Debt and Product Market Fragility*

Preliminary and incomplete

Stefan Arping
HEC School of Management
Université de Lausanne†

January 2000

Abstract

Liquidation of a supplier of durable goods can be costly for its customers because it frequently undermines the smooth supply of after–sales service and spare parts or makes it more costly. This paper studies the interplay between capital structure and product pricing strategy when liquidation imposes costs on customers. I develop a model which illustrates that highly leveraged firms can enter a vicious circle in which financial distress and sales drops are re–enforcing. Multiple equilibria can arise. There exists a "good" equilibrium in which consumers buy and the firm is in good financial shape. However, when agency problems between investors and managers are severe, there is also "bad" equilibrium: consumers turn away from the vendor, the market collapses, and the firm goes bankrupt. Moreover, the "good" equilibrium is highly fragile in that a small shock to the firm's profits can trigger a spiral of sales drops. I show that the firm can avoid the "bad" equilibrium by cutting prices and reducing leverage.

Keywords: Debt, Bankruptcy Costs, Financial Distress, Endogenous Network Externalities, Market Fragility

JEL–Classification: G32, G33, L1

*Work in progress. This research was started while I was visiting INSEAD on a TMR post–doctoral fellowship, under grant # ERBFMRX-CT98-02035DG12-RSRF, within the TMR network "The evolution of network industries". Funding by the European Commission gratefully acknowledged. I would like to thank Olivier Cadot and participants at the CEPR/INSEAD workshop on "The evolution of network industries" (INSEAD, November 1999) for very helpful comments. All errors are, of course, mine.

†HEC, Université de Lausanne, BFSH1, CH–1015 Lausanne, e–mail: stefan.arping@hec.unil.ch

1 Introduction

Many East Asian companies faced dramatic sales slumps during the recent East Asian financial crisis. For instance, Hyundai's car exports fell by some 10% in dollar terms in the first half of 1998—after years of double–digit growth.[1] Given the sharp devaluation of the South Korean currency this is rather surprising as one would expect that such a sharp currency devaluation triggered a boom in exports.

A number of explanations for those sales slumps have been put forward.[2] For instance, lack of demand from East Asia as potential customers from the region were hit by the crisis. This argument rests on financing constraints at the demand side. However, sales slumps did not only occur in East Asia: potential customers in Europe and the US were equally reluctant to buy from Hyundai.[3] This paper provides an explanation that links financing constraints at the supply side with the demand side: customers were reluctant to purchase from East Asian firms because the devaluation triggered a sharp increase in foreign denominated debt burdens of East Asian firms and therefore increased the risk that those firms are going to be liquidated.

Indeed, liquidation of a supplier of durable goods is often costly for its customers. Liquidation can reduce the availability of after–sales service or make it more costly. Liquidation can also reduce the possibility to purchase spare parts or other complimentary products and services. Thus, consumers may be reluctant to purchase from a company which is not in good financial shape.

There are more examples for this. For instance, when Chrysler faced serious financial difficulties in the beginning of the 1980s, Lee Iacooca—Chrysler's former CEO—said that "its share of new car sales dropped nearly two percentage points because potential buyers feared the company would go bankrupt".[4]

In the beginning of the 1980s, International Harvester, a producer of heavy farm equipment, lost customers after having entered financial distress because

[1] See The Economist, Sep 12, 1998

[2] See, for instance, The Economist, Sep 12, 1998

[3] See Business Week...

[4] See The Wall Street Journal, July 23, 1981. Cited after Titman (1984).

of customers' concerns "about getting parts and services".[5] International Harvester was relatively highly leveraged in the mid 1970s, while a main competitor, John Deere, was more conservatively financed.[6] In 1979, the Federal Reserve Board raised interest rates. As a result, International Harvester's costs of serving short–term debt increased such that the company found it difficult to meet its debt payments. Customer concerns about the survival prospects of International Harvester might have contributed to the downfall of this company: International Harvester's market share dropped from 28% in 1976 to 22% in 1980 while more conservatively financed John Deere could increase its market share from 38% to 50%.

A more recent example is Apple's evolution during last years. As is well known, Apple had financial difficulties from the mid 1990s on and many industry observers wondered whether Apple would survive at all.[7] Most likely, an exit of Apple from the computer market would have imposed huge costs on Mac–users as software producers would have refrained from developing new software for the Mac.[8] This may have increased consumers' reluctance to buy from Apple. Indeed, from 1996 to 97, Mac unit sales declined by 27%, and from 1997 to 98 by 4%.[9]

Systematic empirical evidence supporting those examples comes from Opler and Titman (1994). They indeed find that highly leveraged firms tend to loose market share to less leveraged competitors during industry downturns. This suggests that excessive leverage can make consumers reluctant to purchase from a firm and that financial distress is often followed by sales drops. The examples

[5]See The Wall Street Journal, Oct. 11, 1982. Cited after Titman (1984).

[6]See Grinblatt and Titman (1998), p. 577–578, for this and the following.

[7]Last but not least this is reflected by the fact that Apple's debt ratings have been downgraded to non–investment grade over the last couple of years. Only very recently have Apple's debt ratings been upgraded. See Apple's 1998 SEC form 10–K annual report.

[8]Quoting from Apple's 1998 SEC form 10–K annual report: "To the extent the Company's financial looses in prior years and declining demand for the Company's products ... have caused software developers to question the Company's prospects ..., developers could be less inclined to develop new application software ... and more inclined to devote their resources to developing and upgrading software for the larger Windows market."

[9]More recently, though, Apple could increase revenues because Apple's new iMac proved to be very popular.

further suggest that sales drops can be *dramatic* and *persistent* if not met with counteraction.

This paper sheds light on the interplay between capital structure and pricing strategy when customers suffer from liquidation. The basic mechanism identified in the paper is that a vendor's financial trouble causes potential customers to turn away from the vendor, by that fostering the extent of the vendor's financial distress, leading to another sales drop. In fact, network externalities in consumption are present: A potential customer's purchasing decision affects the payoff of all other customers as it reduces the probability that the firm won't be able to meet debt payments and therefore reduces the risk of costly liquidation. As a result, pessimistic expectations about a firm's financial health can be self–fulfilling: when consumers refrain to buy from a firm just because they expect the firm to go bankrupt and be liquidated, the firm indeed goes bankrupt and is liquidated.

Moreover, small shocks can have potentially dramatic consequences: while a financial distress of minor extent ceteris paribus causes only a small fraction of consumers not to purchase from the firm, this sales drop leads to additional liquidation risk which in turn causes another sales drop, leading to additional liquidation risk, and so forth. As a result, sales may drop dramatically.

All those considerations point to a cost of debt. Not only makes it consumers reluctant to purchase from the indebted firm when higher leverage translates into higher liquidation risk: Debt can also lead to market fragility. When a firm is highly leveraged, small shocks can trigger large sales drops. So, why do firms use debt financing when liquidation is costly for customers? The corporate finance literature suggests that debt helps to discipline managers. For example, Jensen (1986) argues that debt may give incentives to managers to pay out free cash flow to shareholders instead of wasting it on unprofitable empire–building projects. Similarly, Bolton and Scharfstein (1990, 1996) and Hart and Moore (1998) show that the termination threat associated with debt commits firms to pay back investors. Grossman and Hart (1982) express the idea that leverage makes managers less tempted to underinvest in effort. The underlying idea of those approaches is that managers enjoy control benefits that would be lost if the firm were liquidated. Debt helps to commit managers to pay out free cash flow or to work hard which allows managers to avoid liquidation, thus, to preserve their control benefits.

In this paper, I suggest a simple model that tackles those opposite forces. In a nutshell, debt increases managerial discipline to pay out but makes it more difficult to generate cash from the product market as it reduces consumers' willingness to pay. The optimal capital structure solves this trade–off. There is a unique and stable equilibrium when managerial incentive problems are of minor extent: consumers buy and a shock won't trigger a spiral of sales drops. However, when agency problems are severe, investors respond to this by demanding a "tough", high powered financial contract, and the firm fully exercises its market power, a second equilibrium exists in which none of the consumers buys: pessimistic beliefs about the firm's financial health become self–fulfilling. Moreover, whenever the "bad" equilibrium exists, the "good" equilibrium is not stable in that a small shock causes a downward spiral of sales drops which ultimately leads to the "bad" equilibrium.

How do firms respond to the possibility of the "bad" equilibrium? This paper's answer is that firms cut prices and reduce leverage with respect to the optimal leverage and pricing strategy when consumers can commit to purchase. Cutting prices, specifically, not fully exercising market power, leaves more rent to customers. This creates a buffer and ensures a positive payoff to a firm's customers even if the probability of default is unexpectedly high. Slashing leverage, specifically, implementing a low powered financial contract, has a similar effect in that it directly reduces the probability that the firm is liquidated in financial distress. Thus, I provide an explanation for why firms often adopt aggressive marketing policies and initiate debt restructurings at the ascent of financial distress. For example, Daewoo implemented an aggressive marketing and pricing policy in the US and Europe after having entered financial trouble.[10]. Similarly, Apple slashed prices during...[11].

The paper is related to several strands of the literature. Titman (1984) argues that a firm's financial stakeholders won't necessarily internalize costs imposed on customers when liquidating the firm. As a result, investors may inefficiently liquidate the firm. Customers anticipate this decision such that investors have to

[10] See Business Week..

[11] reference

bear the corresponding inefficiency ex ante. Assuming that investors can commit to a financial structure, he shows that a specific mix of debt and equity allows to maximize ex ante value in that the firm is liquidated if and only if liquidation is efficient for all stakeholders, including customers. In my paper, liquidation is always inefficient. However, it serves as an incentive device for managers. Thus, the optimal liquidation policy solves a trade off between providing managerial incentives and generating cash from the product market. ... to be completed

The paper is also related to the literature on bank runs.[12] The driving force underlying my model is actually very similar to the driving force underlying (some) models on bank runs: Consumers refrain to trade (i.e. not to withdraw deposits as far as banks are concerned) with a company as they fear this company to fail, thus, widening the extent of the company's failure and by that confirming pessimistic expectations about the company's survival prospects. ...

Cooper and John (1988), Matutes and Vives (1991)

literature on network externalities

Chevalier (1995), Hendel (1996), Phillips (1995), Kovenock and Phillips (1997)

... to be completed

[12]See, for instance, Diamond and Dybvig (1983), and Freixas and Rochet (1997) for further references.

2 The model

2.1 Product market

Consider a firm that launches a durable product.[13] There is a mass of consumers who buy at most one unit and differ in their valuation for the product. A consumer located at $s \in [0, 1]$ derives a gross utility of sV from consuming the product. Consumers are uniformly distributed over $[0, 1]$.

The timing of the game is as follows. First, the firm obtains outside funding from an investor to finance the product launch. The firm's manager sets up the project and quotes a price p for the product. Consumers decide whether to buy the product and profits realize. Profits are affected by a cost shock that realizes after production (marginal cost is normalized to zero). For simplicity, the cost shock is zero with probability θ, while with probability $1 - \theta$ the cost shock is large in which case the firm makes zero profits.

After the realization of profits the firm might be liquidated. Denote by ϕ the probability consumers attach to this event. Liquidation is costly for consumers: whenever the firm is liquidated and exits the product market a consumer incurs a cost C. The idea is that a consumer finds it harder to obtain maintenance service at a reasonable cost or has trouble finding spare parts and complementary products when the original supplier has been liquidated. Thus, given a price p, a consumer with taste s decides to purchase the product as long as $sV - \phi C \geq p$.

What are the forces that determine consumers' expectations about the firm's survival? First, leverage: the higher leverage the higher the probability that the firm is going to be bankrupt and liquidated, other things equal. Second, the probability of the exogenous cost shock. And third, consumers' expectations about total sales. When sales are very low, the firm is in financial distress even if the cost shock does not occur. Thus, network externalities in consumption are present: a consumer's payoff is not only affected by her own purchasing decision but also by the purchasing decisions of all other consumers. As we will see,

[13] I abstract from the typical commitment problem in durable goods markets by assuming that the firm can commit to a price path. Thus, consumers purchase the product in the beginning of the game. Alternatively, it could be very costly for consumers to delay their purchasing decisions.

this will give rise to multiple equilibria. In particular, consumers may fail to coordinate on an equilibrium in which consumers derive value from consumption and the firm makes positive profits. Instead, a pareto–inferior equilibrium may arise where pessimistic expectations about the vendor's survival are self–fulfilling: consumers refrain from buying and, therefore, drive the firm into liquidation.

2.2 Outside financing

The firm/manager needs outside financing I to launch the product. There is an investor who may finance the firm's product. I assume that the investor has the entire bargaining power at the contract offering stage. Suppose, for instance, that the investor acquires industry– or product–specific expertise or provides valuable advice and management support. This should enable the investor to capture a large share of the pie. Alternatively, suppose that the product idea is initially owned by an agent who is not able to launch and market the product. The product idea is acquired by a manager capable of marketing the product via a leveraged buy out (LBO). The optimal financial contract we derive in this section is then just the optimal LBO contract.[14]

Bankruptcy and liquidation would not constitute a problem when the interests of managers, investors, and customers could be perfectly aligned. In reality, however, a firm's stakeholders' interests are often divergent and rather difficult to align. I capture this along two dimensions. First, investors cannot be held liable for a customer's liquidation costs. This implies that investors do not internalize the costs customers have to bear in liquidation. Second, I introduce a simple agency problem between investors and managers along the lines of Bolton and Scharfstein (1996) and Hart and Moore (1998), among others: the firm/manager can divert income. Thus, the investor faces the risk that the firm doesn't pay back the investor: she may default strategically and claim that she didn't generate any cash while in fact she did. Instead of paying back the investor the firm could pocket the cash or invest it in pet projects.

In order to give the firm's manager incentives to pay out the investor can

[14] At any rate, the assumption that the investor has the full bargaining power at the contract offering stage is not crucial for the results. I will come back to this in section 7.

threaten to liquidate the firm in case of default.[15] Liquidation is costly for the manager. Specifically, the manager enjoys a control benefit $B > 0$ from staying in business. For instance, the manager may loose her reputation when being liquidated.[16] Alternatively, the control benefit may capture future rents which are lost when the manager is liquidated.

In general, B can be thought of being inversely related to the extent of the agency problem between investors and the firm's manager. For instance, one might argue that agency problems are of minor extent in countries with strong creditor protection, strong rule of law, and efficient accounting systems. In such countries, hiding cash is probably more likely to be detected and costly than in countries with poor creditor protection or rule of law. Those considerations allow us to connect the variable B to observable variables that in empirical analysis often serve as proxies for the degree of financial market development.[17]

A financial contract specifies a payment R and a fraction of the firm's assets the investor is entitled to liquidate in case of default. For simplicity, the firm survives with probability $1 - \beta$ when the investor liquidates a fraction β of its assets. In other words, if the investor liquidates a fraction β of the firm's assets, the firm exits the market with probability β. For simplicity, assets in place have zero liquidation value.[18] Thus, liquidation only serves as an incentive device and does not constitute a second source of income for the investor. This implies that there is no point for the investor to demand a liquidation right for the case that the firm pays out R. This would not only worsen the manager's incentives to pay

[15]Note that only a credible liquidation threat can provide incentives to pay out. This supports our assumption that the investor is not liable for the customers' claims. If the investors was liable for the customers' claims, the investor would internalize the cost imposed on customers when liquidating the firm. This would undermine the credibility of the liquidation threat and weaken the firm's manager's incentives to pay out.

[16]Gilson (1989) provides empirical evidence that those losses of reputation can be quite substantial. He finds that about more than half of the managers of financially distressed firms are replaced and not hired by comparable, exchange–listed firms for at least three years.

[17]E.g. La Porta et al.

[18]Thus, the investor may waive his liquidation right when the firm just cannot pay out because cash flows are zero. However, I assume that the investor insists on liquidation. While this assumption is crucial for the results, it is rather robust as a small but strictly positive liquidation value would break the indifference.

out but also make consumers more reluctant to purchase from the firm.

The optimal financial contract maximizes the investor's payoff such that the investor breaks even, the firm–manager is willing to accept the deal, the contract is incentive compatible, and respects the limited liability (or cash) constraint. Formally, the optimal contract solves the following problem:[19]

$$\max_{R,\beta\in[0,1]} \quad \theta R$$

$$\begin{aligned}
(\mathbf{IR_I}) \quad & \theta R \geq I \\
(\mathbf{IR_E}) \quad & \theta(\Pi(\beta) - R + B) + (1-\theta)(1-\beta)B \geq 0 \\
(\mathbf{IC}) \quad & \Pi(\beta) - R + B \geq \Pi(\beta) + (1-\beta)B \\
(\mathbf{CASH}) \quad & R \leq \Pi(\beta)
\end{aligned}$$

where $\Pi(\beta) = \max_p \Pi(\beta, p)$ denotes the firm's income from the product market, $(\mathbf{IR_I})$ is the investor's break even constraint, $(\mathbf{IR_E})$ is the manager's participation constraint, $(\mathbf{IC})$ is the incentive constraint, and $(\mathbf{CASH})$ is the cash constraint. The fact that cash flows depend on β captures the idea that consumers' expectations about liquidation and therefore their purchasing decisions are affected by the firm's financial structure.

For convenience, I assume that consumers are able to perfectly observe the financial contract. While it is rather unrealistic to assume that a firm's customer always knows the exact financial structure of its supplier, there are certainly instances when it is important for a customer to have an accurate idea about the financial health and financial structure of its supplier, in particular, when liquidation is costly for this customer. Credit rating agencies, analysts, and coverage by the press should allow customers to form an accurate idea about the firm's financial health.

The optimal financial contract is easily derived. First, let us assume that the investor's break even constraint is not binding. Otherwise, the project couldn't be financed. Then, note that the manager's participation constraint is not binding

[19] I abstract from renegotiation after strategic default by assuming that the investor has the full bargaining power in renegotiation.

because of limited liability. Thus, we are left with the incentive constraint and the cash constraint. Obviously, $R = \min[\beta B, \Pi(\beta)]$. Otherwise, the investor could increase R slightly without affecting neither the incentive nor the cash constraint. Now, at $\beta = 0$ we have $\beta B = 0$ and $\Pi(\beta) > 0$. Moreover, βB is strictly increasing in β and, as we will see, $\Pi(\beta)$ strictly decreasing in β. This just accounts for the fact that liquidation is costly for customers. Finally, I assume that $B > \Pi(1)$.[20] Thus, the optimal liquidation right $\tilde{\beta}$ is the (unique, interior) solution of $\beta B = \Pi(\beta)$.

Proposition 1 *The optimal financial contract is a standard debt contract with face value $R = \tilde{\beta} B$, where $\tilde{\beta} B \equiv \Pi(\tilde{\beta})$. Whenever the firm defaults, i.e. pays out less than R, the investor is entitled to liquidate a fraction $\tilde{\beta}$ of the firm's assets.*

The optimal financial contract solves a tradeoff between rent extraction and cash generation from the product market. While a less tough contract makes consumers less reluctant to purchase from the firm, the investor is worse off as a softer contract worsens the firm's payout discipline.

3 Debt and sales proceeds

In this section, I solve for the equilibrium when consumers are "optimistic". That doesn't mean that consumers' expectations are irrational. Rather, consumers presume that the firm is only liquidated when the cost shock occurs (provided, of course, that such beliefs are rational). In fact, one would think that only those beliefs are rational as the optimal financial contract does not foresee that the firm is going to be liquidated when the cost shock does not occur, i.e. cash flows are high. However, the firm's cash flows are not only affected by the exogenous cost shock but also endogenously by the consumers' purchasing decisions. When a consumer believes that all other consumers refrain from purchasing from the firm, it can indeed be rational to believe that the firm is going to be liquidated even if the exogenous cost shock does not occur, and, therefore, not to buy. That is, "pessimistic" expectations can be self–fulfilling. All what I assume in

[20] Specific conditions for this inequality to hold are given later on.

this section is that consumers do not form "pessimistic" expectations. That is, observing β they believe that the firm is going to be liquidated with probability $(1-\theta)\beta$.

Thus, $\phi = (1-\theta)\beta$. Denote by $\hat{s}$ the location of the indifferent consumer, i.e. $\hat{s}V - (1-\theta)\beta C \equiv p$. Consumers with lower valuation than $\hat{s}$ do not buy given p and β, while consumers with a valuation equal or higher than $\hat{s}$ buy. The firm's optimal pricing strategy solves:

$$\max_{p \geq 0} \int_{\hat{s}}^{1} p \ ds$$

Suppose $V - (1-\theta)\beta C > 0$. Thus, the optimal price is given by $p^M = \frac{1}{2}(V - (1-\theta)\beta C) > 0$, leading to revenues of $\Pi(\beta) = \frac{1}{4V}(V - (1-\theta)\beta C)^2$.

The optimal liquidation right solves $\beta B = \Pi(\beta)$. For an interior solution we need that the control benefit B is not too small. Formally,

$$\sqrt{B} > \frac{1}{2\sqrt{V}}(V - (1-\theta)C)$$

Otherwise, the optimal repayment would be entirely determined by the incentive constraint such that $\beta = 1$. Let $\Phi = \frac{\sqrt{B+(1-\theta)C}-\sqrt{B}}{(1-\theta)C}$. It is easily checked that

$$\tilde{\beta} = V\Phi^2 \tag{1}$$

and $V - (1-\theta)\tilde{\beta}C > 0$.

Substituting (1) into $\hat{s}$, we obtain that demand equals $1 - \hat{s} = \sqrt{B}\Phi$ and the price is given by $p^M = V(1-\hat{s}) = V\sqrt{B}\Phi$.

Proposition 2 *There exists an equilibrium in which the contract specifies* $\tilde{\beta} = V\Phi^2$*, the firm charges* $p^M = V(1-\hat{s}) = V\sqrt{B}\Phi$*, demand equals* $1-\hat{s} = \sqrt{B}\Phi$*, and the firm is liquidated with probability* $\tilde{\beta}$ *when the cost shock occurs.*

For two reasons, I refer to this financial structure and pricing strategy as a "tough" policy: First, the financial contract is high powered in that it puts maximal incentives for the manager to pay out free cash flow. Second, under this pricing strategy the firm fully exercises its market power over consumers.

The comparative statics follow intuition: $\tilde{\beta}$ is decreasing in B and C and increasing in θ and V. Thus, the contract becomes less tough when the agency problem between the firm and the investor becomes less severe, consumers' valuation for the product decreases, and liquidation becomes more likely or more costly for the firm's customers.

Finally, note that β can be regarded as a proxy for the firm's leverage. Let us define leverage as the value of the investor's debt claim over the total value of the firm, i.e. the value of debt plus the value of (inside) equity. The value of debt is given by $\theta\tilde{\beta}B$ while the value of equity is given by $\theta B + (1-\theta)(1-\tilde{\beta})B$. Thus, leverage is given by

$$\frac{\theta\tilde{\beta}}{1-(1-2\theta)\tilde{\beta}}$$

which has exactly the same comparative statics as $\tilde{\beta}$.

4 Self–enforcing financial distress

This section sheds light on the claim that financial distress can be self–enforcing. Suppose the manager unexpectedly generates less cash from the product market than the debt's face value R, say $\Pi < R$. Thus, the firm is in financial distress and cannot fulfill its debt payment such that the investor may exercise his liquidation right. Note, however, that liquidation is inefficient. That is, there is room for renegotiation and the parties may come together and initiate a private debt restructuring.

Consistent with the previous analysis, I assume that the investor has the full bargaining power. The investor makes a restructuring offer (R', β') such that his payoff is maximized and the firm is willing to accept the offer. The firm's status quo payoff is given by $\Pi + (1-\tilde{\beta})B$ while the investor's payoff from the offer is given by $\Pi - R + (1-\beta')B$. It is easily checked that a solution of this problem is given by $R' = \Pi$ and $\beta' = \tilde{\beta} - \frac{\Pi}{B}$.[21]

Lemma 1 *Suppose the firm only generates* $\Pi < R = \tilde{\beta}B$ *from the product market. Then, after strategic default and renegotiation the firm pays out* Π *and is liquidated with probability* $\bar{\beta} = \tilde{\beta} - \frac{\Pi}{B}$.

[21] Note, however, that the solution is not unique as long as the investor does not have a strict benefit from liquidating. A small, but non–zero liquidation value of the firm's assets would make the solution unique.

Thus, the more severe the agency problem between investors and the firm, the lower the firm's survival prospects when unexpectedly entering financial distress.

The next proposition states that when the agency problem between the investor and the firm is severe (B is small) there exist two (and only) two equilibria of the purchasing subgame after the firm quoted p^M, one where all consumers in $[\hat{s}, 1]$ buy, and another one where no consumer buys.[22]

Proposition 3 *Suppose the firm adopts the tough policy. Then, there exists a cut off value $\hat{B}$ (increasing in C) such that whenever the agency problem between investors and the firm is not too severe, $B > \hat{B}$, the purchasing subgame has a unique equilibrium in which demand equals $1 - \hat{s}$. However, whenever the agency problem is severe, $B < \hat{B}$, there exists a second equilibrium in which the market crashes and no consumer buys. Finally, whenever $B = \hat{B}$ there exists a continuum of equilibria indexed by demand realizations $1 - s \in [0, 1 - \hat{s}]$.*

Thus, pessimistic expectations about the firm's survival prospects can be self–fulfilling. The proposition links this possibility to the severity of the agency problem between investors and the firm. To see why note that the financial contract will be relatively high powered when the firm has only little interest to continue such that the liquidation threat has only little bite. Thus, when the firm experiences an unexpected sales drop the chances that it survives financial distress are relatively low. Therefore, purchasing from the firm is a relatively risky business even for high valuation consumers. However, under a low powered financial contract some consumers still buy even if they expect the firm to be in financial distress. This is because the firm has high chances to survive financial distress when the contract is low powered. Given that those consumers buy, others will buy as well. This explains why the "bad" outcome is not an equilibrium when the agency problem is of minor extent.

The critical value $\hat{B}$ is increasing in C. Thus, the more costly liquidation (i.e. the more service intensive the product) for the firm's customers the more "likely" is the existence of the "bad" outcome.[23]

[22] Proofs are in the appendix.

[23] Note further that the critical value $\hat{B}$ is decreasing in θ. Thus, in the current model, safer firms face a higher demand uncertainty. However, this effect is driven by the specific assumption

Corollary 1 *Firms producing relatively service intensive products face a higher endogenous demand uncertainty when sticking to the tough policy.*

The existence of multiple equilibria is somewhat painful for an economist being interested in deriving clear–cut predictions about economic behaviour. However, the fact that there are exactly two equilibria (if there are more than one) gives a hindsight that one equilibrium is not generic in the sense that a tâtonnement process triggered by a small perturbation does not converge to this but the other equilibrium.

Definition 1 *Consider an equilibrium of the purchasing subgame and denote the mass of consumers following equilibrium behaviour by Λ. The equilibrium is **unstable** if for any mass $\epsilon \in (0, \Lambda)$ of consumers deviating from equilibrium behaviour there exists a mass $\epsilon'(\epsilon) > \epsilon$ of consumers whose (strict) best response to this deviation is to deviate. An equilibrium is stable if it is not unstable.*

To understand this definition intuitively consider the equilibrium with positive demand and suppose a very small fraction of consumers change their mind and do not buy (alternatively, consider a very small exogenous shock to the firm's profits). This will increase the firm's liquidation probability slightly. What is the best response of the customers who were planning to buy from the firm to this deviation? If the additional liquidation risk is sufficiently large a fraction larger than the deviating fraction, namely consumers with low valuations, will change their minds and not purchase as they derive negative utility given the firm's financial structure and pricing policy. This widens the firm's financial distress leading more consumers not to purchase. Thus, a downward spiral of sales drops is triggered which ultimately converges to the "bad" equilibrium.[24]

We have the following result:

---

that the firm is never making positive profits when the cost shock occurs. It seems unlikely that such a effect would occur in a more general setting.

[24] Note that in contrast to the standard concept of global stability I do not require that any perturbation of an equilibrium converges back to the equilibrium. In fact, when $B = \hat{B}$ there is a continuum of equilibria which are stable according to my definition. The reason why put the definition in this way will become clear in the next section.

Proposition 4 *Only the equilibrium in which the market collapses is stable when the agency problem between investors and the firm is severe and the firm sticks to the tough policy.*

This gives strong support that the "bad" equilibrium occurs and the firm experiences sharp sales drops when investors implement a high powered financial contract and the firm fully exercises it market power. In fact, whenever the "bad" equilibrium exists it is the unique stable equilibrium of the purchasing subgame if the firm adopts the tough policy.

One might argue that this result is solely driven by the assumption that the investor has the full market power. In the current model, if investors were perfectly competitive the debt's face value would be strictly below profits under the "good" equilibrium. Thus, there exists a buffer and a small shock won't trigger a spiral of sales drops. This leads to the question to what extent the above result is robust. There are two answers: First, introducing a smooth cost shock may lead to an unstable, "good" equilibrium even if investors are competitive. To see why note that under a smooth cost shock whatever small deviation at the demand side will increase the firm's liquidation probability. Second, even if there exists a buffer a small (but sufficiently large) demand shock may be sufficient to raise the firm's liquidation probability and trigger a spiral of sales drops which converges to the "bad" equilibrium. Thus, a safe strategy for the firm is to design the financial structure and pricing policy in such a way that the "bad" equilibrium cannot occur in the first place. This is the avenue I will follow in the next section.

5 Immunization against fragility

How can the firm protect itself against an unexpected sales drops? Note that whenever the highest valuation consumer does not derive positive utility under the worst case scenario that he is the only consumer purchasing from the firm there exists an equilibrium in which no consumer buys. Thus, given a policy (β, p) a necessary condition for eliminating the "bad" equilibrium is $V - \beta C \geq p$. In fact, $V - \beta C > p$ is a sufficient condition for avoiding the "bad" equilibrium since whenever $V - \beta C > 0$ there exists a strictly positive mass of consumers (with sufficiently high valuations) for which it is a dominant strategy to buy.

Unfortunately, however, putting $V - \beta C > p$ as an additional constraint into the investor's maximization problem leads into trouble in that this problem doesn't have solution.[25] Therefore, a make the following assumption:

Assumption 1 *Whenever $V - \beta C \geq p$ and the purchasing subgame has multiple stable equilibria then the equilibrium with highest demand prevails.*

Consider then the following maximization problem:

$$\max_{R,\beta\in[0,1],p} \quad \theta R$$

$$(\textbf{IC}) \qquad R \leq \beta B \tag{2}$$

$$(\textbf{CASH}) \qquad R \leq \Pi(\beta, p) = \frac{V - p - (1-\theta)\beta C}{V} p \tag{3}$$

$$(\textbf{STAB}) \qquad p \leq V - \beta C \tag{4}$$

This problem is identical to the previous one, except for the additional condition that the highest valuation consumer derives non–negative utility under the worst case scenario.

Proposition 5 *Suppose the investor's aim is to avoid market collapse when the agency problem is severe. Then, under assumption 1 there is a unique outcome in which the firm charges a lower price and chooses lower leverage as compared with the tough policy. Demand is strictly positive and the firm is liquidated only when the cost shock occurs.*

Thus, firms with relatively mild agency problems choose a tough business policy with a high powered financial contract and a high price strategy, while firms with relatively severe agency problems choose a soft policy, adopting a low powered financial contract and not exercising full market power.

[25] The reason for this is the standard "openess" problem: there doesn't exist a highest real number strictly smaller than a constant.

Cutting prices (more specifically, not fully exercising market power) leaves more rent to customers. This creates a buffer and ensures a positive payoff to a firm's customers even if the probability of default is unexpectedly high. Slashing leverage has a similar effect in that it directly reduces the probability that the firm is liquidated in financial distress.

The model presumes that a firm's potential customers not only are able to perfectly observe the firm's financial structure but also track the firm's leverage. In reality, it is more likely the case that customers become aware of a vendor's high leverage only after the vendor experienced financial distress (by that triggering coverage by the business press etc.). Then, the vendor may enter a vicious circle where potential customers—fearing that they get stranded when purchasing—stay away from the vendor, by that widening the extent of the financial distress and making pessimistic beliefs self–fulfilling. This adds a dynamic interpretation to our story and it helps to explain why highly leveraged firms often adopt aggressive marketing policies and initiate debt restructurings at the brink of financial distress. For example, Daewoo implemented an aggressive marketing and pricing policy in the US and Europe after having entered financial trouble.[26]...

6 Empirical predictions and robustness

... to be written

7 Conclusion

This paper presented a simple model in order to illustrate that highly leveraged firms can enter a vicious circle in which financial distress and sales drops are re–enforcing. Whenever firms stick to tough business policies—high powered financial contracts and high prices—multiple equilibria can arise. There exists a "good" equilibrium in which consumers buy and the firm is in good financial shape. However, when leverage is high is also "bad" equilibrium: consumers turn away from the vendor, the market collapses, and the firm goes bankrupt.

[26]See Business Week...

Moreover, the "good" equilibrium is highly fragile in that a small shock to the firm's profits can trigger a spiral of sales drops.

I showed that firms can avoid the "bad" equilibrium by cutting prices and reducing leverage. Cutting prices, specifically, not fully exercising market power leaves more rent to customers. This creates a buffer and ensures a positive payoff to a firm's customers even if the probability of default is unexpectedly high. Slashing leverage has a similar effect in that it directly reduces the probability that the firm is liquidated in financial distress.

The model in its present form presumes that a firm's potential customers not only are able to perfectly observe the firm's financial structure but also track the firm's leverage. In reality, it is more likely the case that customers become aware of a vendor's high leverage only after the vendor experienced financial distress. Then, the vendor may enter a vicious circle where potential customers—fearing that they get stranded when purchasing—stay away from the vendor, by that widening the extent of the financial distress and making pessimistic beliefs self–fulfilling. This adds a dynamic interpretation to the model and allows to explain why highly leveraged firms often adopt aggressive marketing policies and initiate debt restructurings at the brink of financial distress.

... to be completed

Appendix

Proof of proposition 3: I show first that whenever $B \neq \hat{B}$ there doesn't exist a pure strategy equilibrium (of the subgame after the firm quoted p^M) where some consumers in $[\hat{s}, 1]$ but others don't. This amounts to showing that it can't be that consumers in some interval $[\hat{s}, \hat{s} + \Delta]$ do not buy but consumers in $(\hat{s} + \Delta, 1]$ buy, where $\Delta \in (0, 1 - \hat{s})$.

Suppose, to the contrary, that types lower than $\hat{s} + \Delta$ don't buy. That is, demand reduces to $1 - \hat{s} - \Delta$ and the corresponding profit equals $(1 - \hat{s} - \Delta)p^M$.

Thus, the firm has to default. From lemma 1,

$$\bar{\beta} = \tilde{\beta} - \frac{(1 - \hat{s} - \Delta)p^M}{B}$$

By definition, the consumer located at $\hat{s} + \Delta$ is indifferent between buying or not, i.e.

$$(\hat{s}+\Delta)V-(\theta\bar{\beta}+(1-\theta)\tilde{\beta})C=p^M$$

which reduces to $\Delta V-\theta\bar{\beta}C=0$, by definition of p^M. Now, by definition of $\tilde{\beta}$ we have $\bar{\beta}=\frac{\Delta p^M}{B}$. Thus, the indifference condition becomes $\Delta V-\theta\Delta p^M\frac{C}{B}=0$. Plugging in p^M this reduces to $B=\frac{\theta^2}{1+\theta}C\equiv\hat{B}$.

Next, I show that for B small there exists a pure strategy equilibrium in which nobody buys. Suppose the consumer with the highest valuation does not buy, i.e.

$$V-(\theta\bar{\beta}+(1-\theta)\tilde{\beta})C-p^M<0 \tag{5}$$

Since the consumer with the highest valuation does not buy nobody else does. Thus, $\bar{\beta}=\tilde{\beta}$. Now,

$$\begin{aligned}
V-(\theta\bar{\beta}+(1-\theta)\tilde{\beta})C-p^M &= \\
\hat{s}V+(1-\hat{s})V-(\theta\tilde{\beta}+(1-\theta)\tilde{\beta})C-p^M &= \\
(1-\hat{s})V-\theta\frac{(1-\hat{s})p^M}{B}C &= \\
(1-\hat{s})\left[V-\theta p^M\frac{C}{B}\right]
\end{aligned}$$

where the second step follows from the indifference condition of the consumer located at $\hat{s}$ and the definition of $\tilde{\beta}$. That is, (5) reduces to

$$V-\theta p^M\frac{C}{B}<0 \tag{6}$$

or $B<\frac{\theta^2}{1+\theta}C=\hat{B}$.

Finally note that a mixed strategy equilibrium doesn't exist. For a mixed strategy equilibrium to exist we need that a strictly positive mass of consumers is indifferent between purchasing the product and not. However, for a given price and strategy profile there is only one type who is indifferent, and this type has zero mass. □

Proof of proposition 4: Let $B<\hat{B}$ and consider the equilibrium in which consumers in $[\hat{s},1]$ buy. Consider any $\epsilon>0$ and suppose a mass ϵ of consumers deviate and do not buy. Denote by $\bar{\beta}(d)$ the probability of liquidation in the high cash flow state when demand equals d. Now, the utility of the consumer located at $\hat{s}+\epsilon$ equals:

$$(\hat{s}+\epsilon)V-(\theta\bar{\beta}(1-\hat{s}-\epsilon)+(1-\theta)\tilde{\beta})C-p^M=\epsilon\left[V-\theta p^M\frac{C}{B}\right]<0$$

Thus, a mass $\epsilon'>\epsilon$ of consumers won't buy. Next, consider the equilibrium in which no consumer buys and suppose a mass ϵ of consumers deviate and buy. The utility of the consumer located at $1-\epsilon$ equals

$$(1-\epsilon)V-(\theta\bar{\beta}(\epsilon)+(1-\theta)\tilde{\beta})C-p^M=(1-\epsilon-\hat{s})\left[V-\theta p^M\frac{C}{B}\right]<0$$

Thus, a mass strictly larger than $1-\epsilon$ wouldn't deviate, i.e. possibly only a mass of $\epsilon'<\epsilon$ would deviate. □

Proof of proposition 5: First, note that (4) is binding. Otherwise, the optimal solution would coincide with the previous solution and (4) would be violated. Suppose that $\beta\leq 1$ is not binding. Thus, (3) must be binding. Next, we have to show that (2) is binding. Suppose that not. Then, $\beta=\arg\max\frac{V-p(\beta)-(1-\theta)\beta C}{V}p(\beta)=\frac{V}{2C}$, where $p(\beta)=V-\beta C$, such that $R=\frac{1}{4}\theta V$. However, $\frac{1}{4}\theta V>\frac{V}{2C}B$ as $B<\frac{\theta^2}{1+\theta}$ and $\theta<1$. Hence,

$$\beta B=\frac{V-p(\beta)-(1-\theta)\beta C}{V}p(\beta)$$

Solving for β we obtain $\beta=V\frac{\theta C-B}{\theta C^2}$. Finally, note that $\beta<\beta^M<1$ as $\beta B<\beta^M B$ and $\beta^M<1$. □

References

[1] Bolton, P. and D. Scharfstein (1990). A Theory of Predation Based on Agency Problems in Financial Contracting. *American Economic Review* 80: 93–106.

[2] Bolton, P. and D. Scharfstein (1996). Optimal Debt Structure and the Number of Creditors. *Journal of Political Economy* 104: 1–25.

[3] Chevalier, J. (1995). Capital Structure and Product Market Competition: Empirical Evidence from the Supermarket Industry. *American Economic Review* 85: 415–435.

[4] Gilson, S. (1989). Management Turnover and Financial Distress. *Journal of Financial Economics* 25: 241–62

[5] Grossman, S. and O. Hart (1992). Corporate Financial Structure and Managerial Incentives. In: Mc Call, J. (ed.). *The Economics of Information and Uncertainty.* University of Chicago Press.

[6] Hart, O. and J. Moore (1998). Default and Renegotiation: A Dynamic Model of Debt. *Quarterly Journal of Economics* 113: 1–41.

[7] Hendel, I. (1996). Competition under Financial Distress. *Journal of Industrial Economics* 44: 309

[8] Jensen, M. (1986). Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers. *American Economic Review* 76: 323–29.

[9] Kovenock, D. and G. Philipps (1997). Capital Structure and Product Market Behaviour: An Examination of Plant Exit and Investment Decisions. *Review of Financial Studies* 10: 767–803.

[10] Opler, T. and S. Titman (1994). Financial Distress and Corporate Performance. *Journal of Finance* 49: 1015–1040.

[11] Phillips, G. (1995). Increased Debt and Product Market Competition: An Empirical Analysis. *Journal of Financial Economics* 37: 189-238.

[12] Titman, S. (1984). The Effect of Capital Structure on a Firm's Liquidation Decision. *Journal of Financial Economics* 13: 137–151.

[13] Titman, S. and R. Wessels (1988). The Determinants of Capital Structure Choice. *Journal of Finance* 43: 1–19.