Debt and Product Market Fragility*

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Abstract

This paper studies the interplay between corporate leverage and product pricing when liquidation is costly for 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. There is a "good" equilibrium in which the firm is in good financial shape. However, when leverage is excessive there is also "bad" equilibrium in which consumers' pessimistic perceptions about the firm's financial health become self-fulfilling. Moreover, whenever the "bad" equilibrium exists the "good" equilibrium is highly fragile in that a small shock can trigger a spiral of sales drops. I show that the firm can avoid the "bad" equilibrium by not fully exercising market power (i.e. cutting prices) and reducing leverage. The model sheds light on why highly leveraged companies often face severe sales drops and how price cuts and debt restructurings can help to restore customer confidence.

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JEL–Classification: G32, G33, L1

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1 Introduction

Many East Asian companies faced dramatic sales slumps during the 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] Total 1998 sales were down by 29.4%.[2] 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.[3] 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 Korean carmakers.[4]

This paper provides an explanation that links financing constraints at the supply side with the demand side. The devaluation of East Asian currencies triggered a sharp increase in foreign denominated debt burdens on East Asian firms and, therefore, the risk of bankruptcy and liquidation. When liquidation is costly for a firm's customers, consumers might well be reluctant to purchase a durable service–intensive product from a firm which is not in good financial shape. This is rather often the case. Liquidation typically undermines the availability of after–sales service or make it more costly. Liquidation is also likely to reduce the possibility to purchase spare parts or other complementary products and services.

There are more examples for this story. 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".[5]

[1] See The Economist, September 12, 1998

[2] See Financial Times, January 05, 1999

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

[4] Actually, Daewoo could slightly increase sales in Britain, Germany, and Italy, but only at the expense of large price cuts. Similarly, Daewoo engaged in aggressive marketing campaigns and price cutting in the US. However, results were far short of projections. See Business Week, August 30, 1999.

[5] See The Wall Street Journal, July 23, 1981. Quoted by Titman (1984).

In the beginning of the 1980s, International Harvester, a producer of heavy farm equipment, lost customers after having entered financial distress because of customers' concerns "about getting parts and services".[6] International Harvester was relatively highly leveraged in the mid 1970s, while a main competitor, John Deere, was more conservatively financed.[7] 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 its downfall: 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.[8] 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.[9] This may have increased consumers' reluctance to purchase a Mac.[10] Indeed, from 1996 to 97, Mac unit sales declined by 27%, and from 1997 to 98 by 4%.[11]

Systematic empirical evidence supporting those examples comes from Opler and Titman (1994). They indeed find that highly leveraged firms tend to loose

[6]See The Wall Street Journal, October 11, 1982. Quoted by Titman (1984).

[7]See Grinblatt and Titman (1998), p. 577–578.

[8]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. See also Business Week, January, 29, and February 05, 1996.

[9]Quoting from Apple's 1998 SEC form 10–K annual report: "To the extent the Company's financial losses 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."

[10]See Business Week, February 05, 1996

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

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 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 policy when customers suffer from liquidation. The basic mechanism identified in this 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 might 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 the termination threat associated with debt helps to discipline managers. The idea is that a firm's managers enjoy control benefits that are lost if the firm is liquidated. For example, Jensen (1986) argues that debt might 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 disciplines managers in exerting high effort.

I develop a simple model that tackles those opposite forces. In a nutshell, leverage increases managerial discipline to pay out but makes it more difficult to generate cash from the product market as consumers are reluctant to purchase from highly leveraged firms. The optimal capital structure solves this trade–off. There is a unique and stable equilibrium when managerial incentive problems are of minor extent (such that leverage is relatively small): consumers buy and a shock won't trigger a spiral of sales drops. However, when agency problems are severe (such that investors demand a "tough", high powered financial contract) and the firm fully exercises its market power, a second equilibrium exists in which 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 coordinate their purchasing decisions. 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 liquidation 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.

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. Because customers anticipate this investors have to bear those costs ex ante. Assuming that investors can commit to a financial structure, Titman 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.

Hendel (1996) argues that financially distressed firms may engage in aggressive price cutting in order to raise cash. The idea is that a financially distressed firm is forced to quickly sell its inventories at a bargain. To put it in more general terms, cutting prices allows a financially distressed firm to boost short–term liquidity if the firm pays its production costs only tomorrow but gets the revenues today. Such a strategy is, of course, inefficient as it decreases long–term profitability. Otherwise, the firm would be better off decreasing its prices no matter whether it entered financial distress or not. I provide an explanation why highly leveraged firms may engage in price cutting (more precisely, not exercising full market power) that does not rely on a maturity mismatch between revenues and costs.

The paper is also related to the literature on the fragility of banks. The driving force underlying my model is actually very similar to the driving force underlying models à la Diamond and Dybvig (1983): 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, by that making the company's failure self–fulfilling. Similarly, Matutes and Vives (1996) present a model of banking fragility and competition in which a bank's safety depends on the size of its network. Thus, depositors care about market share, and as a result, multiple equilibria arise, some of which exhibit systemic collapse.

This paper is organized as follows. The next section presents the model. The set of subgame perfect Nash equilibria of this game is rather large. Following the standard approach in the literature on network externalities or coordination failures, I restrict the set of equilibria as follows: First, in section 3, I suppose that consumers can coordinate their purchasing decisions and that they always coordinate on the equilibrium of the (first period) purchasing subgame which is best for them. Given this restriction on the purchasing subgame, I solve for the optimal capital structure and product pricing strategy. Then, in section 4, I show that whenever the firm adopts this business policy and leverage is excessive the purchasing subgame has a second equilibrium in which the market collapses and the firm is driven into bankruptcy. Further, this equilibrium is the unique stable equilibrium. Section 5 argues that firms can immunize against market collapse by cutting prices and slashing leverage. Section 6 concludes.

2 The model

Consider a firm that produces a durable good. For simplicity, the firm is a monopolist. There is an owner and a management team that runs the firm.[12] The model has two periods and three points in time, $t = 0$, $t = 1$, and $t = 2$.

The timing of the game is as follows: First, the owner sets up an incentive scheme in order to discipline management. As we will see, this incentive scheme is equivalent to a leveraged buy out in which management issues debt to finance the buy out and assumes ownership of the firm. For simplicity, management has no internal funds to start with.

At $t = 0$, a cohort of consumers is born. Consumers live for two periods. The cohort consists of a unit mass of consumers who differ in their valuation for the product. A consumer with taste $s \in [0, 1]$ derives, in total, a gross utility sV from consuming the product. Consumers are uniformly distributed over $[0, 1]$. At $t = 1$, a new cohort of consumers is born which is identical to the $t = 0$ cohort. For simplicity, $t = 0$ cohort consumers either buy the product at $t = 0$ or never. That essentially implies that the firm's pricing strategy at $t = 1$ is not affected by the price it charges at $t = 0$. After the second period, the product no longer attracts consumers and profit opportunities cease to exist.

After the $t = 0$ cohort is born, management quotes a price for its product and consumers decide whether to buy the product after having observed the price and the firm's leverage.[13] Similarly, at $t = 1$, management quotes a price and $t = 1$ cohorts consumers decide whether to purchase the product.

The firm may exit the market after the first period and it does exit after the second period because the market no longer provides profit opportunities. Exit is costly for the firm's customers. Whenever the firm exits customers who bought the product in the previous period incur a cost C, which I assume to

[12] All parties are risk neutral and the risk free interest rate is normalized to zero.

[13] For simplicity, 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 a potential customer to form an idea about the firm's financial health.

be independent of the consumer's valuation for the product. The idea is that a consumer finds it harder to obtain maintenance service at a reasonable price or has trouble finding spare parts and complementary products when the original supplier has been liquidated. Thus, C just accounts for the additional cost of obtaining maintenance service and spare parts.

First and second period cash flows are affected by a cost shock (realizing *after* production). For simplicity, the cost shock is either small in which case the firm has zero marginal cost, or large in which case the firm doesn't generate cash flows that could be paid out to investors. Further, the cost shocks are uncorrelated between periods. Denote the probability that the firm doesn't experience an adverse cost shock during the first period by θ.

Consider, then, the second period pricing problem. A consumer with taste s decides to buy the product as long as $sV - C \geq p$. Thus, management maximizes $\Pi(p) = \left(1 - \frac{p+C}{V}\right) p$ when quoting the second period price, leading to expected profits of $\Pi = \theta \frac{1}{4V}(V - C)^2$.

The agency relationship between management and the owner (respectively, investors) is subject to moral hazard. Here, I follow Diamond (1986), Bolton and Scharfstein (1990, 1996), and Hart and Moore (1998) and assume that cash flows are unverifiable and management has discretion over cash flows. Essentially, investors are not able to prove in court whether the cost shock occurred or not. Thus, management can always declare that it did not generate any profits, while in fact it did, and invest the cash in perks or pet projects. This immediately implies that investors cannot extract anything from management after the second period. The firm exits anyway, so management would default on any positive payment.

In order to give management incentives to pay out investors can threaten to liquidate the firm in case of default.[14] This works because management has something to loose when the firm is shut down. First of all, expected second period

[14] I assume here that investors are not liable for customers' claims. This is because only a credible liquidation threat can provide incentives to pay out. If the investor were 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 management's incentives to pay out.

profits. In addition, there might be other costs management has to bear. For instance, management might loose its reputation when the firm is liquidated.[15] In what follows, I denote management's benefit from staying in control by B. This captures the foregone second period profits plus any additional costs management incurs in liquidation. The assumption that second period profits are not affected by first period prices essentially allows me to treat this variable as given when solving for the optimal financial structure and first period pricing strategy.

A financial contract specifies a payment R to be made after the first period and a liquidation right. Specifically, the investor is entitled to liquidate the firm with probability β should management default.[16] For simplicity, assets in place have zero liquidation value.[17]

Now, back to the owner's original problem of designing a managerial incentive scheme. I consider, without loss of generality, the following scheme: The owner offers management to buy the firm. In order to finance the deal, management issues debt. The price at which management is able to buy the firm is then just given by the highest amount management is able to raise from the credit market. Hence, the optimal financial contract maximizes the cash proceeds from the debt issue such that management is willing to accept the deal, the contract is incentive compatible, and respects the limited liability constraint. Formally, the optimal contract solves the following problem:[18]

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

[15] 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.

[16] To motivate this suppose the firm pledges a fraction of its assets which the investor can liquidate in default. Suppose, further that if the investor liquidates a fraction β of the firm's assets the firm survives subsequent restructuring with probability $1-\beta$ and exits with probability β.

[17] Thus, investors might waive their liquidation rights when the firm just cannot pay out because cash flows are zero. However, I assume that investors insist 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.

[18] For simplicity, investors have the full bargaining power in renegotiation after strategic default and management's outside utility is set to zero.

$$
\begin{aligned}
(\textbf{IR}) \qquad & \theta(\Pi(\beta) - R + B) + (1-\theta)(1-\beta)B \geq 0 \\
(\textbf{IC}) \qquad & R \leq \beta B \\
(\textbf{CASH}) \qquad & R \leq \Pi(\beta)
\end{aligned}
$$

where $\Pi(\beta) = \max_p \Pi(\beta, p)$ denotes the firm's first period income from the product market. For the moment, I tackle the firm's income as reduced form. The fact that income depends on β captures the idea that consumers' expectations about liquidation and, therefore, their purchasing decisions are affected by the firm's financial structure. Expected cash proceeds from the debt issue are given by θR which in turn is just the highest price at which the owner is able to sell the firm to management. (**IR**) is management's participation constraint. (**IC**) is the incentive constraint: management cannot commit to pay out more than it would loose if it were defaulting. Finally, (**CASH**) is the limited liability constraint: management cannot pay out more than it has.

The optimal financial contract is easily derived. First, note that the manager's participation constraint is not binding 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 $B > \Pi(1)$.[19] Thus, the optimal liquidation right β^M is the (unique, interior) solution of $\beta B = \Pi(\beta)$.

Proposition 1 *The optimal financial contract is a standard debt contract with face value $R = \beta^M B$, where $\beta^M B \equiv \Pi(\beta^M)$. After liquidity default the firm exits with probability β^M.*

The optimal financial contract solves a tradeoff between managerial rent extraction and cash generation from the product market. While a softer 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.

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

3 Debt and sales proceeds when consumers can coordinate

In this section, I solve for the equilibrium when consumers can coordinate their purchasing decisions. Specifically, I suppose that consumers coordinate on the equilibrium of the (first period) purchasing subgame which is best for them. Therefore, coordination failures are no issue and the firm won't experience an unexpected cash shortfall. In other words, observing β, consumers believe that the firm is going to be liquidated with probability $(1-\theta)\beta$.

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

$$\max_{p\geq 0}\int_{\hat{s}}^{1} p \; ds = \max_{p\geq 0}\frac{V-p-(1-\theta)\beta C}{V}p \equiv \Pi(\beta)$$

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 β^M 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 $\beta^M=1$. Let $\Phi=\frac{\sqrt{B+(1-\theta)C}-\sqrt{B}}{(1-\theta)C}$. It is easily checked that

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

and $V-(1-\theta)\beta^M C>0$.

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 financial contract specifies $\beta^M=V\Phi^2$, the firm charges $p^M=V(1-\hat{s})=V\sqrt{B}\Phi$, demand is given by $1-\hat{s}=\sqrt{B}\Phi$, the firm is liquidated with probability β^M when the cost shock occurs, and continues with probability one when the cost shock does not occur.*

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 management to pay out free cash flow. Second, under this pricing strategy the firm fully exercises its market power over consumers.

Note that β can be regarded as a proxy for the firm's leverage. Let us define leverage as the value of the 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 $\theta\beta^M B$ while the value of equity is given by $\theta B + (1-\theta)(1-\beta^M)B$. Thus, leverage is given by

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

which has exactly the same qualitative comparative statics as β^M.[20] Hence, in what follows I just speak of β^M as the firm's leverage.

The comparative statics follow intuition: Leverage 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.

4 Self–enforcing financial distress

The previous section characterized the optimal leverage and (first period) pricing policy under the assumption that consumers coordinate their (first period) purchasing decisions. In this section, I derive the full set of Nash equilibria of the purchasing subgame taking this business policy as given.

That a coordination failure can occur shouldn't be surprising. After all, a small shortfall in demand is sufficient to drive the firm into financial distress. Then, management has to default for liquidity reasons, and investors are, in principle, entitled to liquidate a fraction β^M of the firm's assets. And given that the firm exits with probability β^M some consumers might well be better off not purchasing from the firm.

[20] Formally, $\operatorname{sign} d\frac{\frac{\theta\beta^M}{1-(1-2\theta)\beta^M}}{d\theta} = \operatorname{sign} \beta^M(1-\beta^M) + \frac{d\beta^M}{d\theta}\theta\beta > 0$ and $\operatorname{sign} d\frac{\frac{\theta\beta^M}{1-(1-2\theta)\beta^M}}{dx} = \operatorname{sign} \frac{d\beta^M}{dx}$ for $x \in \{B, V, C\}$.

However, this is only part of the full story. In reality, firms restructure debt when experiencing financial distress. In our setting, it is unreasonable that investors exercise their full liquidation rights when management falls short of meeting the debt payment by a tiny amount. In that case, all parties are better off if debt is restructured and management pays out the cash it has in exchange for investors waiving most of their liquidation rights. Hence, while a small demand short fall is sufficient to trigger financial distress it only slightly increases liquidation risk. Then, it is no longer clear whether consumers are better off not buying from the firm. That depends, of course, on how large "slightly" is.

Suppose, then, that there is a demand short fall Δ such that income is only given by $\Pi = (1 - \hat{s} - \Delta)p^M < R$. 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 investors have the full bargaining power. Investors make a restructuring offer (R', β') such that their payoff is maximized and management is willing to accept the offer. Formally,

$$\begin{aligned} \max_{R', \beta' \in [0,1]} \quad & R' \\ s.t. \quad & \\ (\mathbf{IR}') \quad & \Pi - R' + (1 - \beta')B \geq \Pi + (1 - \beta^M)B \\ (\mathbf{CASH}') \quad & R' \leq \Pi \end{aligned}$$

where the right hand side of $(\mathbf{IR}')$ is management's status quo payoff. Obviously, any optimal solution of this problem has $R' = \Pi$, and $\beta' = \beta^M - \frac{\Pi}{B}$ is optimal.[21]

[21] In fact, whenever the firm's assets have a non–zero liquidation value and investors capture the liquidation proceeds the participation constraint is binding. Thus, the proposed contract emerges as the unique limit contract when the asset's liquidation value goes to zero. In that sense, the proposed restructuring offer $(R' = \Pi, \beta' = \beta^M - \frac{\Pi}{B})$ is the unique robust solution of the investors' maximization problem.

Lemma 1 *Suppose the firm only generates* $\Pi = (1-\hat{s}-\Delta)p^M < R = \beta^M B$ *from the product market. Then, after strategic default and renegotiation the firm pays out* Π *and is liquidated with probability* $\bar{\beta}(1-\hat{s}-\Delta) = \beta^M - \frac{(1-\hat{s}-\Delta)p^M}{B} = \Delta\frac{V\Phi}{\sqrt{B}}$.

Note that $\bar{\beta}$ is decreasing in B. Thus, the more severe the agency problem between investors and the firm (or the higher leverage), the lower the firm's survival prospects when unexpectedly experiencing a sales drop. The next proposition builds on this insight.[22]

Proposition 3 *Suppose management adopts the tough policy. Then, there exists a cut off value* $\hat{B}$ *such that whenever the agency problem between investors and management is not too severe (*$B > \hat{B}$*) the first period purchasing subgame has a unique equilibrium in which demand equals* $1-\hat{s}$*. However, when the agency problem is severe (*$B < \hat{B}$*) there exists a second equilibrium exhibiting complete market collapse. Finally, whenever* $B = \hat{B}$ *there exists a continuum of equilibria indexed by demand realizations* $d \in [0, 1-\hat{s}]$.

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 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. Specifically, purchasing is a dominant strategy for consumers with high valuations. Given that high valuation consumers buy, others 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.

[22] Proofs are in the appendix.

Corollary 1 *Firms producing relatively service intensive products face a higher risk of market collapse when sticking to the tough policy.*

The existence of multiple equilibria is somewhat painful for an economist being interested in deriving clear–cut predictions. 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.*[23]

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 an infinitesimal small exogenous adverse shock to the firm's profits). This will increase the firm's liquidation probability slightly. What is the best response of those 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 change their minds and do not purchase since 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:

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.*

[23]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.

[24]Strictly speaking, though, the model does not predict that this tâtonnement process evolves over time as the model is of purely static nature.

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 investors have the full market power (this being driven by the assumption that the owner makes a take–it–or–leave–it offer to management). In the current version of the 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. Under a smooth cost shock whatever small sales drop increases 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.[25]

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 unexpected sales drops? Note that whenever the highest valuation consumer derives negative utility under the worst case scenario that he is the only consumer purchasing from the firm there exists an

[25] It is easily checked that under perfect competition among investors there only exist the high demand equilibrium when B is high and two stable equilibria when B is low, namely one equilibrium with high demand and another equilibrium exhibiting complete market collapse. Moreover, when B is sufficiently low the equilibrium exhibiting market collapse is less fragile than the high demand equilibrium in the sense that a larger fraction of deviating consumers is needed for deviation to be a best response.

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 for which it is a dominant strategy to buy. Unfortunately, putting $V - \beta C > p$ as an additional constraint into the investors' maximization problem leads into trouble in that this problem doesn't have solution.[26] Therefore, I just assume that 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:

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

$$s.t. \tag{2}$$

$$(\mathbf{IC}) \quad R \leq \beta B \tag{3}$$

$$(\mathbf{CASH}) \quad R \leq \Pi(\beta, p) = \frac{V - p - (1-\theta)\beta C}{V} p \tag{4}$$

$$(\mathbf{STAB}) \quad p \leq V - \beta C \tag{5}$$

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 agency problem is severe. Then, there is a unique outcome in which the doesn't fully exercise its market power (i.e. charges a lower price) and investors demand a less incentive–intensive financial contract (i.e. the firm has 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

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

firms with relatively severe agency problems choose a soft policy, adopting a low powered financial contract and not exercising full market power.

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 liquidation 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 are able to perfectly 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 (which, in turn, triggers coverage by the business press and analysts). Then, the vendor may enter a vicious circle in which 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 on the brink of financial distress.

For example, Korean carmaker Hyundai implemented an aggressive marketing policy and engaged in severe price cutting in the US and Europe after having been hit by the Asian financial crisis. Those policies weren't too successful in the short run.[27] However, complemented by subsequent debt restructurings[28], customer confidence could be restored in the medium term: In the US, Korean car sales soared by 83% from 1998 to 1999.

6 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

[27]See, in particular, Business Week, August 30, 1999.

[28]See Financial Times, September, 01, 1999, and Business Week, January 24, 2000

shape. However, when leverage is high 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 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.

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Appendix

Proof of proposition 3: I show first that whenever $B \neq \hat{B} \equiv \frac{\theta^2}{1-\theta}C$ there doesn't exist a pure strategy equilibrium of the purchasing subgame (given p^M and β^M) where some consumers in $[\hat{s}, 1]$ buy and others don't. This amounts to showing that whenever $B \neq \hat{B}$ 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 there is an equilibrium in which types with valuation lower than $\hat{s}+\Delta$ don't buy, where $\Delta \in (0, 1-\hat{s})$. 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,

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

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

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

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

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.

$$V - (\theta\bar{\beta} + (1-\theta)\beta^M)C - p^M < 0 \tag{6}$$

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

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

where the second step follows from the indifference condition of the consumer located at $\hat{s}$ and the definition of β. That is, (6) reduces to

$$V - \theta p^M \frac{C}{B} < 0 \tag{7}$$

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 $\epsilon(0, 1-\hat{s})$ 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:

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

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

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

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, (5) is binding. Otherwise, the optimal solution would coincide with the previous solution and (5) would be violated. Thus, $p=V-\beta C=p(\beta)$. Next, suppose that $\beta\leq 1$ is not binding. Hence, (4) is binding. Next, (3) is binding. Otherwise, the optimal liquidation right $\tilde{\beta}$ solves $\max(1-\hat{s}(p(\beta)))p(\beta)$, where $\hat{s}(p(\beta))$ is defined by $sV-(1-\theta)\beta C=p(\beta)$, 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 $\theta<1$, so (3) is violated. Hence,

$$\tilde{\beta}B=(1-\hat{s}(p(\tilde{\beta})))p(\beta)$$

such that $\tilde{\beta}=V\frac{\theta C-B}{\theta C^2}$ and $p=\frac{VB}{\theta C}$. Finally, note that $\tilde{\beta}<\beta^M<1$ as $\tilde{\beta}B<\beta^M B$ and $\beta^M<1$.

To complete the proof I show that given $\tilde{\beta}$ and $p=V-\tilde{\beta}C$ there exists a continuum of stable equilibria indexed by demand realizations $d\in[0,1-\hat{s}(p(\tilde{\beta}))]$. So, suppose a fraction $1-\hat{s}(p(\tilde{\beta}))-\epsilon$ buys the product, where $\epsilon\in[0,1-\hat{s}(p(\tilde{\beta}))]$. The utility of the consumer located at $\hat{s}+\epsilon$ equals

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

since $V-\theta(V-\tilde{\beta}C)\frac{C}{B}=V-\theta\frac{VB}{\theta C}\frac{C}{B}=0$. Hence, any demand realization $d\in[0,1-\hat{s}(p(\tilde{\beta}))]$ is supported by a (stable) equilibrium. Under our assumption, the equilibrium with highest demand $1-\hat{s}(p(\tilde{\beta}))$ is the unique outcome. □