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# SIGNALING IN FINANCIAL REORGANIZATION: THEORY AND EVIDENCE FROM CANADA

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# Signaling in Financial Reorganization: Theory and Evidence from Canada*

*Jocelyn Martel*†

**Résumé / Abstract**

Cet article propose un modèle de comportement de la firme en réorganisation financière dans lequel la structure du contrat de réorganisation, et plus particulièrement la répartition entre les paiements comptants et différés, est utilisée afin de transmettre de l'information aux créanciers non-informés sur la viabilité de la firme. Les prédictions du modèle sont testées à l'aide d'une banque de données originale de 393 entreprises canadiennes en réorganisation financière. L'analyse empirique confirme que la probabilité de succès en réorganisation augmente avec la proportion des paiements à court terme (3 à 6 mois) aux créanciers non-garantis, après avoir contrôlé pour la contrainte de liquidité des entreprises. De plus, la probabilité d'acceptation d'une proposition par les créanciers non-garantis augmente avec la proportion des paiements comptants (1 mois) et la probabilité de succès de la proposition telle qu'anticipée par les créanciers.

*This article proposes a signaling model of financial reorganization in which the firms use the provisions of the reorganization proposal, in particular the split between short term cash and deferred payments, to signal their viability to uninformed unsecured creditors. The empirical analysis based on an original data set of 393 Canadian firms in reorganization confirms that the probability of success in reorganization increases with the proportion of short term cash payments (3 to 6 months) to unsecured creditors, when controlling for the fact that firms are cash constrained. Also, the probability of acceptance of a proposal by unsecured creditors increases with the proportion of up-front payments (1 month) and the perceived probability of success of the proposal by unsecured creditors.*

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Bankruptcy laws in a number of industrial countries, especially in the U.S. and to a certain extent in Canada, have been highly criticized by economists and jurists recently.[1] An important criticism of these bankruptcy systems lies in the simultaneous existence of a liquidation and a reorganization procedure for financially distressed firms which gives rise to filtering failures whereby inefficient firms may be saved by the reorganization procedure while efficient firms may be eliminated by the liquidation procedure. Using a a game theoretical model, White (1994) shows how the U.S. bankruptcy system can generate pooling equilibria where more efficient firms gain by pretending to be less efficient and less efficient firms gain by pretending to be more efficient. The filtering problems in bankruptcy originate from the presence of asymmetric information between a firm and its creditors about the firm's viability which impacts on the creditors' decision to accept or reject a reorganization proposal.

Given the defficiencies of the bankruptcy systems, one should ask whether there exist any means by which efficient firms can minimize the occurence of filtering failures. The first contribution of this article is to propose an model of financial reorganization in the presence of asymmetric information with respect to the firms' viability which exploits the information content of the reorganization proposal and its impact on the creditors' participation and on the expected outcome of reorganization as defined by the probability of success.[2] The model focuses on situations where firms face an internal cash constraint and a loan extension constraint from the bank, which is argued to be a natural environment in which financially distressed operates. In such an environment, firms can use the structure of the reorganization proposal, in particular the split between short term cash and deferred payments, to signal their level of viability to uninformed unsecured creditors. Using a two-period model, it is shown that with symmetric information, firms reorganizing postpone all payments to creditors until the second period. In an environment characterized by asymmetric information, under the assumption that the marginal cost of short term cash payments is less for more efficient than for less efficient firms, a separating equilibrium arises in which cash payments are

[1] See Aghion, Hart & Moore (1992), Bebchuk (1988), Bradley & Rosenzweig (1992), Fisher & Martel (1994a), Martel (1994b), Rasmussen (1992), Roe (1983) and White (1994).

[2] Canadian data shows that the default rate on accepted proposals is about 30%. Recent U.S. data shows that more than 40% of Chapter 11 cases are failures (Jensen-Conklin 1992).

used by more efficient firms to separate themselves from less efficient firms. In addition, it is shown that there exists no pooling equilibria in which firms of different types offer the same contract with no short term cash payments which satisfies the Intuitive criteria. Under the opposite assumption with respect to the marginal costs of short term cash payments, it is shown that the previous separating equilibrium is also an equilibrium of the reorganization game but that pooling equilibria, in which at least two different types of firms offer the same contract whith no short term cash payments, can also arise in equilibrium. Finally, the model confirms the occurence of filtering failures in bankruptcy.

The second contribution of the article is to test the predictions of the model with an original data set of 393 commercial reorganization proposals filed at the two largest bankruptcy offices in Canada (Montreal and Toronto) between 1977 and 1988. The empirical analysis confirms many important features of the model. First, the probability of success of a proposal increases with the proportion of first period payments to creditors, after controlling for the cash-flow constraint. This is consistent with the view that cash payments have a signaling role in reorganization. Second, the probability of success of a proposal decreases with the number of periods over which installments are made. Third, the probability of acceptance of a proposal increases significantly with the perceived probability of success of the proposal by unsecured creditors.

The article is organized as follows. Section 2 presents the theoretical model of financial reorganization and Section 3 summarizes its empirical implications. Section 4 discusses the econometric technique used to estimate the model. Finally, Sections 5 and 6 present the preliminary data analysis and the estimation results respectively.

# I. The Reorganization Game

Consider a two-period model with a risk neutral firm in financial distress which needs to reorganize its debt with unsecured creditors and find new bank financing. At period 1, the firm, which has a net cash-flow of $S_1$, equal to the value of tangible assets, financial slack and a bank loan which has absolute priority over unsecured debt, and which faces an investment opportunity, offers a new financial contract to unsecured creditors and chooses a level of

investment, $x$. The contract specifies a first and a second period payment, $(P_1, P_2)$, with $P_2$ being contingent on the success of the investment project. If unsecured creditors, who are assumed to be identical, reject the proposal, the firm is declared bankrupt and the assets are liquidated and distributed according to the absolute priority rule. If they accept, the firm obtains the loan previously negotiated with the bank and invests an amount $x$, which generates revenues of $\gamma x + \theta$ in the second period, where $\gamma$ is a depreciation factor on the investment. Since investment is contingent on the extension of the bank loan and a reduction of the unsecured debt, the basic problem of the firm is then one of cash-flow in the first period. The contract $(P_1, P_2)$ is binding on the firm and cannot be renegotiated once it is rejected or accepted. Any default on the terms of the contract entails liquidation.

The private information on the firm's type, parameterized by $t$, is exogenously given. The stochastic parameter $\theta$ has support $[0,\ \bar{\theta}]$ and a probability distribution $F(\theta|x,t)$, which depends on the firm's type and on the level of investment.[3]

This model, which considers the relationship between the firm and its unsecured creditors at the time of financial reorganization, is characterized by two important features. First, the firm has negotiated a new loan or a loan extension with the bank prior to an agreement with unsecured creditors. Although the loan can be observable, creditors cannot infer all useful information with respect to the future profitability of the firm's investment project.[4] This structure is justified on the basis that banks play only an indirect role in a court supervised reorganization and is mostly restricted to the renewal or extension of the existing loans.[5] As suggested by Bulow & Shoven (1978), the role of banks in the refinancing of insolvent firms takes all its importance at a stage prior to financial reorganization, namely when a firm has to decide between liquidation, continuance and reorganization.

Second, the firm's own cash-flow and the new bank loan are insufficient to invest first best the optimal level of investment (i.e. $S_1(t) < x^*(t)$), which

[3]The dependence of $F(\theta|\cdot)$ on $x(t)$ is explained by the fact that the level of investment affects the probability of success in reorganization.

[4]Empirical evidence supporting the positive signaling role played by the renewal of bank loans, in particular when the firm is in financial distress, have been provided by Chemmanur & Fulghieri (1994), Fisher & Martel (1995), Lummer & McConnell (1989) and James (1986).

[5]See Martel (1991) and Fisher & Martel (1995, 1994a) for Canadian evidence.

justifies the need for unsecured debt reorganization. The constrained level of investment is denoted $\bar{x}(t)$. This premise is justified on the basis that firms with internal cash constraints and low levels of collateral have limited access to debt markets.[6] In addition, small firms in financial distress may encounter greater difficulty in raising capital because of the heightened informational asymmetry between the firm and the creditors.[7] Empirically, this view is supported by the findings of Fisher & Martel (1994b) and Martel (1994a) who have shown that there is very little free assets to secure new loans at the time of reorganization, which imposes a constraint on the amount the firm can borrow.

The expected payoff of the firm and the creditors in financial reorganization, net of their expected payoff in liquidation, are:

$$\Pi(P_1, P_2, B_2, S_1, x, |t, C) = S_1 - P_1 - x + \int_{B_2+P_2-\gamma x}^{\bar{\theta}} (\gamma x + \theta - B_2 - P_2)\, dF(\theta|x,t) \quad (1)$$

$$\Gamma(P_1, P_2, B_2, x|t, C) = P_1 + \int_{B_2-\gamma x}^{P_2+B_2-\gamma x} [\gamma x + \theta - B_2]\, dF(\theta|x,t)$$

$$+ \int_{P_2+B_2-\gamma x}^{\bar{\theta}} P_2\, dF(\theta|x,t) - C \quad (2)$$

where:
$C$ : expected liquidation payoff on unsecured claims;
$B_2$ : bank loan to be reimbursed in period 2.

It is assumed that there are three types of firms, that is an inefficient firm, $NV$, and two efficient firms, $L$ and $H$, with $H$ having better future prospects than $L$ in reorganization.[8] For simplicity, the interest rate is assumed to be zero. Also, the payoff on unsecured claims in liquidation, $C$, is strictly greater than zero, independent of the firm's type and can take two values from the

[6] See Whited (1992), Myers (1984) and Gertler (1988).

[7] See Opler & Titman (1994).

[8] The terms inefficient and efficient firms refer to firms which should be shut down and which should continue operating respectively. These terms are borrowed from White (1994).

unsecured creditors' perspective: a low value, $\underline{C}$, or a high value, $\overline{C}$.[9] The firm does not know the creditors' valuation of $C$ when offering the contract and they assign a probability $q$ to a high valuation and a probability $(1-q)$ to a low valuation by creditors. The upper and lower limits of the integral are determined by the absolute priority rule in bankruptcy. For instance, the firm can only make positive profits in period 2 after paying for its bank loan and unsecured claims. Similarly, the payment to unsecured creditors is a function of the state of the world. They receive any amount exceeding the bank loan when $B_2 - \gamma x < \theta < P_2 + B_2 - \gamma x$ while they receive the full payment, $P_2$ when $P_2 + B_2 - \gamma x < \theta < \bar{\theta}$.

We impose the following additional assumptions:

**Assumption 1** $F(\theta|x,H) < F(\theta|x,L) < F(\theta|x,NV)$

**Assumption 2** $F(\theta|x=0,t) = 1 \qquad \forall \theta > 0 \ and \qquad \forall t$

**Assumption 3** $F_x(\theta|x,NV) < F_x(\theta|x,L) < F_x(\theta|x,H) < 0$

Assumption 1 states that a more efficient firm has a greater probability of success than a less efficient firm in reorganization. Assumption 2 implies that the project fails if the firm does not invest in the first period. Finally, assumption 3 states that the marginal effect of the firm's investment in period 1 on the distribution function of $\theta$, is larger, in absolute value, for less efficient than more efficient firms. The intuition behind this assumption is the following. As previously mentioned, the basic problem faced by firms at the beginning of reorganization is one of cash-flow. In this context, one would want to leave the firm with a high enough level of cash in order to maximize its chances of successfully reorganizing. Given that more efficient firms have, by assumption, a higher probability of success, relaxing the cash constraint on the less efficient firms should have a larger marginal effect. This also means that first period payments to unsecured creditors are marginally less costly for more efficient firms than for less efficient firms. The implications of this assumption on the equilibrium outcome of the game are discussed later in the paper. In particular, the impact of an alternative specification is examined.

[9] $\overline{C}$ is defined as the value of $C$ such that $\Pi(P_1, P_2, \cdot, t|\ \overline{C}) < 0$ for inefficient firms and $\Pi(P_1, P_2, \cdot, t|\ \overline{C}) \geq 0$ for efficient firms while $\underline{C}$ is defined as the value of $C$ such that $\Pi(P_1, P_2, \cdot, t|\ \underline{C}) \geq 0$ for all firms.

The outcome of the game depends on the information structure between the firm and the creditors.

## A. Symmetric Information

With symmetric information, the firm's type, $t$, and the unsecured creditors' valuation of the liquidation value of the firm is common knowledge to all parties. The optimal contract and investment level is the solution to the following maximization problem[10]:

$$\max_{P_1,P_2,x} \Pi(P_1, P_2, B_2, S_1, x|t, C) \tag{3}$$

subject to:

$$S_1 - P_1 - x \geq 0 \tag{4}$$

$$, (P_1, P_2, B_2, x|t, C) \geq 0 \tag{5}$$

$$P_1 \geq 0, \quad P_2 \geq 0, \quad x \geq 0 \tag{6}$$

The first constraint specifies that the amount invested cannot exceed the net cash-flow available to the debtor in period 1 while the second constraint represents the creditors' participation constraint in reorganization. The last three constraints ensure that unsecured creditors receive a non-negative payment on their original claims and that the investment level is non-negative.[11]

**Proposition 1** *The following allocation corresponds to an equilibrium of the reorganization game with symmetric information:*

*(i) Firm NV liquidates.*

*(ii) Firms L and H reorganize.*

[10] The choice variables are a function of the firm's type. We omit the reference to $t$ for simplicity.

[11] The non-negativity constraints on the payment to creditor are not inconsistent with the fact that creditors can keep on doing business with the firm; an activity which is typically associated with a negative payment to creditors over a short period of time (often over a period 60 or 90 days). New claims acquired after reorganization are simply treated independently of the proposed payment in reorganization.

*(iii)* $P_1(t) = 0 \quad$ *for* $\quad t = L, H.$

*(iv) The expected return to unsecured creditors in reorganization, for each type of firms, is equal to their expected return in liquidation.*

*(v)* $x(t) = \bar{x}(t) = S_1(t) \quad$ *for* $\quad t = L, H.$

*(vi) Creditors reject the offer if and only if* , $(0, P_2, B_2, x|t, C) < 0.$

The solution to this problem can be found in the Appendix. Given that the firm's type is common knowledge, the inefficient firm liquidates its assets while efficient firms opt for reorganization. For liquidity reasons, the level of investment is contingent on the type of contract offered to unsecured creditors. Since first period payments conveys no information about the firm's viability to uninformed creditors, investment and profits are maximized when they are set equal to zero and all payments are postponed to the second period.

## B. Asymmetric Information

In more realistic cases, unsecured creditors have less information than the firm about the firm's ongoing viability and the bank loan is not fully revealing. Since the firm has some private information about its own viability at the time of negotiation, the reorganization contract may convey information to creditors about its type. Knowing this, creditors may use this information to form beliefs about the firm's type. A more efficient firm then has an incentive to use the contract to separate itself from a less efficient firm and self-selection can occur through the use of the first period payment, $P_1$.

**Lemma 1** *In the* $\{P_1, P_2\}$ *space,* , $(P_1, P_2 = 0|t) =$ , $(P_1, P_2 = 0|t+1) = C.$ *In addition, in the* $\{P_1, P_2\}$ *space,* , $(P_1, P_2|t)$ *lies to the right of* , $(P_1, P_2|t+1), \ \forall \ P_2 > 0$ *and* $\forall \ x \geq 0$

Lemma 1 states that the creditors' participation constraints based on the beliefs that they face a type $NV$, $L$ or $H$ firm cross at the same point at the origin since the liquidation payoff to unsecured creditors, $C$, is independent of $t$. In addition, for a given $P_2 > 0$, a lower type firm must offer a larger $P_1$ than a higher type firm in order to satisfy the creditors' participation constraint.

The equilibria of the game depend on the so-called *single-crossing* property.[12] The next lemma shows that this property is satisfied in the $\{P_1, P_2\}$ space.

**Lemma 2** *In the $\{P_1, P_2\}$ space, the single-crossing property for the firm is satisfied.*

The solution to the signaling game is described by the concept of *Perfect Bayesian Equilibrium* (PBE) in pure strategies. A PBE of the signaling game specifies, for each type, a couple $\{P_1, P_2\}$ tendered by the firm. A strategy by the unsecured creditors is an acceptance rule that maps $\{P_1, P_2\}$ into an acceptance decision and a system of beliefs updated by Bayes Rule whenever possible along the equilibrium path.[13] Sequential rationality implies that their strategies are rational given their beliefs and that their beliefs are consistent with the others' strategies. There exists a continuum of Perfect Bayesian Equilibrium for this game depending on the structure of beliefs off the equilibrium path. The structure of the equilibrium is the following:

**Proposition 2** *The following allocation corresponds to a PBE of the reorganization game:*

*(i) Firm NV liquidates if $q = 1$ and reorganizes if $q < 1$ with an offer of $(P_1, P_2)$ such that , $(P_1, P_2|t, \underline{C}) = 0$ and $P_1(NV) = 0$.*

*(ii) Firms L and H reorganize for all values of $q$ and offer a contract $(P_1, P_2)$ such that , $(P_1, P_2|t, \overline{C}) = 0$ if $q > q^*$ where $q^*$ is such that $\Pi(P_1, P_2|t, \overline{C}) = \Pi(P_1, P_2|t, \underline{C})$. Otherwise, $(P_1, P_2)$ is such that , $(P_1, P_2|t, \underline{C}) = 0$.*

*(iii) The expected return to unsecured creditors in reorganization, for each type of firms, is equal to their expected return in liquidation; i.e. Let's define the function $P_2^*(P_1, t)$ such that , $(P_1, P_2^*(P_1, t)|C) = 0, \quad \forall\ P_1$ and $t$, then $P_2(t) = P_2^*(P_1, t)$ for all firms in reorganization.*

*(iv) $P_1(L) = 0$ if $q > q^*$ and $P_1(H)$ is the value of $P_1(H) > P_1(L)$, with $P_1(H) > 0$, which solves $\Pi(P_1, P_2^*(P_1, H), L) = \Pi(P_1(L), P_2(L), L)$. Otherwise, $P_1(L) > 0$ and $P_1(L)$ is the value of $P_1(L) > P_1(NV)$ which*

[12] See Cooper (1984).

[13] See Fudenberg & Tirole (1991).

*solves* $\Pi(P_1, P_2^*(P_1, L), NV) = \Pi(P_1(NV), P_2(NV), NV)$ *and* $P_1(H) > 0$ *and is the value of* $P_1(H) > P_1(L)$ *which solves* $\Pi(P_1, P_2^*(P_1, H), L) = \Pi(P_1(L), P_2(L), L)$.

*(v) Creditors reject the offer if and only if* , $(P_1, P_2, t|C) < 0$.

*(vi)* $x(t) = \bar{x}(t) = S_1(t) - P_1(t)$ *for all firms in reorganization.*

For ease of presentation, the solution to this game is depicted in two figures. Figure 1(a) illustrates the case of an inefficient, $NV$, and an efficient firm, $L$, while Figure 1(b) illustrates the case of two efficient firms, $L$ and $H$.[14] In Figure 1(a), firm $NV$ liquidates if $q = 1$, since there are no mutually beneficial contract between the firm and its creditors. To deter $NV$ from deviating from its equilibrium strategy, firm $L$ offers contract $B$ with $P_1(L) > 0$. Creditors accept $L$'s offer irrespective of their true valuation of $C$. If $q = 0$, firms $NV$ and $L$ reorganize and offer contract $A$, with $P_1(NV) = 0$, and contract $D$, with $P_1(L) > 0$, respectively. Creditors accept the offers if their true valuation of the assets is equal to $\underline{C}$ and reject otherwise. However, unlike firm $NV$ which offers contract $A$ for any value of $0 < q < 1$, firm $L$ can take a chance an offer contract $D$ which provides for a lower $P_1$ and higher payoffs but also with a lower probability of acceptance by creditors than contract $B$. As a result, the reorganization contract of an efficient firm can be rejected in equilibrium.

The same analysis applies to two efficient firms where the firms $L$ and $H$ can offer the contract $A$ and $B$ respectively which are accepted with probability one by creditors or offer the contract $E$ and $D$ which are accepted with a probability of less than one. The choice of a contract by firms $L$ and $H$ reflects the trade-off between a higher first period payment, associated with a higher probability of acceptance of a plan, and a lower cash-flow and total payoffs. This is illustrated in Figure 1(b). This analysis supports White's (1994) and Fisher & Martel's (1995) results with respect to the occurence of filtering failures in bankrupcty.

**Proposition 3** *There exists no pooling equilibrium outcomes of the reorganization game, with all types of firms offering* $P_1 = 0$*, which satisfies the Intuitive criterion.*[15]

[14] See the Appendix for a complete proof.

[15] See Cho & Kreps (1987)

Proposition 3 can be demonstrated using Figure 2 which considers two efficient firms for $C = \overline{C}$.[16] Let $\{P_1(p), P_2(p)\}$ be the pooling contract such that $\mu_0$ , $(P_1(p), P_2(p), x|H) + (1 - \mu_0)$ , $(P_1(p), P_2(p), x|L) = \overline{C}$, where $\mu_0$ is the creditors' prior belief that the firm is of type $H$. The creditors' participation constraint is represented by the indifference curve , $_P$. Contract A represents a pooling equilibrium and is supported by the beliefs that $\mu(L|P_1 > 0) = 1$. Now consider contract $B$ which is strictly preferred by type $H$ to contract $A$. Then, the Intuitive criterion requires that the creditors should assign a probability equal to one that this contract is offered by type $H$ since type $L$'s profits are lower if it deviates. Hence, type $H$ offers contract $B$ and creditors accept, thus upsetting the equilibrium.

The outcomes of the reorganization game in Propositions 2 and 3 are derived under assumption 3 which states that the marginal effect of investment is larger for the lower type than for the higher type firms. The next proposition characterizes the outcome of the game with the opposite assumption.

**Proposition 4** *If $F_x(\theta|x, H) < F_x(\theta|x, L) < F_x(\theta|x, NV) < 0$, the Perfect Bayesian Equilibrium in Proposition 2 is also a separating equilibrium of the signaling game.*

**Proposition 5** *If $F_x(\theta|x, H) < F_x(\theta|x, L) < F_x(\theta|x, NV) < 0$, there exists no pooling equilibrium outcomes of the reorganization game, with all types offering $P_1 > 0$, which satisfies the Intuitive criterion.*

In Figure 3, let the candidate pooling equilibrium with $P_1 > 0$ be represented by contract $E$. Consider an alternative contract such as $D$ with $P_1 = 0$. According to the Intuitive criterion, creditors should assign a probability equal to one that contract $D$ originates from the type $H$ firm since type $L$ would lower its profit if it deviates. Therefore, $H$ offers contract $D$, creditors accept, thus upsetting the equilibrium. The intuition behind these two propositions is very simple.[17] In an environment characterized by cash constraints and asymmetric information on the firms' viability, there are potential gains to signaling for the higher type firm. However, in the event that the marginal return to holding additional cash for investment is significantly larger for the higher type than for the lower firm, the gains from signaling

[16] The same analysis applies when considering an inefficient and an efficient firm.

[17] See the Appendix for the proof.

disappear and both types offer the same contract with a first period payment equal to zero.

These results can be compared to those of White (1994) and Giammarino (1989) who show that pooling equilibria in which insolvent and solvent firms offer the same contract in equilibrium can arise in the context of financial rerganization with asymmetric information. According to White, creditors cannot infer the firm's type from the form of payments when both types of firms benefit from pooling rather than separating. The signaling model presented in this paper supports this view only when the marginal costs of cash payments is significantly inferior for lower type than for higher type firms. Otherwise, the structure of payments specified in the reorganization contract carries information to creditors about the firms' viability and are used by more efficient firms accordingly. However, contrary to White's model which assumes that the payments to creditors under a low-payment proposal is made as a lump-sum following the approval of the plan, the present model derives endogenously the structure of the reorganization contract. Since a priori, it is not clear which view is the most appropriate, an empirical analysis of the behaviour of firms and creditors in reorganization can shed some light on that debate. This is the object of the next sections.

# II. Empirical Implications

The reorganization procedure is a two-stage game. At stage one, debtors submit a proposal to unsecured creditors for their approval.[18] At stage two, an accepted proposal can either be a success or a failure.[19] The model presented in this paper generates empirical implications with respect to each of these two stages.

The probability of success in reorganization:

1. decreases with the proportion of first period cash payments in the context of symmetric information;[20]

[18] There is a stage prior to the creditors' vote, that is the firm's choice between liquidation and reorganization. It is outside the scope of this study.

[19] A proposal is a success when all the terms of the original agreement have been met and the trustee is discharged.

[20] The impact of $P_1$ is derived in the presence of cash constraint on firms in reorganization.

2. increases with the proportion of first period cash payments in the context of asymmetric information;

3. increases with the firm's cash-flow level at the beginning of reorganization.

The probability of acceptance of a reorganization proposal by unsecured creditors:

1. increases with the perceived probability of success of the proposal;

2. increases with the proportion of first period cash payments;

3. increases with the proposed payment in reorganization;[21]

4. decreases with the expected payment on unsecured claims in liquidation.

# III. Parametric Analysis of Reorganization

The creditors' decision to accept or reject a reorganization proposal depends, among other factors, on its perceived probability of success. Following McFadden's (1981) random utility model, let $y^*_{ij}$ be the expected level of indirect utility of creditor $i$ in alternative $j$. We can write:

$$y^*_{ij} = \beta' \tilde{p}(x_{ij}) + \alpha'_j z_i + \epsilon_{ij} \tag{7}$$

where $\tilde{p}(x_{ij})$ is the creditor's perceived probability of success and $z_i$ is a vector of measured characteristics for creditor $i$. Since $y^*_{ij}$ is unobservable, the choice rule is the following:

$$y_{ij} = 1 \quad \text{if} \quad y^*_{ij} > y^*_{ik} \qquad \forall \quad k \neq j$$

$$y_{ij} = 0 \quad \text{otherwise}$$

The probability that a proposal is accepted and successful can be written as:

$$P_{ij} = Prob(y_{ij} = 1) = \frac{exp[\beta' \ \tilde{p}_{ij} + \alpha'_j z_i]}{1 + exp[\beta' \ \tilde{p}_{ik} + \alpha'_k z_i]} \tag{8}$$

[21] This is the total payment unadjusted for risk.

However equation (8) cannot be estimated since the probability of success is not observable. Assuming that this probability is a linear function of a number of factors, we can write:

$$\tilde{p}_{ij} = \gamma_j^{'} \; x_{ij} + \mu_{ij} \tag{9}$$

Although $\tilde{p}_{ij}$ is unobservable, we can define a variable $s$ such that:

$s_{ij} = 1$ if the proposal is successful

$s_{ij} = 0$ otherwise

and the probability of success of a proposal can be written as:

$$p_{ij} = Prob(s_{ij} = 1) = \frac{exp[\gamma_j^{'} x_{ij}]}{1 + exp[\gamma_j^{'} x_{ij}]} \tag{10}$$

Assuming weak exogeneity for $\tilde{p}$, a two-step procedure is used to estimate the model.[22] First, we estimate equation (10) with a logit model. The parameter estimates of (9) are then used to calculate a predicted probability of success for each proposal in the sample. Finally, equation (8) is estimated with the predicted probability of success and other measured characteristics.[23]

# IV. Preliminary Data Analysis

Each reorganization proposal made under the Canadian *Bankruptcy Act* is filed with one of 15 regional bankruptcy offices of Industry & Science Canada. The data used for this study originate from individual reorganization files filed at the Montreal and Toronto regional offices during the period 1977-1987. From a population of 1280 commercial proposals, a random sample of 500 files was selected.[24] Due to the presence of some consumer proposals,

[22] Weak exogeneity assumes the independence of the error terms $\epsilon_{ij}$ and $\mu_{ij}$. This procedure is less efficient but provides consistent estimates. See Engle, Hendry & Richard (1983).

[23] See Maddala (1983). Estimation is performed using Version 7.0 of SHAZAM.

[24] Random sampling was carried out using the Systematic Random Sampling Procedure. The sample is chosen to be representative of the regional distribution of bankruptcies and proposals over the years.

commercial bankruptcies or the absence of key information in the files, the final sample has 393 proposals, of which 273 are from Montreal and 120 are from Toronto.

Table I offers a condensed description of the characteristics of firms in financial reorganization.[25] Canadian firms filing a proposal are relatively small, with an average value of assets of $2.45 million and an average value of liabilities of $2.98 million.[26] About 72% of the firms in the sample have a real value of assets less than $1 million. More than 60% of total liabilities are unsecured while secured and preferred debt represent respectively 32% and 6% of total debts. On average, there are 110 creditors involved in a reorganization proposal; the majority, 84%, being unsecured creditors.

Firms in reorganization offer a mean payoff rate of 38.2 cents on the dollar on unsecured claims.[27] On average, 7.2 % of the proposed payoff is paid in cash up-front, 91.1 % is paid in cash installments and 1.6 % is paid in equity in the firm.[28] Installment payments are paid in 3 separate installments which are spread over a mean period of 14 months. The gross expected payoff to unsecured creditors in a liquidation is estimated at 7.2%.[29]

It takes, on average, 50 days before creditors can take the final vote of a proposal and the the acceptance rate by unsecured creditors is 74.8%. Of these accepted proposals, more than 70% are successful, that is all the terms of the proposals are met by the debtor before the trustee is discharged. Therefore, the probability that a firm filing for a proposal will be successful in reorganization is about 53%.

Table II reveals some important stylized facts on the payoff to unsecured creditors. First, the proposed payoff in reorganization is higher for accepted than for rejected proposals while the expected liquidation payoff

[25] See Martel (1994a) for a detailed description of the sample.

[26] All dollar figures are reported in thousands of June 1993 Canadian dollars, deflated by the GDP deflator (Series D20556).

[27] The non-discounted payoff rate to unsecured creditors originates from the debtors' proposal to creditors.

[28] Cash up-front payments are defined as cash payments made within strictly less than one month of the court's approval. Only four proposals provided for equity payments.

[29] The gross expected payoff in liquidation is defined as ((0.5 * book value of assets) - secured claims - preferred claims) / unsecured claims. This represents an upper bound on the payment unsecured creditors anticipate receiving in liquidation since it is gross of administration costs. Given the absence of information on the ratio of market to book value of assets, a value of 0.5 was used.

rate to unsecured creditors is higher for rejected than for accepted proposals. These confirm the larger net gain for accepted than for rejected proposals. Second, the proportion of short term payments, whether defined as the proportion of payments paid up-front, within one month, three months and six months from approval, is significantly higher for successful as compared to non-successful proposals. This stylized fact is well summarized in Figure 4 which shows that, on average, successful proposals provide for a higher ex ante proposed payment than non successful proposals, as expressed by the *net gain* line, with the peak being between three and nine months from confirmation. These findings provide preliminary support for the signaling role of short term payments in reorganization.

# V. Results

The data allow for several measures of the first period payments which can be measured as the proportion of payments made upon court's approval, or the proportion of payments made within one month, three or six months of court's approval. These alternative specifications are all tested. Given the absence of data on the firms' cash-flow, the proportion of government claims in total liabilities is used as a proxy.[30] The reason for using this variable is that, in reorganization, government claims have to be fully reimbursed upon the court's approval, which reduces the cash-flow of the firm.[31] In addition, a high level of proportion of government claims can denote recurrent cash-flow problems and the fact that the firm has been negotiating with the government an informal rescheduling of its claims over the years prior to reorganization.[32] A negative coefficient for this variable would support the conjecture that the firms are cash constrained at the beginning of reorganization. In reorganization, uncertainty increases with the number of installments required to reimburse the creditors. The number of installments specified in the proposal

[30]Government claims refer to claims for source deductions, sales and corporate taxes and customs fees, etc.

[31]The 1992 reform to the Bankruptcy Act changed the status of government claims in reorganization. Although this model is inspired by the regime prevailing prior to 1992, these institutional changes do not alter the structure of the model. See Martel (1994b) and Fisher & Martel (1994a) for a discussion of the bankruptcy reform.

[32]Government claims in proportion of total liabilities is used to control for firm size effects and to reduce the sensitivity of the estimates to extreme values.

is used to capture this effect. To control for the firms' relative financial situation, the assets to liabilities ratio is used. Dummy variables to control for corporations, region and industries are also used.

Table III lists the results from the logit estimation of the success incidence equation.[33] The estimation results show that the probability of success increases with the proportion of first period payments as measured by the proportion of payments paid within six months of court's approval.[34] The interesting feature about this result is that first period payments have a larger effect when paid within a relatively short period of time than when paid upon court's approval. This suggests that the possibility for the firm to spread these payments over a few months gives it the additional breathing space that is necessary to maximize its probability of success in reorganization. One might argue that this effect is not a signaling effect but rather a wealth effect whereby more viable firms simply have more cash than less viable firms. This view is not supported by the empirical results since the cash payments variable is significant when controlling for the cash-flow effect, as measured by government claims. Column 2 in Table V reports the results from an alternative regression which controls for the proportion of free assets in the firm shows that this variable does not have a significant impact on the probability of success of a proposal while the proportion of payments paid within six months of court's approval is still significant. [35] According to Column 3 of Table V, the proportion of free assets is even less significant when excluding the cash payments variable. These results supports the signaling role played by the proportion of first period cash payments in the presence of asymmetric information.[36]

[33]The sample size is 244 proposals. For the purpose of estimation, we omitted files with missing information on the value of assets and the number of installments. In cases where the return (1 case) and the proportion of cash payments (9 cases) is unknown, it has been set to zero on the grounds that this is the worst creditors can expect. An alternative regression where files with unknown return and payments are rejected yields similar results.

[34]The proportion of payments made at three months from the court's approval also have a positive and significant effect while the proportion of payments made upon approval or after one month of approval have a positive but non-significant effect.

[35]The proportion of free assets is defined as ((assets - secured claims) / assets). Negative values have been set to zero. Although being an imperfect measure of cash, the proportion of free assets is certainly positively correlated with the amount of liquid assets.

[36]One can also argue that the use of cash payments may simply result from the presence

The negative coefficient of the proportion of government claims estimator confirms the view that firms in reorganization are cash constrained even following an extension of the bank loan. These claims impose a burden on the firms' cash-flow at the beginning of reorganization and reduce their likelihood of success. This also supports the view expressed earlier with respect to the limited access to debt markets for small firms. Proposals with payments spread over many installments are less likely to be successful, which provides evidence that the uncertainty reduces the likelihood of success of a reorganization proposal. The assets to liabilities ratio has a positive and significant coefficient which supports the view that firms in relatively better financial health are more likely to succeed in reorganization. Relative to Toronto, reorganization proposals filed in Montreal are less likely to be successful. Corporate proposals are not estimated to have significantly different success probability than non-corporate proposals. Finally, there are no statistically significant differences in the probability of success across industries.[37] A likelihood-ratio test cannot reject the hypothesis that the industry coefficients are jointly equal to zero with a $\chi^2$ test statistics of 4.73 with 5 degrees of freedom.[38] Similarly, we reject the hypothesis that the probability of success is determined by the dummy variables only with a $\chi^2$ test statistics of 24.46 with 4 degrees of freedom.[39]

Using the estimated coefficients, a predicted probability of success is computed for each proposal in the sample which is then compared to the observed probability of success. The model predicts that expected probability of success is 73.77 percent for accepted proposals and 67.20 percent for rejected proposals. This confirms that rejected proposals have a lower expected probability of success ex ante.

The creditors' decision in reorganization is based on their participation constraint. We examine the impact of the proportion of first period payments, the perceived probability of success of the proposal, the total pay-

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of a large individual creditor having a potential veto right on the approval of the proposal. The micro-data on firms which had their reorganization proposals accepted shows that this is not the case since the number of proposals involving a large individual ordinary creditor (with more than 25% of the ordinary claims) is not statistically (at the 5% level) different when comparing successful and unsuccessful proposals.

[37] These five industries were selected according to their relative importance in the sample.

[38] The critical value is 11.07 at the 5 percent level.

[39] The critical value is 9.49 and 13.28 at the 5 and 1 percent level respectively.

ment in reorganization and the expected payoff in liquidation. To examine the effect of delays in the reorganization procedure, a variable measuring the time between filing and voting is added to the list of explanatory variables. Bargaining between the firm and creditors is captured by the number of amendments to the proposal. The estimation also includes a variable measuring the proportion of secured claims in total claims to examine the implicit role of banks in reorganization [Fisher & Martel (1995)]. The change in the unemployment rate over the six months prior to the creditors' decision is used as a proxy for the business climate just prior to reorganization. Since, the voting rule gives a veto right to any unsecured creditor having more than 25% of unsecured claims, a dummy variable is used to control for the presence of a large unsecured creditor. A dummy variable for holding proposals is used to control for additional uncertainty from the creditors' perspective.[40]

Table IV presents the results from the logit estimation of the acceptance incidence equation.[41] As predicted by the model, the perceived probability of success of a proposal plays a key role in the creditor's decision. An increase in the perceived probability of success increases the likelihood of acceptance of a proposal. The estimation results confirm that the probability of acceptance increases with the proportion of first period payments as measured by the proportion of payments made within one month of the court's approval, after controlling for the effect of short-term payments on the probability of success. This result illustrates the trade-off involved in using cash payments. From the creditors' perspective, short term payments have a greater impact when paid very shortly following the court's approval while from the firm's perspective, they have a greater impact on the probability of success if spread over a reasonably short period of time. These results confirm the recent findings of Fisher & Martel (1995) who provide evidence that proposals offering higher short term cash payments are more likely to be accepted and to succeed.

[40] A holding proposal is an interim document requiring more time to prepare a final proposal.

[41] The sample size is 384 proposals. For the purpose of estimation, we omitted files with missing information on the value of assets, the number of amendments and the time between filing and voting. One file with an exceptionally long period between filing and voting (1681 days) is also deleted. In cases where the proposed reorganization payment (35 cases) and the proportion of short term payments (84 cases) are unknown, they have been set to zero. An alternative regression where the cases with unknown return and payment are rejected yields similar results.

Contrary to expectation, although coefficients for the expected payoff in liquidation and the non-discounted proposed payoff in reorganization have the right signs, they do not have significant impact on the probability of acceptance. However, a likelihood-ratio test rejects the hypothesis that the parameters of the participation constraint variables are jointly equal to zero with a $\chi^2$ test statistics of 15.78 with 4 degrees of freedom.[42] Although these results contrast with those of Fisher & Martel (1995) who find a significant effect of these two variables on the probability of acceptance in reorganization, an alternative specification in which the acceptance stage of the game is estimated indepently yields similar results to those find by these authors.

The probability of acceptance also increases with the number of amendments to the proposal, which confirms the positive impact of successful negotiation prior to the vote.[43] The change in the unemployment rate over the six months prior to voting is estimated to affect negatively the acceptance probability, suggesting that the behaviour of creditors is pro-cyclical. Holding proposals are also less likely to be accepted. The results provide only weak evidence for Fisher & Martel's (1995) findings with respect to the positive signaling role played by secured creditors in reorganization. The coefficient of the estimator for the ratio of secured claims to total claims is positive but not significantly different than zero. The same is true for the variable measuring for the time between filing and voting. According to Fisher & Martel, an increase in the time period between filing and voting reduces the likelihood of acceptance of a proposal while the present results suggests that, although the coefficient of the estimator being negative, the effect is not significantly different than zero. Finally, the presence of a large unsecured creditor does not have a statistically significant impact on the vote. A likelihood-ratio test rejects the hypothesis that all the parameters except those for the dummy variables are jointly equal to zero with a $\chi^2$ test statistics of 49.92 with 8

[42] These variables are the expected payoff in liquidation, the payoff in reorganization, the proportion of payments within one month and the proposal's perceived probability of success. The critical value is 9.49 and 13.38 at the 5 and 1 percent level.

[43] 37% of the proposals in the sample have been amended at least once by unsecured creditors. Typically, an amendment aims at increasing the proposed payoff rate on unsecured claims. The observance of an amendment confirms the successful negotiation between unsecured creditors and the debtor over the provisions of the initial proposal. However, the non-observance of an amendment is not informative of whether or not there were negotiations between the two parties prior to the vote.

degrees of freedom.[44]

# VI. Conclusion

This paper proposes a signaling model of financial reorganization which exploits the structure of the reorganization contract between the firm and creditors. The model focuses on situations in which the firm's own financial slack and the extension of the original bank loan are insufficient to attain the first-best level of investment, and there is asymmetric information with respect to the firm's level of viability. This environment is argued to a natural one for firms in financial reorganization. Under this setting, it is shown that there exists a separating equilibrium in which firms use the provisions of the reorganization contract to signal their type to uninformed creditors who can then update their beliefs on the firm's likelihood of success in reorganization and vote accordingly on the proposal. This article has also shown that pooling equilibria, in which firms of different types offer the same contract, can arise in reorganization.

In an attempt to discriminate between the possible outcomes of the game and a number of predictions in the literature, a reduced form model of the probability of success and of the probability of acceptance of proposals was estimated with an original data set of commercial reorganization proposals filed in Canada between 1977 and 1987. The empirical analysis confirms that first period payments are used by firms to convey information to unsecured creditors and that firms in reorganization face liquidity constraints. In the creditors' participation in reorganization is determined by the proportion of first period payments, the perceived probability of success of the reorganization proposal and the extent of bargaining with the firm.

From a public policy perspective, the importance of the liquidity constraint and the use of first period payments provides additional evidence against the priority granted to government claims in reorganization. By granting itself such a priority, the government reduces the chances of financially distressed firms to reorganize successfully which increases the likelihood of filtering failures in bankruptcy.

[44]The critical value is 15.51 and 20.09 at the 5 and 1 percent level.

# Appendix

*Proof of Proposition 1*:

The first order conditions of the firm's maximization problem are:

$$P_1 : -1 - \lambda_1 + \lambda_2 \Gamma_{P_1} + \lambda_3 = 0 \tag{11}$$

$$P_2 : (1 - \lambda_2)\Pi_{P_2} + \lambda_4 = 0 \tag{12}$$

$$x : \Pi_x - \lambda_1 + \lambda_2 \Gamma_x + \lambda_5 = 0 \tag{13}$$

where $\lambda_3$,$\lambda_4$ and $\lambda_5$ are the multipliers for the non-negativity constraints on the choice variables.

If we suppose $\lambda_2 = 0$, equation (12) simplifies to $\Pi_{P_2} + \lambda_4 = 0$. Since $\Pi_{P_2} < 0$ then $\lambda_4 > 0$ which implies that $P_2 = 0$. Equation (11) also simplifies to $\lambda_3 = 1 + \lambda_1$ which implies that $\lambda_3 > 0$ and $P_1 = 0$. However, we cannot have $P_1$ and $P_2$ equal to zero at the same time so $\lambda_2 > 0$ and the creditors' participation constraint is binding in equilibrium.

We can now show that $\lambda_2 = 1$. If we assume that $\lambda_2 > 1$, then $(1 - \lambda_2)\Pi_{P_2} > 0$, which is impossible since $\lambda_4 \geq 0$ and equation (12) can never be satisfied. Similarly, if we assume that $\lambda_2$ is between zero and one, $(1 - \lambda_2)\Pi_{P_2} < 0$ which implies that $\lambda_4 > 0$ and $P_2 = 0$. Equation (11) can be rewritten as $(\lambda_2 - 1) + \lambda_3 = \lambda_1$. Since the first term is strictly negative, $\lambda_3 > 0$ which implies that $P_1 = 0$. Again, this is impossible because we cannot have $P_1$ and $P_2$ equal to zero at the same time. Therefore, $\lambda_2 = 1$

In equation (13), we know that $\lambda_5 = 0$ since we are considering situations where $x > 0$. This equation simplifies to $\Pi_x + , _x = \lambda_1$. The left-hand side of the equation represents the marginal condition on the investment level in the absence of any constraint by the bank. We know by definition that the loan constraint on the firm prevents the firm from attaining the first best level of investment in which case we have $\Pi_x + , _x > 0$ since the value of the firm is concave in $x$. Therefore, we conclude that $\lambda_1 > 0$ and the investment constraint is binding in equilibrium. From equation (11), we also conclude that $\lambda_3 > 0$ so that $P_1 = 0$.

*Q.E.D.*

*Proof of Lemma 1*: Integrating by parts equation (2), the creditors' participation constraint becomes:

$$\Gamma(\cdot) = P_1 + P_2 - \int_{B_2-\gamma x}^{P_2+B_2-\gamma x} F(\theta|x,t)]\, d\theta - C \tag{14}$$

From equation (14), it is easy to see that $P_1(t) = P_1(t+1) = C$ when $P_2(t) = P_2(t+1) = 0$. Similarly, for any $P_2 > 0$, we can write:

$$P_1(t) + P_2(t) - \int_{B_2-\gamma x}^{P_2+B_2-\gamma x} F(\theta|x,t)]\, d\theta =$$

$$P_1(t+1) + P_2(t+1) - \int_{B_2-\gamma x}^{P_2+B_2-\gamma x} F(\theta|x,t+1)]\, d\theta$$

Rearranging, we get:

$$[P_1(t) - P_1(t+1)] + [P_2(t) - P_2(t+1)] = \int_{B_2-\gamma x}^{P_2+B_2-\gamma x} [F(\theta|x,t) - F(\theta|x,t+1)]\, d\theta$$

We know from assumption 1 that $F(\theta|x,t) > F(\theta|x,t+1)$ which implies that the right-hand side of the equation is strictly greater than zero for any $P_2 > 0$. Therefore, $P_1(t) > P_1(t+1)$ for any $P_2 > 0$. Note that this result is independent of the relative magnitude of the function $F_x(\theta|x,t)$ across types. *Q.E.D.*

*Proof of Lemma 2*: For a given contract $\{P_1, P_2\}$, and a given value of $S_1$, $B_2$ and $t$, the firm's profit function is defined as:[45]

$$\Pi(P_1, P_2, B_2, S_1, x|t) = \int_{B_2+P_2-\gamma x}^{\bar{\theta}} [(\gamma x + \theta) - B_2 - P_2]\, dF(\theta|x,t)$$

Integrating by parts, we get:

$$\Pi(P_1, P_2, B_1, B_2, x|t) = \int_{B_2+P_2-\gamma x}^{\bar{\theta}} [1 - F(\theta|x,t)]\, d\theta$$

[45] For simplicity, we assume that the firm's profit in period 1 is zero, which is the case in equilibrium.

I now compare the marginal rate of substitution between $P_1$ and $P_2$, for two types of firm, to verify the single-crossing property in the $\{P_1, P_2\}$ subspace.

i) The slope of a firm's iso-profit curve in $\{P_1, P_2\}$ subspace is:

$$\left.\frac{dP_2}{dP_1}\right|_{\Pi} = -\gamma + \frac{\int_{B_2+P_2-\gamma x}^{\bar{\theta}} F_x(\theta|x,t)\ d\theta}{[1-F(B_2+P_2-\gamma x|x,t)]} \quad < \ 0$$

To compute the relative slope of both type's iso-profit curves for a given contract $\{P_1, P_2\}$, we calculate

$$\text{sign} \quad \left\{ \frac{\int_{B_2+P_2-\gamma x}^{\bar{\theta}} F_x(\theta|x,t+1)\ d\theta}{[1-F(B_2+P_2-\gamma x|x,t+1)]} \right\} - \quad \left\{ \frac{\int_{B_2+P_2-\gamma x}^{\bar{\theta}} F_x(\theta|x,t)\ d\theta}{[1-F(B_2+P_2-\gamma x|x,t)]} \right\}$$

Rearranging:

$$\text{sign} \quad \left\{ \frac{[1-F(P_2+B_2-\gamma x|x,t+1)]}{[1-F(P_2+B_2-\gamma x|x,t)]} \right\} - \left\{ \frac{\int_{B_2+P_2-\gamma x}^{\bar{\theta}} F_x(\theta|x,t+1)]\ d\theta}{\int_{B_2+P_2-\gamma x}^{\bar{\theta}} F_x(\theta|x,t)]\ d\theta} \right\}$$

Using assumptions 1 and 3, the first term of the expression is greater than one while the second term is less than one. Therefore, $(dP_2/\ dP_1)_{t+1} \ > \ (dP_2/\ dP_1)_t$. *Q.E.D.*

*Proof of Proposition 2*:
For any pair $(P_1, P_2)$, the creditors assign a belief that $t = NV$ if $P_1 < P_1(L)$, that $t = L$ if $P_1 \in [P_1(L), P_1(H))$ and that $t = H$ if $P_1 > P_1(H)$. By construction, the proposed system of beliefs is consistent with Bayes rule. Further, creditors accept the firm's take-it-or-leave-it offer if and only if, given their belief about the firm's type, they expect non-negative payoffs. The creditors' strategy in (v) is thus optimal given their beliefs. For some fixed $P_1(t)$, the firm $t$ will offer the lowest acceptable $P_2$, hence condition (iii).
Given the definition of $\underline{C}$ and $\overline{C}$, the inefficient firm, $NV$, cannot gain by offering an acceptable contract to unsecured creditors when $q = 1$ and can only gain by offering a reorganization contract $(P_1, P_2)$ which satisfies , $(P_1, P_2|t, \underline{C}) = 0$ when $q < 1$, hence condition (i). Condition (iv) states

that $\Pi(P_1(H), P_2(H)|L, \overline{C}) = \Pi(P_1(L), P_2(L)|L, \overline{C})$ when $q > q^*$. When $P_1(H) > P_1(L)$, it implies from the single-crossing property that:
$\Pi(P_1(H), P_2(H)|H, \overline{C}) \geq \Pi(P_1(L), P_2(L)|H, \overline{C})$ and
$\Pi(P_1(H), P_2(H)|\underline{L}, \overline{C}) = \Pi(P_1(L), P_2(\underline{L})|L, \overline{C})$. It follows that:
$\Pi(P_1(t), P_2(t)|t, \overline{C}) \geq \Pi(P_1(l), P_2(l)|t, \overline{C})$ for $l$ and $t = L, H$.
Condition (iv) also states that $\Pi(P_1(L), P_2(L)|NV, \underline{C}) = \Pi(P_1(NV), P_2(NV)|NV, \underline{C})$ and $\Pi(P_1(H), P_2(H)|L, \underline{C}) = \Pi(P_1(L), P_2(L)|L, \underline{C})$ when $q < q^*$. When $P_1(L) > P_1(NV)$, it implies from the single-crossing property that:
$\Pi(P_1(L), P_2(L)|L, \underline{C}) \geq \Pi(P_1(NV), P_2(NV)|L, \underline{C})$ and
$\Pi(P_1(L), P_2(L)|NV, \underline{C}) = \Pi(P_1(NV), P_2(NV)|NV, \underline{C})$. It follows that:
$\Pi(P_1(t), P_2(t)|t, \underline{C}) \geq \Pi(P_1(l), P_2(l)|t, \underline{C})$ for $l$ and $t = NV, L$.
Hence, among the set of all acceptable contracts, $(P_1(t), P_2(t))$ is the preferred contract for type $t$. So, condition (iv) implies that the strategy for each firm is optimal given the creditors' response.
Irrespective of the creditors' valuation of the firm's assets, there always exists a mutually beneficial contract between an efficient firm and unsecured creditors. An efficient firm can then follow two strategies: (a) offer a contract $(P_1, P_2)$ such that , $(P_1, P_2|t, \overline{C}) = 0$ which is accepted by creditors with a probability equal to one, or (b) offer a contract $(P_1, P_2)$ such that , $(P_1, P_2|t, \underline{C}) = 0$ which is accepted by creditors with a probability less than one. Comparing the firm's expected payoff under both strategies, we can compute the value of $q^*$ such that the firm is indifferent between either strategies, that is $q^*$ is such that $\Pi(P_1, P_2|t, \underline{C}) = \Pi(P_1, P_2|t, \overline{C})$. This is condition (ii).
Finally, since $F_x(\theta|t) < 0$, firms in reorganization invests all their free cash-flow, hence condition (vi).
*Q.E.D.*

*Proof of Proposition 4*:
Following Lemma 2, the relative slope of the iso-profit curves of firms $t$ and $t+1$ is determined by the sign of the following expression:

$$\text{sign} \quad \left\{ \frac{[1 - F(P_2 + B_2 - \gamma x|x, t+1)]}{[1 - F(P_2 + B_2 - \gamma x|x, t)]} \right\} - \left\{ \frac{\int_{B_2+P_2-\gamma x}^{\bar{\theta}} F_x(\theta|x, t+1)] \, d\theta}{\int_{B_2+P_2-\gamma x}^{\bar{\theta}} F_x(\theta|x, t)] \, d\theta} \right\}$$

Assuming that $F_x(\theta|\ x, t+1) < F_x(\theta|\ x, t)$, the sign of $d/dt[dP_2/dP_1]$ can be greater, equal or less than zero. Let's examine the three possibilities in

the case of two efficient firms.

*Case 1*: $d/dt[dP_2/dP_1] > 0$
The equilibrium corresponds to the *PBE* in Proposition 2. This result is explained by the fact that the relative difference in the marginal effect of investment on the probability of success, $F_x(\theta|\ x,t)$ is not sufficiently large to dominate the relative difference in the probability of success between firms. Therefore, although cash is more important to the higher type firm, it can still separate from the lower type firm by offering a positive first period payment to creditors.

*Case 2*: $d/dt[dP_2/dP_1] < 0$
This case is depicted in Figure 3. Under this scenario, the slope of the iso-profit curve is smaller for type $H$ than for type $L$. This is explained by the fact that the relative difference in the marginal effect of investment on the probability of success is sufficiently large to dominate the relative difference in the probability of success between firms. Cash is more important to the higher type firm and it cannot gain by separating and offering a positive first period payment to creditors. The equilibrium contract will be somewhere along the segment $AB$.

*Case 3*: $d/dt[dP_2/dP_1] = 0$
In such a case, the iso-profit curves of firm $L$ and $H$ have the same slope and the type $L$ firm can always deviate and offer any contract that type $H$ would offer. The only equilibria which maximizes the firms' profits are pooling equilibria with $P_1 = 0$. Segment $AB$ represents the locus of pooling equilibria and the equilibrium contract moves towards $B$ as $\mu_0$ increases.

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TABLE I
Descriptive Statistics of Firms in Reorganization in Canada.[1]

| Variables | Mean | Median | Standard deviation | Min | Max |
|---|---|---|---|---|---|
| Total assets[2] | 2 453.309 | 350.874 | 19 674.204 | 0.00 | 385 765.05 |
| Total liabilities | 2 981.584 | 783.890 | 15 875.596 | 22.00 | 301 750.68 |
| Secured claims | 1 610.431 | 201.254 | 12 247.279 | 0.00 | 237 437.86 |
| Unsecured claims | 1 008.831 | 438.754 | 2 024.847 | 11.70 | 25 659.25 |
| Preferred claims | 111.459 | 23.744 | 321.962 | 0.00 | 4 653.79 |
| Crown claims | 76.137 | 15.094 | 204.747 | 0.00 | 2 424.72 |
| | | | | | |
| Liabilities to assets ratio | 16.005 | 1.767 | 211.130 | 0.44 | 4 100.00 |
| Secured claims / total assets | 0.781 | 0.539 | 3.372 | 0.00 | 65.00 |
| | | | | | |
| Number of secured creditors | 3.407 | 2.000 | 17.071 | 0.00 | 331.00 |
| Number of unsecured creditors | 86.489 | 59.000 | 98.178 | 2.00 | 834.00 |
| Number of preferred creditors | 20.122 | 3.000 | 65.731 | 0.00 | 826.00 |
| Total number of creditors | 110.100 | 68.000 | 141.540 | 4.00 | 1 257.00 |
| | | | | | |
| Expected payoff in liquidation[3] | 7.208 | 0.000 | 15.569 | 0.00 | 100.00 |
| Payoff in reorganization[4] | 38.157 | 30.000 | 28.143 | 0.00 | 124.00 |
| Proportion of payments in cash | 7.230 | 0.000 | 23.234 | 0.00 | 100.00 |
| Proportion of payments by installment | 91.141 | 100.000 | 25.885 | 0.00 | 100.00 |
| Proportion of payments in equity | 1.629 | 0.000 | 12.378 | 0.00 | 100.00 |
| | | | | | |
| Number of installments | 3.050 | 2.000 | 4.121 | 0.00 | 36.00 |
| Period for repayment (months) | 14.011 | 9.000 | 16.027 | 0.00 | 120.00 |
| Time between filing and voting (days) | 50.000 | 25.000 | 105.460 | 0.00 | 1631.00 |

Notes:

1. The sample size is 393 plans and the acceptance rate is 74.8% (294 of 393).
2. The total assets, total liabilities, and the *claims* variables are reported in thousands of June 1993 Canadian dollars, deflated by the GDP deflator (series D20556).
3. The expected payoff in liquidation, the payoff in reorganization and the payments variables are reported in percentages.
4. Based on a sample of 356 proposals where the payment to unsecured creditors is given.

TABLE II

Mean Returns and First Period Payments in Reorganization[1]

| | Accepted | | Accepted | Rejected |
|---|---|---|---|---|
| | Success | Failure | | |
| Payoff in reorganization[2] | 36.9 | 37.2 | 36.7 | 28.4 |
| % Up-front cash payments[3] | 9.2 | 0.9 | 7.1 | 4.0 |
| % Payments $\leq$ 1 month | 36.0 | 13.8 | 29.8 | 11.4 |
| % Payments $\leq$ 3 months | 52.2 | 22.4 | 44.0 | 24.2 |
| % Payments $\leq$ 6 months | 61.6 | 31.6 | 53.2 | 35.7 |
| Expected payoff in liquidation | 7.7 | 6.2 | 7.0 | 7.7 |
| Number of plans | 206 | 79 | 294 | 99 |

Notes:

1. The payments have been set to zero when the values were unknown.
2. The payoff in reorganization is significantly higher (at the 5% level) for accepted proposals compared to rejected proposals.
3. The payment variables are defined as a percentage of the payoff in reorganization.

TABLE III

Logit Estimates of the Probability of Success[1]

| Explanatory variable | Mean | Logit coefficient[2] | Change in probability[3] |
|---|---|---|---|
| Payments within 6 months / total payments | 0.6415 | 1.3692** | 0.2649 |
| | | (0.4524) | |
| Number of installments | 2.9877 | -0.0733** | -0.0142 |
| | | (0.0365) | |
| Government claims / total liabilities | 0.0406 | -4.5953** | -0.8892 |
| | | (2.3059) | |
| Assets / liabilities | 0.5489 | 0.8449* | 0.1635 |
| | | (0.4831) | |
| Montreal[4] | 0.6271 | -1.0037** | -0.2301 |
| | | (0.3748) | |
| Corporations | 0.8279 | -0.2051 | -0.0416 |
| | | (0.4643) | |
| Metallic minerals & metal products | 0.0533 | -0.9037 | -0.2051 |
| | | (0.6889) | |
| Construction & related activities | 0.1516 | -0.4168 | -0.0881 |
| | | (0.4623) | |
| Communications | 0.0574 | 1.2893 | 0.1731 |
| | | (1.1046) | |
| Accommodation, restaurant & recreation services | 0.0615 | -0.0987 | -0.0195 |
| | | (0.6769) | |
| Consumer goods & services | 0.2582 | 0.1402 | 0.0262 |
| | | (0.4071) | |
| Constant | | 1.1356* | — |
| | | (0.6574) | |

Notes:

1. The sample size is 244 proposals and the succesd rate is 73.77% (180 of 244).
2. Statistical significance is denoted by ** at the .05 level and * at the .10 level where the critical values are 1.96 and 1.65 for a two-tailed test. Standard errors are are reported in parentheses. Cragg-Uhler R-Square = 0.227
3. Change in probability of success in response to a unit change in the corresponding explanatory variable evaluated at the mean success rate. For dummy variables, the change in probability measures the effects of a discrete change. See Gunderson, Kervin & Reid (1986).
4. The "Montreal", "Corporations" and "Industry" variables are dummy variables and reported as ratios.

TABLE IV

Logit Estimates of the Probability of Acceptance[1]

| Explanatory variable | Mean | Logit coefficient[2] | Change in probability[3] |
|---|---|---|---|
| Expected payoff in liquidation[4] | 0.0717 | -0.8688 | -0.1629 |
| | | (0.9700) | |
| Payoff in reorganization | 0.3441 | 0.3078 | 0.0577 |
| | | (0.5331) | |
| Payments within 1 month / total payments | 0.2511 | 1.1331** | 0.2124 |
| | | (0.4593) | |
| Perceived probability of success | 0.7040 | 1.4891* | 0.2792 |
| | | (0.8704) | |
| Secured claims / total claims | 0.3167 | 0.3435 | 0.0644 |
| | | (0.5971) | |
| Number of amendments | 0.4115 | 2.2372** | 0.4195 |
| | | (0.4041) | |
| $\Delta$ unemployment rate (last 6 months) | 0.2165 | -0.2865** | -0.0537 |
| | | (0.1302) | |
| Time between filing and voting (days) | 45.763 | -0.0032 | 0.0006 |
| | | (0.0022) | |
| Claims of ordinary creditor $> 25\%$ | 0.4870 | 0.1814 | 0.0324 |
| | | (0.2711) | |
| Holding | 0.2344 | -1.2123** | -0.2784 |
| | | (0.4125) | |
| Constant | | -0.5287 | — |
| | | (0.6631) | |

Notes:

1. The sample size is 384 proposals and the acceptance rate is 75.0% (288 of 384).

2. Statistical significance is denoted by ** at the .05 level and * at the .10 level where the critical values are 1.96 and 1.65 for a two-tailed test. Standard errors are reported in parentheses. Cragg-Uhler R-Square = 0.272

3. Change in probability of acceptance in response to a unit change in the corresponding explanatory variable evaluated at the mean acceptance rate. For dummy variables, the change in probability measures the effects of a discrete change.

4. The liquidation and reorganization payoff variables are reported on a per dollar of claims basis.

TABLE V

Alternative Regressions for Logit Estimates of the Probability of Success[1]

| Explanatory variable[2] | (1)[3] | (2) | (3) |
|---|---|---|---|
| Prop. of payments within 6 months | 1.3692** | 1.4224** | – |
| | (0.4524) | (0.4581) | – |
| Number of installments | -0.0733** | -0.0714** | -0.1253** |
| | (0.0365) | (0.0365) | (0.0380) |
| Proportion of free assets | – | 0.5446 | 0.4082 |
| | – | (0.4833) | (0.4701) |
| Ratio of Crown claims to total liabilities | -4.5953** | -4.6102** | -4.5281** |
| | (2.3059) | (2.3337) | (2.2885) |
| Assets to liabilities ratio | 0.8449* | 0.7911 | 0.5961 |
| | (0.4831) | (0.4900) | (0.4729) |
| Montreal (dummy) | -1.0037** | -1.1086** | -1.0370** |
| | (0.3748) | (0.3904) | (0.3872) |
| Corporations (dummy) | -0.2051 | -0.2040 | -0.3094 |
| | (0.4643) | (0.4688) | (0.4693) |

Notes:

1. The estimators for the industry dummies and the constant term are not reported.
2. Statistical significance is denoted by ** at the .05 level and * at the .10 level where the critical values are 1.96 and 1.65 for a two-tailed test. Standard errors are reported in parentheses.
3. Estimates of the base model.

*Figure 1(a)*

*Efficient and Ineffecient Firms*

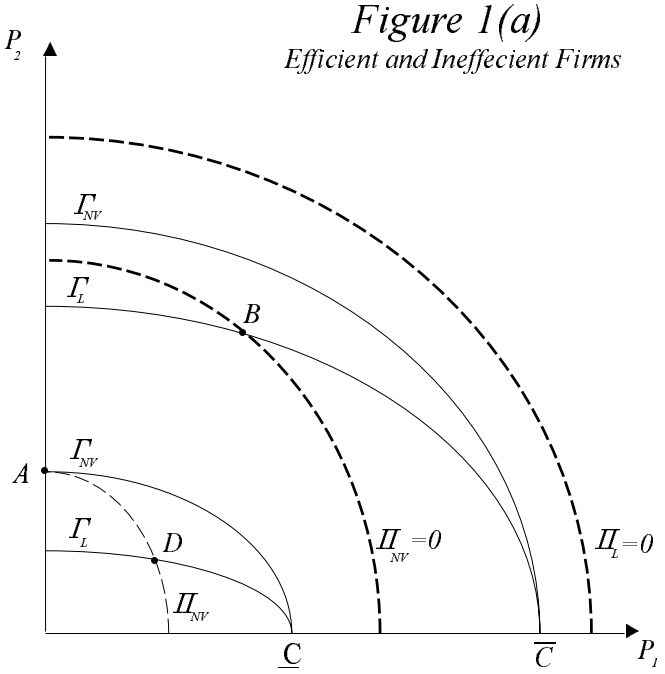


*Figure 1(b)*

*Two Efficient Firms*

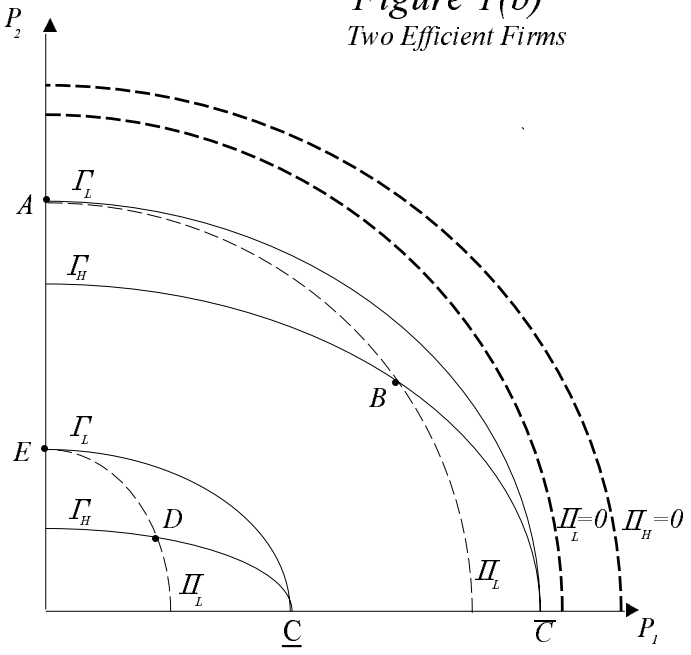

*FIGURE 2*

*No pooling with $P_1=0$*

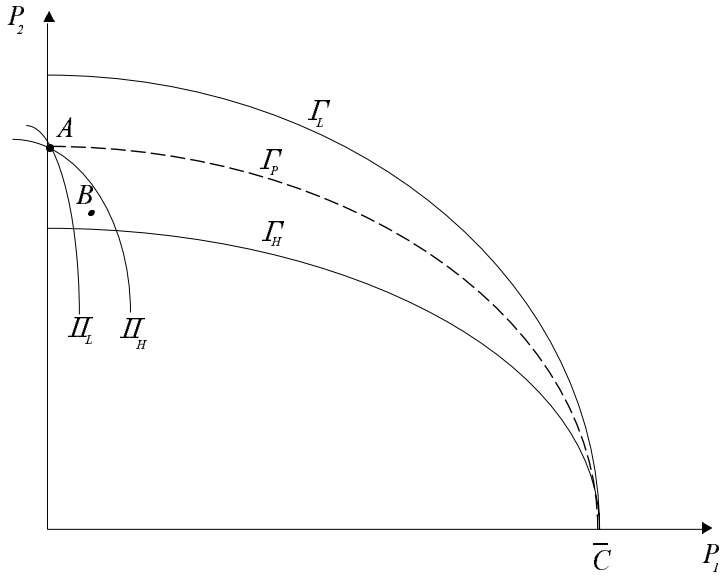


*FIGURE 3*

*No Pooling with $P_1>0$*

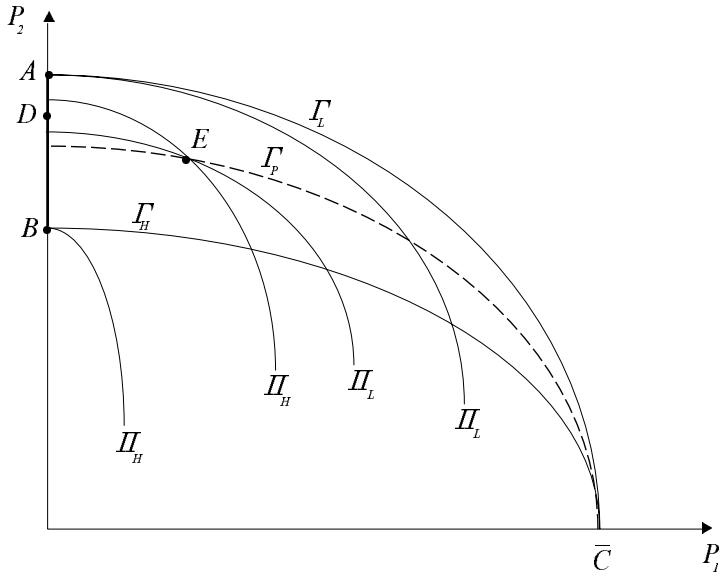

*Figure 4*

*Payment to Creditors in Reorganization*