}\left[\frac{\partial G}{\partial \sigma_\varepsilon^2}\right]$ and compute

$$\frac{\partial G}{\partial \sigma_\varepsilon^2} = \frac{1}{2}r\varphi x^2 - (1-\varphi x)rx = rx\left(\frac{3}{2}\varphi x - 1\right) \quad (31)$$

We compute

$$\kappa \equiv \frac{3}{2}\varphi x^C - 1 = \frac{r\sigma_\varepsilon^2 + 2m\varphi - \left(r^2\sigma_\varepsilon^4 + 4(m\varphi)^2 - 2r\sigma_\varepsilon^2\varphi(m - 3\varphi[\pi + s(1-p_b)]\right)^{1/2}}{2r\sigma_\varepsilon^2} - 1 \quad (32)$$

and derive $\kappa < 0 \Leftrightarrow m > -3\varphi(\pi + s(1-p_b))$. Hence, κ is always smaller than zero for all $m > 0$. Because $\text{sign}\left[\frac{\partial x^C}{\partial \sigma_\varepsilon^2}\right] = \text{sign}\left[\frac{\partial G}{\partial \sigma_\varepsilon^2}\right]$, we conclude $\frac{\partial x^C}{\partial \sigma_\varepsilon^2} < 0 \Leftrightarrow r > 0$ and $\frac{\partial x^C}{\partial \sigma_\varepsilon^2} > 0 \Leftrightarrow r < 0$.

A.4 Proof of Proposition 3

The derivation of condition (9), which implicitly defines the SD's optimal choice with respect to the bailout probability p_b^{SD}, is straightforward by applying the Kuhn-Tucker conditions. Whether an interior solution $p_b^{SD} \in (0,1)$ exists depends on the parameters of the model. Specifically, a necessary condition for the existence of an interior solution $p_b^{SD} \in (0,1)$ is that the bailout costs b are bounded form below and above, i.e., $b \in (\underline{b}, \overline{b})$. Hence, the optimal bailout probability for the SD is not necessarily a corner solution.

To derive the necessary conditions for an interior solution $p_b^{SD} \in (0,1)$, we proceed as follows. We rearrange the first-order condition and define $\lambda_{MC}(p_b)$ and $\lambda_{MR}(p_b)$ as

$$\begin{aligned} \lambda_{MC}(p_b) &= p_l(x^C)b + p_l'(x^C)\tfrac{\partial x^C}{\partial p_b}\left[p_b b + \mu_C(x^C)\right] \text{ and} \\ \lambda_{MR}(p_b) &= (1-p_l(x^C))\tfrac{\partial \mu_C}{\partial x}\tfrac{\partial x^C}{\partial p_b}, \end{aligned} \tag{33}$$

respectively. $\lambda_{MC}(p_b)$ represents the marginal costs and $\lambda_{MR}(x)$ is the marginal revenue of a higher bailout probability p_b. It is easy to show that $\frac{\partial \lambda_{MC}(p_b)}{\partial p_b} > 0$. Moreover, we derive

$$\frac{\partial \lambda_{MR}(p_b)}{\partial p_b} = -p_l'(x)\frac{\partial x^C}{\partial p_b}\left(\frac{\partial \mu_C}{\partial x}\frac{\partial x^C}{\partial p_b}\right) + (1-p_l(x^C))\frac{\partial \mu_C}{\partial x}\frac{\partial^2 x^C}{\partial p_b^2}.$$

To ensure that the second-order condition holds, the term $(1-p_l(x))\frac{\partial \mu_C}{\partial x}\frac{\partial^2 x^C}{\partial p_b^2}$ must be sufficiently small and hence $\frac{\partial \lambda_{MR}(p_b)}{\partial p_b} < 0$.

To prove the claim, we need the following additional assumptions:

$$\begin{aligned} b < \overline{b} &\equiv \tfrac{1}{p_l(x_0)}\left((1-p_l(x_0))\tfrac{\partial \mu_C}{\partial x}\tfrac{\partial x_0}{\partial p_b} - p_l'(x_0)\tfrac{\partial x_0}{\partial p_b}\mu_C(x_0)\right) \\ b > \underline{b} &\equiv \tfrac{1}{p_l(x_1)}\left((1-p_l(x_1))\tfrac{\partial \mu_C}{\partial x}\tfrac{\partial x_1}{\partial p_b} - p_l'(x_1)\tfrac{\partial x_1}{\partial p_b}\left[b + \mu_C(x_1)\right]\right) \end{aligned} \tag{34}$$

where $x_0 = x^C(0)$ and $x_1 = x^C(1)$ is the club-optimal level of riskiness for a bailout probability of 0 and 1, respectively. The assumption $b < \overline{b}$ ensures that $\lambda_{MC}(0) < \lambda_{MR}(0)$ and $b > \underline{b}$ ensures that $\lambda_{MC}(1) > \lambda_{MR}(1)$. Together with $\frac{\partial \lambda_{MC}(p_b)}{\partial p_b} > 0$ and $\frac{\partial \lambda_{MR}(p_b)}{\partial p_b} < 0$, we derive that there must exists an interior p_b^{SD}, i.e., $p_b^{SD} \in (0,1)$ that maximizes $\Phi_{SD}(p_b)$.

A.5 Proof of Proposition 4

To show that a public SD has a higher optimal bailout probability than a private SD if the responsiveness $p_l'(x)$ of the bankruptcy function is not too large, we proceed as follows. Define H as the first-order condition of a public SD, i.e.,

$$\begin{aligned} H := \frac{\partial \Phi_{SD}^{pub}(p_b)}{\partial p_b} = -&\left(p_l(x^C)\,(b-d) + p_l'(x^C)\frac{\partial x^C}{\partial p_b}\left[p_b^{SD} b + (1-p_b)d + \mu_C(x^C)\right]\right) \\ &+(1-p_l(x^C))\frac{\partial \mu_C}{\partial x}\frac{\partial x^C}{\partial p_b} = 0. \end{aligned} \tag{35}$$

Then, the implicit function theorem gives us $\frac{\partial p_b^{SD}}{\partial d} = -\frac{\partial H/\partial d}{\partial H/\partial p_b}$. We know that the denominator is negative because $\partial H/\partial p_b$ are the second-order conditions which are negative. Hence, $\text{sign}\left[\partial p_b^{SD}/\partial d\right] = \text{sign}[\partial H/\partial d]$. We derive

$$\frac{\partial H}{\partial d} = p_l(x^C) - (1-p_b)p_l'(x^C)\frac{\partial x^C}{\partial p_b} > 0 \Leftrightarrow p_l'(x^C) < \widehat{p}_l'(x^C) \equiv \frac{p_l(x^C)}{(1-p_b)\partial x^C/\partial p_b} \tag{36}$$

We conclude that the optimal bailout probability of a public SD increases with a higher collateral damage d if $p_l'(x^C) < \widehat{p}_l'(x^C)$ and it decrease with a higher collateral damage if $p_l'(x^C) > \widehat{p}_l'(x^C)$. Particularly, $\left.\frac{\partial p_b^{SD}}{\partial d}\right|_{d=0} > 0 \Leftrightarrow p_l'(x^C) < \widehat{p}_l'(x^C)$, which shows that a public SD has a higher bailout probability than a private SD if $p_l'(x^C) < \widehat{p}_l'(x^C)$.

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