Predation Due to Bargaining Power Difference in Financial Contracting

Chan, Kwok Ho and Lu, Zhou and Fung, Ka Wai Terence

United Interntional College - Beijing Normal University and Hong Kong Baptist University, City College of New York, United Interntional College - Beijing Normal University and Hong Kong Baptist University

July 2013

Predation Due to Bargaining Power Difference in Financial Contracting

Kwok Ho Chan[*], Ka Wai Terence Fung[+] , and Zhou Lu[^]

Abstract

Previous literature presented a predation model based on agency problems in financial contracting. In that model, predation reduced prey's cash flow through breaking the relationship between the prey and its investors as the prey is financially constrained. This paper presents a different model in which both the predator and the prey are financially constrained and in need of external funding. The only dissimilarity between the predator and the prey is their corresponding level of bargaining power in financial contracting over their respective investors. The asymmetry of bargaining power is the unique source of predatory behavior. Financial contract between firm with less bargaining power (prey) and its investor can deter predation if the predator cannot renegotiate the contract with its own investor. If renegotiation is available for the predator, no financial contract can successfully deter predation.

JEL Codes: D82; G32; L12; L14
Keywords: Predation; Long-purse; Signal-jamming; Financial Contracts; Bargaining Power

[*] Division of Business and Management, United International College, Zhuhai, China thomaschan@uic.edu.
[+] Division of Business and Management, United International College, Zhuhai, China econfkw@hotmail.com
[^] Department of Economics, City College of New York, New York, NY 10031 luzhou59@gmail.com

We would like to thank Hideo Konishi, Donald Cox and Wei Sun for helpful comments. All errors are ours.

1. Introduction

The well-known "long-purse" theory of predation (McGee, 1958; Tesler, 1966) states that an incumbent firm with sufficient internal financing preys on an entrant firm with limited financial resources. After the entrant enters the market and creates competition in the product market, the incumbent uses its financial power to engage in costly predatory activities. The predatory activities can be in the form of price wars that exhaust the entrant's financial resources and drive it out of the market. If entry is profitable and capital markets are perfect, the entrant can always obtain external finance and enter the market, rendering predation unsuccessful.

Nonetheless, predation will be credit and deters new entrants at the onset if capital market is imperfect. Benoit (1984) assumes that the entrant is financially constrained and it can endure the price war for only several periods. Fudenberg and Tirole (1985) show that the financial constraints can be made endogenous using the models by Diamond (1984) and Gale and Hellwig (1985). In their model, the entrant firm needs financing from the bank to enter the market. It is very costly for the bank to observe the firm's profit. The optimal debt contract between the bank and the firm requires the firm to commit a minimum equity investment in the project. In a two-period model, the incumbent firm can prey on the entrant and drives down its cash flow. This hampers the entrant's ability to secure sufficient finance and increases the probability of exit.

The assumption of imperfect capital market leads to large literature on the interaction between financial contract and predation. Fudenberg and Tirole (1986) proposed a signal-jamming model in which the entrant firm needs to use the current profit to infer future profitability. The inference problem exists because it is assumed that the bank or the owners of the entrant firm cannot reveal the information of output prices and fixed costs from the managers. This gives the incumbent firm a chance to prey on the entrant by jamming the profit 'signal'. In equilibrium, entrant's profit is lower but predation does not fool the entrant. The entrant rationally expects the predatory action and only exits the market if it is unprofitable, as if predation does not occur. Yet, predation does reduce the probability of entry. Poitevin (1989) developed a model in which information asymmetry in the financial market increases the vulnerability of the entrant firm. In the model, both the incumbent and the entrant have to make a fixed investment before starting production. Incumbent's cost structure is known while the entrants' cost -can be higher or lower than that of the incumbent- is unknown. The entrant has the incentive to signal its cost structure to the financial market in order to get the external finance. In

equilibrium, the low cost entrant credibly signals its type to the financial market and gets the external debt to finance its initial investment. While the entrant's financial structure reveals its unobserved quality to the market, it will be exposed to a larger risk of bankruptcy. The incumbent, financed by equity, preys on the entrant to increase the latter's probability of exiting the market. Poitevin (1989) thus showed that information asymmetry could affect firm's financial structure, which can affect the market structure and competition by inducing predation.

Bolton and Scharfstein (1990) proposed a predation model based on agency problems in financial contracting. In their model, the entrant is assumed to be financially constrained. Ex-post information asymmetries exist such that ex-post profits are imperfectly observed by the investors. The investors have all the bargaining power over the entrant in financial contracting. Through financial contracting, the investors can terminate the financial support to the entrant if it performs poorly. This termination threat is optimal to alleviate the agency problem but at the same time increases the probability of predation. The incumbent without any financial constraint can prey on the entrant to lower its profit and induce exit. The predatory behavior can break the relationship between the entrant and its investors forcing an immature exit of the entrant. Snyder (1996) presented a similar model in which the role of renegotiation was investigated. The investor offers another contract to the entrant firm after the incumbent's predatory behavior but before any profit realization. It was found that the financial contract between the entrant and the investors can still deter predation from the incumbent even with the possibility of contract renegotiation. Yet, renegotiation lowers the commitment value of the contracts and predation is more likely to occur than in the case of no renegotiation. Snyder also proved that the result is robust in the case where the entrant firm has all bargaining power over the investors.

Based on the model of Bolton and Scharfstein (1990) and the model of Snyder (1996), this paper presents a new model to examine how bargaining power difference in financial contracting triggers predation. Both papers assume that the incumbent has unlimited internal financial resources. The incumbent always invests and competes in the market. It only needs to decide whether to prey on the entrant or not. The decision depends on the details of financial contract between the entrant and the investors, creating an intricate interaction between predatory behavior and financial contracting. Nevertheless, the assumption of unlimited financial resources seems too strong, as most firms in reality need external funding like debts or bank loans. We relax this strong assumption in this paper. In particular, both the incumbent and the entrant are

assumed to be financially constrained and in need of external funding. The only difference between them is their bargaining power in financial contracting over their respective investors. The asymmetry in bargaining power will be shown to be the unique source of predatory behavior.

In section 2, we introduce the background of the model and review some results of Bolton and Scharfstein (1990) and Snyder (1996). In particular, under the no predation assumption, we analyze the financial contract between the firm with no bargaining power and its investors as well as the financial contract between the firm with all bargaining power and its investors. Both financial contracts are set to alleviate the agency problems but the contractual terms differ because of the asymmetry of bargaining power.

In section 3, we introduce the possibility of predation. The firm with more bargaining power will prey on the firm with less bargaining power. The investor of the targeted firm will change the term of the financial contract to protect the firm against predation. In particular, lowering the refinancing likelihood when the firm performs well (shallow pocket strategy) or increasing the refinancing likelihood when the firm performs poorly (deep pocket strategy) can achieve the same outcome. It will be shown that the investor will choose shallow pocket strategy when the only difference is bargaining power.

In section 4, we analyze the interaction between renegotiation of the financial contract and predation. We will show that renegotiation between the prey and its investors will lead to a higher probability of predation than in the case of no renegotiation. We will also show that the firm with more bargaining power can lower the cost of predation with renegotiation. As the cost of predation becomes trivial, no financial contract between the prey and its investors can successfully prevent predation.

The basic framework of this paper is closely related to the models of Bolton and Scharfstein (1990) and Snyder (1996). However, they assume only one firm is financially constrained while we assume both firms are financial constrained. This paper is also related to the work of Fernandez-Ruiz (2004) in which predatory behavior is triggered by agency problems. Nonetheless, the agency problem investigated in that paper is based on ex-ante information asymmetries while our paper focuses on ex-post information asymmetries.

2. Contracting without predation

In a two-period and two-state world, two firms, labeled A and B, compete in the product

market. Both firms need to invest a positive lump-sum amount, F, at the beginning of each period. Both firms face the same profit distribution when they compete in the market in each period. The probabilities of bad and good states are p and (1-p), respectively. p $(1-p)$. Bad (good) state will lead both firms to earn low (high) profit $\pi_1(\pi_2)$ in that period. It is assumed that $\pi_1 < F$ but the expected net present value of the investment is positive : $V \equiv p\pi_1 + (1-p)\pi_2 > F$. If one firm exits, the other firm will earn monopoly profit π_m. It is assumed that $\pi_m > \pi_2$, meaning the profitability of being a monopolist is higher than that in the good state of being in a competitive market. All players in the world have this prior information about the profit distribution.

Both firms are assumed to be financially constrained and in need of external investment. The only difference between the two firms is the level of bargaining power over their respective investors in financial contracting. For simplicity and expositional purpose, firm A is assumed to have all the bargaining power over the external investors; while firm B's external investors have all the bargaining power over firm B. We can view firm B as a very young company that is in need of capital. Thus, it is less capable to bargain with investors. At the same time, we can view firm A as a mature firm with solid record. Because of the competitive nature of the capital market, competition between investors will drive the bargaining power out of the investor's hand into firm A.[1]

One important characteristic of this model is that the realized profit is private information to the production firms (unobservable to the investors); thus, the financial contract cannot be set contingent on the realized profit.[2] The financial contract can be viewed as a direct revelation game. The contract is offered and accepted ex-ante at the initial date 0 and the repayment amount is set in advance according to the reported profit from the firm at each period. The agency problem arises because of this characteristic. In a one-period setting, let $R_1(R_2)$ be the repayment to the investors if the reported profit is $\pi_1(\pi_2)$. As the firms are assumed to have no other asset, $R_1(R_2)$ cannot be greater than $\pi_1(\pi_2)$. In this case, the firm will always report π_1 to minimize the financing cost. No investor will invest in a one-period world as $\pi_1 < F$ and π_1 is the most that the investor can get i.e. coordination failure. In a two-period world, the investors can make the firm truly report the profit level of the first period and repay more than π_1 by threatening a

[1] Bolton and Scharstein (1990) mentioned the main changes in the financial contract if the firm has all the bargaining power while Snyder (1996) presented a very detailed analysis on this.
[2] Read Bolton and Scharstein (1990) for detailed interpretation of this characteristic.

funding cut at the beginning of the second period. The threat is credible because no investor will invest in the second period as it is identical to a one-period world.

Suppose predation is infeasible. First, we consider the financial contract between firm B and its investors. The investors will invest the amount F at the beginning of the first period. After the profit of the first period is realized, firm B will report its profit level $\pi_i(i = 1,2)$ and repay the amount $R_i(i = 1,2)$ according to it. Let $\beta_i(i = 1,2)$ be the probability of reinvestment by the investor at the beginning of the second period given the reported profit level $\pi_i(i = 1,2)$. In the second period, the repayment cannot depend on the level of second period profit because firm B will always report the lower profit level as there is no threat of funding cutoff. Let $r_i(i = 1,2)$ be the repayment in the second period given that the reported profit in the first period is $\pi_i(i = 1,2)$. In the first period, the investors can set a probability of continuing investment based on the reported level of profit in the first period making a credible cutoff threat.

As the investors are assumed to have all bargaining power in setting the financial contract over firm B, firm B will accept the take-it-or-leave-it financial contract offer from the investors if the investment can provide nonnegative net expected return to the firm. The optimal financial contract between firm B and its investor solves the following program:

(1) $\max_{\beta_i,R_i,r_i}\{p[R_1 + \beta_1(r_1 - F)] + (1-p)[R_2 + \beta_2(r_2 - F)] - F\}$

subject to

(2) $\pi_2 - R_2 + \beta_2(V - r_2) \geq \pi_2 - R_1 + \beta_1(V - r_1)$

(3) $\pi_i \geq R_i \qquad i = 1,2$

(4) $\pi_i - R_i + \pi_1 \geq r_i \qquad i = 1,2$

(5) $p[\pi_1 - R_1 + \beta_1(V - r_1) + (1-p)[\pi_2 - R_2 + \beta_2(V - r_2) \geq 0$

The optimal financial contract maximizes investor's return (1) subject to the following constraints: (2) is an incentive compatibility constraint for which firm B will truthfully report its profit level in the first period; (3) and (4) are limited liability constraints for which firm B will not repay more than its earnings because the firm is assumed to have no other assets[3]; (5) is the individual rationality constraint for which firm B will sign the contract at the initial date 0.Maximization gives the following result: $R_1^* = \pi_1$, $\beta_1^* = 0$, $R_2^* = V$ and $\beta_2^* = 1$. The repayment in the second period, $r_i(i = 1,2)$, is always π_1 regardless of the profit level.[4]

[4] The proof can be referred to Lemma 2 and Proposition 1 in Bolton and Scharfstein (1990).

This optimal contract will ensure that firm B truly reports the profit level in the first period as the firm will get nonnegative return in the second period if it is still in the market. However, the contract will lead to ex-post inefficiency, as in most cases of moral hazard, since firm B will not operate in the second period if the profit in the first period is π_1, even though it is efficient to do so. Also, the contract cannot be renegotiated at the end of the first period because firm B and the investors face the same situation as in a one-period world.[5]

Now we switch focus to the financial contract between firm A and its investors. As firm A is assumed to have all bargaining power over its investors in setting the financial contract, it will make a take-it-or-leave-it offer to the investors at the initial date 0. The investors will invest the amount F at the beginning of the first period. After the profit of the first period is realized, firm A will report its profit level $\pi_i(i = 1,2)$ and repay the amount $S_i(i = 1,2)$ according to the profit level. Let $\gamma_i(i = 1,2)$ be the probability of reinvestment by the investors at the beginning of the second period given reported profit level $\pi_i(i = 1,2)$. In the second period, the repayment cannot depend on the level of the second period profit because firm A will always report the lower profit level as there is no threat of funding cutoff. Let $s_i(i = 1,2)$ be the repayment in the second period given that the reported profit in the first period is $\pi_i(i = 1,2)$. The optimal financial contract between firm A and its investor solves the following program:

(6) $\max_{\gamma_i, S_i, s_i}\{p[\pi_1 - S_1 + \gamma_1(V - s_1)] + (1 - p)[\pi_2 - S_2 + \gamma_2(V - s_2)]\}$

subject to

(7) $\pi_2 - S_2 + \gamma_2(V - s_2) \geq \pi_2 - S_1 + \gamma_1(V - s_1)$

(8) $\pi_i \geq S_i \qquad i = 1,2$

(9) $\pi_i - S_i + \pi_1 \geq s_i \qquad i = 1,2$

(10) $p[S_1 + \gamma_1(s_1 - F)] + (1 - p)[S_2 + \gamma_2(s_2 - F)] - F \geq 0$

The optimal financial contract maximizes firm A's return (6) subject to several constraints. Constraints (7), (8) and (9) are identical to (2), (3) and (4). (10) is the individual rationality constraint for which the investor of firm A will sign the contract at the initial date 0. By solving the program, we have the following result:

$S_1^* = \pi_1, \gamma_1^* = [(1 - p)(V - F) - (F - \pi_1)]/[(1 - p)(V - F) + (F - \pi_1)], S_2^* = V - \gamma_1(V - \pi_1), \gamma_2^* = 1$. The repayment in the second period, $s_i(i = 1,2)$, is always π_1 regardless of

[5] Details can be referred to Bolton and Scharfstein (1990).

the profit level.[6]

3. Contracting with predation

In this section, we consider the following case of predation: either firm can increase the probability of bad state from p to q. If one firm exits after the first period, the other firm will become the monopolist and it will earn π_m. If no firm exits, both firms will face the same profit distribution in the second period as in the case of no predation, meaning the expected profit for both firm will be V. Using the above information, we can calculate the expected benefit of predation for each firm. For firm A, the expected second period marginal profit from predation is $(\beta_2 - \beta_1)(q - p)(\pi_m - V)$. However, in order for firm A to prey, it will incur an endogenous cost to do it. In fact, predation increases firm A's own probability of earning low profit from p to q. Firm A will earn less profit for the first period. She may lose the reinvestment as the second period expected profit depends on the probability of reinvestment set in the financial contract. Thus, the expected cost of predation for firm A is$(q-p)(\pi_2-\pi_1)+(q-p)(\gamma_2-\gamma_1)V$ $(\gamma_2 - \gamma_1)(q - p)(V - \pi_1)$.[7] Firm A will prey if the cost of predation is smaller than the expected profit of being a monopolist in the second period, which is

(11)$(\gamma_2 - \gamma_1)(q - p)(V - \pi_1) < (\beta_2 - \beta_1)(q - p)(\pi_m - V)$ $(q-p)(\pi_2-\pi_1)+(q-p)(\gamma_2-\gamma_1)V < (q-p)(\beta_2-\beta_1)(\pi_m - V)$

Similarly, firm B will prey if

(12)$(\beta_2 - \beta_1)(q - p)(V - \pi_1) < (\gamma_2 - \gamma_1)(q - p)(\pi_m - V)$ $(q-p)(\pi_2-\pi_1)+(q-p)(\beta_2-\beta_1)V < (q-p)(\gamma_2-\gamma_1)(\pi_m - V)$

It can be shown that if it is profitable for firm B to prey, then it is profitable for firm A to prey.

Lemma 1 Suppose that predation can increase the probability of bad state from p to q, equation (12) is a sufficient condition for equation (11).

However, the converse may not be true. Another interesting result is that if both firms have the same level of bargaining power over their respective investors, the expected profit of

[6] The proof can be referred to the appendix in Snyder (1996).
[7] We assume all other exogenous costs of predation are negligible.

predation will equal to the cost of predation for both firms. Preying will not be an optimal strategy for either firm. [8] We can conclude that it is not necessary for one firm to have sufficient internal financial resources for predation to occur. Rather, different level of bargaining power between two firms on financial contracting can prompt predation.

We next focus on how the financial contract between the preyed firm and its investors can be altered to deter predation. For the following analysis, several assumptions need to be made. We first assume that it is only profitable for firm A to prey on firm B. The second assumption is that firm A will secure its funding first. Firm A offers the take-it-or-leave-it contract to the investor. The contract between firm A and its investors will be the same as the one discussed in the previous section. The third assumption is that the financial contract between firm A and its investor is observable by firm B and firm B's investors after it is finalized. Hence, firm B's investors know the cost of predation for firm A. The final assumption is that the financial contract between firm B and its investors is observable by firm A after it is finalized. Thus, firm A knows the expected profit of predation. As a result, firm A can decide to prey or not based on the terms of the contracts.

With the assumption of observable contract between firm B and its investors, it is clear that the contract can be modified to affect firm A's action and deter predation. In particular, the financial contract between firm B and its investor solves the program (1) – (5) with an additional "no-predation constraint":

(13) $(\beta_2 - \beta_1)(q-p)(\pi_m - V) \leq (\gamma_2 - \gamma_1)(q-p)(V - \pi_1)$ $(q-p)(\beta_2-\beta_1)(\pi_m - V) < (q-p)(\pi_2-\pi_1)+(q-p)(\gamma_2-\gamma_1)V$ or

(13') $(\beta_2 - \beta_1) \leq (\gamma_2 - \gamma_1)(V - \pi_1)/(\pi_m - V) \equiv \Delta$ $(\beta_2-\beta_1) < [(\pi_2-\pi_1)+(\gamma_2-\gamma_1)V] / (\pi_m - V) \equiv \Delta$

Apparently, the optimal contract between firm B and its investors discussed in the previous section ($\beta_2 = 1,\ \beta_1 = 0$) will maximize firm A's expected profit and its incentive to prey. In contrast, by minimizing the difference between β_2 and β_1, the contract can reduce the expected gain of predation for firm A and deter predation successfully. Firm B's investors have two choices of strategies. The first choice is to increase β_1. In the extreme case, the investor can choose $\beta_1 = \beta_2 = 1$ or what previous studies call a "deep pocket" strategy; meaning the investor

[8] In the case where exogenous costs of predation exist, it will be unprofitable for both firms to prey on the other even if they don't have the same level of bargaining power.

will definitely invest in the second period. The second choice is a "shallow pocket" strategy. As firm A will not prey if$(\beta_2 - \beta_1) \leq (\gamma_2 - \gamma_1)(V - \pi_1)/(\pi_m - V) \equiv \Delta$ (β_2-β_1) $<$ [(π_2-π_1)+(γ_2-γ_1)V] / (π_m –V)≡Δ, with $\beta_1 = 0$, β_2 should be set to equal$(\gamma_2 - \gamma_1)(V - \pi_1)/(\pi_m - V) \equiv \Delta < 1$ [(π_2-π_1)+(γ_2-γ_1)V] / (π_m –V)≡Δ<1 , meaning the probability of reinvestment in a high profit scenario is lower than that of the optimal contract ($\beta_1 = 0,\ \beta_2 = 1$).

Lemma 2: Given the no-predation constraint (13'), the optimal contract between firm B and its investors is: $R_1^* = \pi_1$, $\beta_1^* = 0$, $R_2^* = \Delta V + (1 - \Delta)\pi_1$ and $\beta_2^* = \Delta$

where $(\gamma_2 - \gamma_1)(V - \pi_1)/(\pi_m - V) \equiv \Delta < 1$ [(π_2-π_1)+(γ_2-γ_1)V] / (π_m –V)≡Δ<1

Although both strategies can deter predation effectively by increasing β_1, the investors of firm B are also increasing the probability of losing $F - \pi_1$ in the second period because the investors will only be repaid π_1 in the second period regardless. By decreasing β_2, the investor lowers the probability of losing money in the second period. The shallow pocket can effectively deter predation and maximize firm B's investor's return concurrently. Firm B and its investors will use the "shallow pocket" strategy instead of the "deep pocket" strategy and they can successfully deter predation. $R_1^* = \pi_1$ $\beta_1^* = 0$ $R_2^* = \Delta V + (1 - \Delta)\pi_1$ $\beta_2^* = \Delta$ The repayment in the second period, $r_i(i = 1,2)$, is again always π_1 regardless of the profit level.[9]

4. Contracting with predation and renegotiation

In this section, we consider the case in which renegotiation of the contract between the firms and the investors is possible. Both the contract between firm B and its investors as well as the contract between firm A and its investors will be examined. We first consider the case in which only the contract between firm B and its investors is negotiable. In a world without predation, the optimal contract ($\beta_1 = 0,\ \beta_2 = 1$) is always offered to firm B by its investors. Firm B is not able to renegotiate a new contract with its investors after first-period profit is realized. The reason is that the investor can at most get a return of $\pi_1 < F$ in the second period, just as in a one-period world. According to Snyder (1996), renegotiation can occur if the other firm preys on firm B and the optimal contract between firm B and its investors aims to deter

[9] The proof can be referred to Proposition 2 in Bolton and Scharfstein (1990).

predation.

Since the optimal contract ($\beta_1 = 0,\ \beta_2 = \Delta$) analyzed in last section is designed to deter predation, the extra constraint aims at deterring predation creates the potential for the investors and firm B to renegotiate the contract once firm A has decided to prey.

Proposition 1: If renegotiation between firm B and its investors can occur after firm A made the predation decision but before the realization of first-period profit, Predation is more likely to occur than the case without renegotiation.

The investors of firm B can extract more profit from firm B by offering a new contract. The new contract increases both β_2 and R_2 to make firm B indifferent between the new contract and the predation-deterring optimal contract. Further analysis can show that any contract with $\beta_2 < 1$ can be renegotiated. A formal proof can be found from Snyder (1996). The heuristic reason is that the firm is always efficient to operate in the second period since$V \equiv p\pi_1 + (1-p)\pi_2 > F$. If the investors can somehow extract the profit from firm B, they will increase the probability of reinvestment. Under the case of high-profit realization in the first period, the investor will be able to do so. Thus, renegotiation to increase both β_2 and R_2will always occur if $\beta_2 < 1$.[10] With the possibility of renegotiation, the shallow-pocket strategy designed to deter predation is not credible. Firm A will have a higher incentive to increase the probability of low first-period profit in order to drive firm B out of the market. Snyder (1996) proved that the existence of renegotiation would lower the effect of the predation deterring contract. Predation is more likely to occur than in the case of no renegotiation.[11] The same result holds in this paper. One should note that the above results hold no matter firm A is self-financed or financed by external investor.

We proceed to consider the case in which only the contract between firm A and its investors is negotiable.

Proposition 2: If renegotiation between firm A and investors can occur after firm B signed the contract with its investors but before firm A makes the predation decision, firm A will prey on firm B with probability of one and no financial contract between firm B and its investors can

[10] Details can be referred to Snyder (1996).
[11] The proof can be referred to the appendix in Snyder (1996).

successfully deter predation.

Following the analysis in section 2, the contract signed by firm A and its investors is the following: $S_1^* = \pi_1, \gamma_1^* = [(1-p)(V-F) - (F-\pi_1)]/[(1-p)(V-F) + (F-\pi_1)], S_2^* = V - \gamma_1(V-\pi_1), \gamma_2^* = 1, s_1^* = s_2^* = \pi_1$. It is also shown in section 3 that the investors of firm B use the shallow pocket strategy ($\beta_1 = 0,\ \beta_2 = \Delta$) to discourage predation. Firm A can observe this contract between firm B and its investors. With the probability of reinvestment set at zero by firm B's investors, firm A will definitely earn the monopoly profit π_m in the second period if it is bad state in the first period. Since firm A faces its own reinvestment probability at $\gamma_1^* < 1$, it will have the incentive to renegotiate the contract in order to increase the reinvestment probability for the second period.

Referring to the formula in the previous sections, (10) is the individual rationality constraint of firm A's investors. When the state in the first period is bad, the payoff for the investor is indicated by the first part of the formula ($p[S_1 + \gamma_1(s_1 - F)]$). This formula has to hold for the investors to be willing to sign the contract. S_1 cannot increase because of the limited liability constraint (8). In order to increase the probability of reinvestment(γ_1), the only possible way is to increase the repayment in the second period (s_1) such that the limited liability constraint (9) is no longer relevant. It is obvious that why this limited liability constraint no longer applies in this case. With firm B definitely quitting the market if the state in the first period is bad, firm A will earn π_m and is able to repay more than π_1 in the second period. Let $\widehat{\gamma_1}$ be the new probability of reinvestment and $\widehat{s_1}$ be the new repayment. The investors of firm A will sign the contract as long as the following holds:

(14) $\gamma_1(s_1 - F) = \widehat{\gamma_1}(\widehat{s_1} - F)$

We next show that it is rational for firm A to increase the repayment in the second period in order to increase the reinvestment probability. (6) is the profit function to be maximized by firm A. In particular, the first part of the function $p[\pi_1 - S_1 + \gamma_1(V - s_1)]$ indicates the profit for firm A if the state in the first period is bad. With firm B quitting the market and the possible renegotiation, that part of the function will become $p[\pi_1 - S_1 + \widehat{\gamma_1}(\pi_m - \widehat{s_1})]$. Firm A will have the incentive to renegotiate the contract with its investor as long as the following holds:

(15) $\widehat{\gamma_1}(\pi_m - \widehat{s_1}) > \gamma_1(V - s_1)$

Using (14), (15), some simple algebra can show that it is profitable for firm A to renegotiate

the contract with its investors. Both the reinvestment probability ($\widehat{\gamma_1}$) and the repayment to the investors ($\widehat{s_1}$) will be higher than those in the old contract. It should be noted that the renegotiation is profitable for both firm A and its investors due to the fact that firm B will exit the market following a low-profit realization in the first period. The monopoly profit in the second period would be more than enough for firm A to increase the repayment to the investors. The repayment in the second period can be set to follow the first-period profit realization and part of the monopoly profit is transferred to the investors in order to increase the reinvestment probability. Both parties will have incentive to commit to the new contract. Further analysis can show that any contract with γ_1<1 would be renegotiated, meaning the final contract between firm A and its investors would have $\widehat{\gamma_1} = 1$. The investors will continue to invest in the second period no matter what happens in the first period.

With the possibility of renegotiation, firm A can ensure the investment in the second period. The endogenous cost of predation for firm A, $(\gamma_2 - \gamma_1)(q - p)(V - \pi_1)$, will become zero. Hence,, the shallow pocket strategy between firm B and its investors cannot deter predation. In contrast, the deep pocket strategy can deter predation as the investors will refinance firm B under both situations. Firm A will not have incentive to prey if this is the case. However, the deep pocket strategy will never be used because the strategy will lead to a certain loss for the investor of firm B in the second period. We can conclude that with the possibility of renegotiation, firm A will prey with probability of one and no financial contract between firm B and its investors can successfully deter predation. [12]

5. Conclusion

In this paper, both firms are assumed to be financially constrained and in need of external funding for investment. They differ only in the level of bargaining power over their respective investors. Under this framework, we showed that the asymmetry of bargaining power is the unique source of predatory behavior. The optimal financial contract between the firm with less bargaining power and its investors will provide the incentive for the firm with complete bargaining power to prey. Similar to previous literature, a shallow pocket strategy between the

[12] One assumption of our analysis is that the exogenous cost of predation is negligible. Existence of significant exogenous cost enables some financial contracts between firm B and its investor to deter predation. Nonetheless, with renegotiation, firm A can still lower its endogenous cost of predation and predation is more likely to occur than in the case of no renegotiation.

prey and its investor can deter predation if renegotiation is not feasible for the predator. However, with the possibility of renegotiation, the firm with more bargaining power can ensure investment for the future. Consequently, it will always prey on its competitor. The shallow pocket strategy and all other financial contracts between the prey and its investor will fail to deter predation.

Our model of predation departs from previous literature in which only the prey is assumed to be financially constrained. Financially constrained firms with enormous bargaining power over external investors may not be less influential than their financially rich counterparts. We showed that one firm having sufficient financial resources is not a necessary condition for predation to occur. Different levels of bargaining power over external investors between two financially constrained firms can also trigger predation.

References:

Benoit, J-P., 1984. Financially Constrained Entry in a Game with Incomplete Information. The RAND Journal of Economics 15(4), 490-499.

Bolton, P., Scharfstein, D.S., 1990. A Theory of Predation Based on Agency Problems in Financial Contracting. American Economic Review 80(1), 93-106.

Diamond D.W., 1984. Financial Intermediation and Delegated Monitoring. Review of Economic Studies 51(3), 393-444.

Fernandez-Ruiz, J., 2004. Predation due to Adverse Selection in Financial Markets. International Journal of Industrial Organization 22(5), 715-733.

Fudenberg, D., Tirole, J., 1985. Predation without Reputation, No 377, Working papers, Massachusetts Institute of Technology (MIT), Department of Economics.

Fudenberg, D., Tirole, J., 1986. A 'Signal Jamming' Theory of Predation. The RAND Journal of Economics 17(3), 366–376.

Gale, D., Hellwig M., 1985. Incentive-Compatible Debt Contracts: The One-Period Problem. Review of Economic Studies 52(4), 647-664.

McGee, J., 1958. Predatory Price Cutting: The Standard Oil (N.J.) Case. Journal of Law and Economics 1, 137–169.

Poitevin, M., 1989. Financial Signalling and the 'Deep-Pocket' Argument. The RAND Journal of Economics 20(1), 26– 40.

Snyder, C.M., 1996. Negotiation and Renegotiation of Optimal Financial Contracts under the Threat of Predation. The Journal of Industrial Economics 44(3), 325-343.

Telser, L., 1966. Cutthroat Competition and the Long Purse. Journal of Law and Economics 9, 259–277.