
CAPITAL STRUCTURE CHOICES AND SURVIVAL IN A DEREGULATED ENVIRONMENT

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ABSTRACT

We examine the impact of capital structure choices for survival in a deregulated industry. Financial leverage in particular has been identified by numerous prior studies as a major determinant of the probability of survival in most industries. In the course of a deregulation, the debt overhang effect stemming from high leverage negatively affects the ability of existing firms to survive when a regulatory shock occurs (Zingales, 1998). Following such a regulatory shock, and consistent with the tradeoff and debt overhang theories of capital structure, firms are more likely to reduce their level of leverage (Ovtchinnikov, 2010). This causes the expected costs of financial distress to rise higher and we can expect a negative association between leverage and survival in a deregulated industry. However, in a highly competitive setting, firms may signal their level of quality by contracting for more debt instead of equity (Ross, 1977). This signaling perspective can therefore induce the existence of a positive association between leverage and survival in a deregulated context. Using a sample of private trucking firms, we test this hypothesis and find a negative association between leverage and survival. In a refined analysis aimed at distinguishing high “quality” versus low “quality” firms, we adopt the “excess capacity” approach of De Vany and Saving (1977). Consistent with our initial findings, we find that the negative association between leverage and survival increases with the level of excess capacity.

INTRODUCTION

The U.S. interstate trucking industry was deregulated by Motor Carrier Act of 1980 (MCA 1980). With deregulation, the barriers to entry were lowered and, in the 1980s, many new trucking firms entered the market. We focus on the private trucking firms that either survived deregulation or were created after that regulatory shock and examine the association between a trucking firm’s choice of capital structure and its chances of survival after deregulation. Contrary to other studies focusing on the same question that rely on samples of publicly traded firms, we

only look at private firms. Our reliance on private firms allows us to examine the effect of constrained capital choices whereby a deviation from optimality is particularly detrimental for the survival of these firms.

DEREGULATION IN THE TRUCKING INDUSTRY

From 1935 to 1980, the Interstate Commerce Commission (ICC) federally regulated interstate motor carriers in the U.S. The ICC was created in 1887 to regulate railroads that were perceived to be monopolistic and were practicing rate discrimination. As other modes of transportation evolved in the 1900s, the ICC eventually was empowered to regulate all common carriers. The ICC approved licensing, rates (tariffs), and routes. Because of the restrictive ICC controls, entry into these regulated markets was very difficult. In addition, the regulations led to inefficiencies in the operations of the carriers (Moore, 1993). Since the ICC regulated rates and routes, carriers could operate with inefficient cost structures and still earn a market return on investment.

Beginning in the 1950s, the criticisms of the effects of regulation led to efforts to begin to deregulate the controls over common carriers. In 1977, the ICC began to change their policies related to the trucking industry (Zingales, 1998). Barriers to entry eased and increased rate competition was encouraged. The passage of the MCA 1980 solidified these steps towards deregulation of interstate common carriers.

While the MCA 1980 did not completely remove interstate trucking companies from regulation, it did ease the economic restrictions of the regulations. As a result, dramatic changes in the trucking industry occurred and influenced segments of the trucking industry differently. As noted by Zingales (1998), the interstate trucking business has two distinct segments: the truckload (TL) segment which includes carriers which transport full loads of 10,000 pounds or more from point to point, and the less than truckload (LTL) segment carriers which transport loads of less than 10,000 pounds and need to consolidate loads to move efficiently from point to point. Because of the logistics and equipment required to pick and deliver smaller loads, the LTL segment requires greater capital and equipment to create the terminals and networks needed to combine loads and deliver efficiently across the country. The TL segment requires somewhat less capital investment (i.e., one independent trucker can pick up and deliver a load directly to the end point) but many firms in the TL segment rely on leverage via equipment financing to enter the market.

LEVERAGE AND SURVIVAL IN THE TRUCKING INDUSTRY

In the trucking industry, inventories of any kind are a very small part of total assets and usually consist of parts for repairs and tires. The majority of the fixed assets are equipment which is financed. Financing in the trucking industry is easier than in many industries because

there are many platforms to finance tractors and trailers and there is a ready market for the vehicles in the event of a default. The availability of lenders covers a broad spectrum with financial instruments limited only by the imagination of the lender and the needs of the borrowers. The basic lenders that are available are dealer financing, third party equipment financiers, operating leases and financial leases.

Borrowing is necessary for growth because the industry is capital intensive and each individual carrier needs critical mass to survive. Milano (2011) notes that at the end of 2010, the total gross operating assets in the industry amounted to over \$700 billion, more than twice the revenue generated that year. Critical mass may be one tractor for an owner-operator or thousands of units for a large carrier. The industry is basically pure competition and the profit margins hover around three to six percent of sales with a two plus turnover of assets. Financial leverage can cause pressure on firm survival because of the revenue/margin pressures from competition in a deregulated environment. It is not unusual for trucking companies to reduce their rate for services (prices) to generate short term cash flows to service debt. These pressures can lead to firm bankruptcy.

By 1989, deregulation had effectively been completed in the U.S. trucking industry and a new era of competition began. The economic barriers to entry in the TL segment were significantly reduced and competition increased as new carriers entered the market. These new carriers were predominately private, non-union, low cost carriers who competed on rates (tariffs). Henrickson and Wilson (2008) using firm-level data find that surviving union firms did not experience the benefits from the reduction in average compensation that new entrants obtained after deregulation. Actually, the compensation premium at the union firms increased rather decreased. This increase in compensation premium was potentially one of the reasons why many union firms exited the industry after deregulation. As free competition increased in the TL segment, freight rates became competitive bids established in an open market. In a deregulated market, TL carriers have to be price and service competitive and control costs in order to have a sufficient profit margin and cash flow to survive. However, leverage is frequently used as the vehicle for entry of these private TL firms.

THEORETICAL FOUNDATIONS AND HYPOTHESES DEVELOPMENT

The literature on the association between financial leverage and the probability of bankruptcy is extensive. Baxter (1967) outlines the basic finding that excess leverage and the associated increase in the cost of capital are events heightening the risk of bankruptcy. Altman (1968) identifies financial leverage as one of the main factors to be considered for a discriminant analysis upon which the Z-score is based. Closely related to our work, is Zingales (1998). This study examines whether financial leverage is a determinant of survival in an industry that is made more competitive because of a major regulatory shock. The findings support the notion that highly leveraged trucking firms in the pre-deregulation period are less likely to survive the

regulatory shock. Viscusi, Vernon and Harrington (2005) note that deregulation in the trucking industry was instituted by releasing both the barriers to entry and the barriers to exit. Doing so led to both a reduction in industry-level profitability (Ying and Keeler, 1991, estimate a growing reduction in rates following deregulation from a range of 15-20% by 1983 to a range of 25-35% by 1985) through increased competition, and also through an easing of the exit of less efficient firms through bankruptcies. Indeed, Madsen and Walker (2007) examine competitive pressures from entrants and incumbents in the trucking around deregulation. They find that competitive pressures from entrants are a driving factor of the exit rate in the industry after deregulation. Among the reasons cited, they mention the stock of experience of entrants rather than that of incumbents. We could interpret their findings from a financial perspective to note that entrants are less likely to be as financially leveraged as incumbents, thus their greater competitiveness.

We follow up on Zingales (1998) and examine whether or not financial leverage in the trucking industry remains a major determinant of survival even after the participants in this industry have adapted to the new competitive environment.

First, the debt overhang perspective developed by Myers (1977) predicts a negative association between survival and the level of contracted leverage. From this perspective, a debt-ridden borrower is not able to raise new funds to take advantage of new profitable opportunities. This inability to raise funds could be due to the decrease in the net worth of the firm because of the claims of the current creditors, leaving too few net assets which can be pledged in favor of the future lenders. The second explanation has to do with the level of profitability of the new ventures to be financed with new debt. With regards to the trucking industry, the first explanation can be supported by the high prevalence of equipment financing whereby the lien on the financed equipment is retained by the first lender, leaving nothing for the new creditors. The second explanation however, may not be fully supported as carriers can often extract substantial rents from new customers with specialized loads.

Following the angle of the tradeoff theory of capital structure, Ovtchinnikov (2010) examines the capital structure choices of firms in industries that went through deregulation. Not only does he find increases in the growth opportunities of these firms, but more important, these firms reduce their reliance on debt to finance these new operations. His results are consistent with the need for trucking firms to reduce leverage in order to survive in the period post-regulation. His study is different from ours because he relies on a sample of publicly traded companies whereas we examine a set of private trucking firms. Access to equity financing is not as easy for private firms as it is for public firms. Therefore, debt may be the only option for these private firms. This peculiarity renders the findings from our tests even more interesting as they will apply to a larger portion of the economy. Furthermore, Jensen (2005) notes that debt and the associated level of leverage can serve as an efficient monitoring mechanism. Firms saddled with debt implicitly give power to their creditors who can intervene in their strategic choices. The creditors are not interested in halting the operations of the debtors, but in finding a way for them to meet their contractual obligations. As such, even if they hold a lien against the equipment of

the trucking firm, the creditors are likely to suffer a haircut on the value of their loan in the event of bankruptcy. It is therefore to the advantage of the creditors to negotiate with the indebted trucking firm to avoid bankruptcy and take advantage of the growth opportunities that arose from deregulation. Since it is not clear how current leverage will affect the ability of acclimated trucking firms to survive in a deregulated environment, we state the first variant of our research hypothesis as the following null:

H1a: There is no association between current leverage and the probability of survival for trucking firms in a deregulated environment.

We conduct an additional examination of our research hypothesis by considering the pricing power of trucking firms providing high quality service to their customers. Ross (1977) provides an analysis of the signaling theory from the perspective of capital structure choices. Starting from the Modigliani-Miller irrelevancy propositions, he analytically shows that in a situation whereby a manager of a firm of high quality has private information about the prospects of that firm, that manager can contract for a level of debt that can be used by market participants to infer the quality of that firm and separate it from its competitors. One of his empirical predictions is that we could observe the counterintuitive positive association between the probability of bankruptcy and the quality of the firm. High quality firms in the trucking industry have the potential to command higher rates from shippers because the said firms can handle specialized shipments which are not subject to the competitive pricing structure of the rest of the industry. This observation is supported by the findings of Li and Lee (1994) who develop an analytical model to show how firms with higher processing rates in a competitive environment always enjoy a price premium over competitors. In their model, just as in the trucking industry, customers are concerned not only with price, but more importantly with delivery speed which is an indication of the service quality of the firm. Since it is not clear whether it is going to be the pricing power of a high quality firm or its excess leverage due to signaling which will prevail as the main the determinant of survival, we then formulate our second variant of our research hypothesis as the following null:

H1b: There is no association between current leverage and the probability of survival for trucking firms in a deregulated environment regardless of the quality of service provided by the trucking firm.

DATA AND RESEARCH METHODOLOGY

Sample Selection

We start our data collection process with the Motor Carrier Financial and Operating Information filings made by trucking firms with the Federal Motor Carrier Safety Administration (FMCSA) of the Department of Transportation for the years 1989 through 2003 (The analyses

are limited to this time period as the Department of Transportation stopped releasing these reports in an electronic format after 2003). We only focus on a sample of full truckload companies to make sure that we analyze homogeneous firms. Our starting sample consists of 12,305 firm-year observations pertaining to 3,314 unique companies. The next step consists in manually identifying the years of incorporation and bankruptcy of these companies. We are able to obtain that information for 1,400 companies of which 107 are identified as bankrupt. We delete the observations pertaining to public firms as they have access to other sources of capital not available to private firms. This step results in a sample of 6,137 firm-year observations for 1,384 unique companies. To remove the effects of outliers from the data, we drop observations above (below) the 99th (1st) percentile for our independent variables (Kothari and Zimmerman, 1995). Our final sample consists of 2,246 firm-year observations for 795 individual firms.

	# of firm-year observations	# of unique firms
Full truckload firms with reports filed with FMCSA from 1989 to 2003.	12,305	3,314
After identifying years of incorporation and years of bankruptcy	6,313	1,400
After deleting firms with publicly traded equity capital	6,137	1,384
After deleting outliers	2,246	795

Research Design

We are interested in analyzing the extent to which leverage plays a role in the ability of a firm to survive in the period following a regulatory shock. We rely on the design developed by Zingales (1998) and model the probability of survival as a function of firm-specific characteristics among which the degree of financial leverage in the firm's capital structure. Our probit model is as follows:

$$Pr(\text{survival up to 2003}) = f(\text{NDTC}, \text{COV}, \text{ROA}, \text{REV}, \text{LABCOST}, \text{CAP}, \text{COSTDEBT}, \text{OPRATIO}, \text{TRAIL-TRACT}) \quad (1)$$

Where:

NDTC = Net debt to capital ratio: (Total debt - cash reserves)/ (Total debt + equity)

COV = Interest coverage ratio: (Earnings before interest, taxes and depreciation)/Interest expense

ROA = Return on assets: (Earnings before interest, taxes and depreciation)/Total assets; this ratio is later decomposed into: (1) MARGIN = (Earnings before interest, taxes, and depreciation)/Total revenues;

(2) TURNOVER = Total revenues/Total assets

REV = Log of total revenues; LABCOST = (Wages +benefits)/Operating expenses;

CAP = Ratio of trailers to tractors; COSTDEBT = Interest expense/ Total debt;

OPRATIO = Ratio of total expenses to total revenues;

TRAIL-TRACT= Ratio of trailers to tractors;

We do not include a variable to control for the level of intangibles as Zingales (1998) did because it will severely restrict our sample size. In this model, we are interested in the coefficient on NDTC which serves as a proxy for leverage. In the second part of the analysis, we examine the signaling hypothesis of Ross (1977). To proxy for product quality, we adopt the excess capacity perspective of De Vany and Saving (1977) and we sort firms into three groups depending on how many trailers they have for each tractor in their fleet. De Vany and Saving (1977) note that carriers who can minimize wait time for the shippers are rated higher than others in terms of service quality. To minimize wait time, the carrier must invest in more capacity. Capacity is well defined based upon the number of loads a carrier can move. Dollars of revenues and ton/miles would be a surrogate for the ability to move loads. The number of tractors is a measure of capacity because a carrier cannot move a trailer without a tractor. The ratio of trailers to tractors becomes an important measure of capacity because trailers can increase the efficiency of tractors. Freight can be preloaded by the shipper and the incoming driver can drop an empty trailer and hook up to a loaded trailer. Loading time becomes meaningless under a drop-and-hook system. Based on this characterization of service quality using available capacity, we then estimate model (1) for each of these groups.

RESULTS

Descriptive Statistics and Univariate Analyses

The descriptive statistics in Table 2 (Panel A for surviving firms, Panel B for the non-surviving ones and Panel C for the univariate tests of differences in means across the two groups) indicate that non-surviving firms are on average larger than the surviving ones. There are statistically significant differences in the size of the asset package (9.49 million for surviving versus 11.61 million for non-surviving), and the magnitude of their operations as evidenced by the revenues generated (21.99 million for surviving versus 25.43 million for non-surviving). These differences in size are in line with the difference in leverage with the non-surviving firms being more leveraged than the surviving ones. A potential explanation for these findings is that the non-surviving firms have over-stretched their operations and are in dire need of external financing to support these operations.

We do not observe any difference in the cost of debt across these groups of firms. This no-difference situation is an indication of their equal access to lending from creditors or lenders with an average cost of debt around 20%. We observe that surviving firms generate a higher level of income compared to non-surviving to cover their interest payments on contracted debt (interest coverage ratio of 5.69 for surviving versus 3.21 for non-surviving). The differences in ROA and Margin provide additional evidence that surviving firms are more successful at turning revenues into profit than their non-surviving counterparts. Furthermore, it is an early indication that the expected positive association between firm quality and financial leverage predicted by

models of capital structure choices and signaling may not be verified. Indeed many studies have not found evidence consistent with the predictions of these models (see Harris and Raviv, 1991 for a review of these findings).

The absence of a statistically significant difference in the labor costs faced by these two groups of firms is in line with the nature of the industry. This finding is consistent with those of Henrickson and Wilson (2006) who point out that the changes in labor costs after deregulation evolved in different steps. Initially, firms with unionized labor forces before deregulation did not experience much of the expected decrease in labor costs that should come with deregulation. However, the new entrants in the industry automatically enjoyed the benefits of non-unionized labor forces. But as more and more firms with unionized labor forces vanished away, the labor market in that industry became more competitive with more homogeneous labor costs even though qualified drivers are a very scarce resource. With the increased competition in the labor market, companies also experience high rates of turnover among their drivers, thus making the pay scale transparent between companies. The absence of a difference in the ratio of trailers to tractors is another finding that depicts the nature of the industry. Deviating from the benchmark of 3 trailers to 1 tractor has to be justified by strategic reasons otherwise it is a strong indication of managerial inefficiency.

Table 2: Descriptive statistics

Panel A: Surviving firms						
Variables	N	Q1	Mean	Median	Q3	Standard deviation
Revenue	2109	10.68	21.99	15.61	27.88	16.51
Assets	2109	3.24	9.49	6.47	12.09	9.13
Net debt-to-capital	2109	0.29	0.73	0.56	0.76	2.34
Cost of debt	2109	0.07	0.21	0.09	0.12	1.08
Coverage	2109	2.29	5.69	4.28	7.73	6.70
ROA	2109	0.09	0.17	0.17	0.24	0.15
Margin	2109	0.03	0.07	0.07	0.11	0.07
Turnover	2109	1.73	3.34	2.60	4.19	2.51
Labor Cost	2109	0.05	0.25	0.29	0.41	0.18
Ratio of trailers to tractors	1808	1.61	2.93	2.32	3.55	2.16
Operating Ratio	2109	0.95	0.97	0.97	0.99	0.05

Table 2: Descriptive statistics

Panel B: Non-surviving firms						
Variables	N	Q1	Mean	Median	Q3	Standard deviation
Revenue	137	11.5	25.43	17.85	30.03	19.89
Assets	137	3.58	11.61	6.37	16.75	11.81
Net debt-to-capital	137	0.53	0.95	0.75	0.91	3.27
Cost of debt	137	0.07	0.20	0.10	0.19	0.29
Coverage	137	0.86	3.21	2.75	4.66	7.59
ROA	137	0.05	0.11	0.14	0.21	0.20

Table 2: Descriptive statistics

Panel B: Non-surviving firms						
Variables	N	Q1	Mean	Median	Q3	Standard deviation
Margin	137	0.02	0.06	0.06	0.10	0.06
Turnover	137	1.78	3.39	2.72	3.90	3.08
Labor Cost	137	0.00	0.24	0.31	0.40	0.20
Ratio of trailers to tractors	137	1.68	3.15	2.23	3.61	2.56
Operating Ratio	137	0.94	0.98	0.98	0.99	0.04

Table 2: Descriptive statistics

Panel C: univariate tests of differences of means (Surviving minus non-surviving)		
Variables	Difference of means	p-value
Revenue	-3.44	0.019
Assets	-2.12	0.009
Net debt-to-capital	-0.22	0.048
Cost of debt	0.01	0.929
Coverage	2.48	<0.001
ROA	0.06	<0.001
Margin	0.01	0.0024
Turnover	-0.05	0.8236
Labor Cost	0.01	0.6042
Ratio of trailers to tractors	-0.22	0.2989
Operating Ratio	-0.01	0.0933

Multivariate Analyses

We conduct our multivariate analyses in two phases. First, we pool observations across the two groups of firms and estimate a logistic regression to model the probability of survival. In Table 3, from the baseline model (model 1), we find a statistically significant negative association between the degree of financial leverage and the likelihood of survival (coefficient of -0.03 with p-value of 0.03). This finding is consistent with the debt overhang hypothesis predicting a negative impact of leverage on the operations of deregulated companies. In this same model, the positive coefficient on the interest coverage ratio reinforces the importance of contracting for sustainable levels of debt. Interestingly, even though the two types of firms in the analysis do not exhibit significant differences in the level of labor costs, the negative and statistically significant coefficient on labor costs (-1.44, p-value <0.01) indicates that deviating from the industry norm can be very detrimental for survival.

In model (2), we account for the effects of excess capacity using the ratio of trailers to tractors as it could be an indication of high quality operations or alternatively of a very poor operational strategy. Consistent with the poor operational strategy argument, we find a negative

and statistically significant association between excess capacity and the probability of survival. This effect seems to subsume the one stemming from leverage as the coefficient on that variable becomes statistically insignificant. An explanation for this finding is that the non-surviving firms use debt financing to acquire these excess trailers which generate revenues but not in a timely fashion. As the payback period for the financing of these excess trailers extends into the future, the highly leveraged firms become more sensitive to periodic economic shocks that can endanger their ability to survive. In model (3), we decompose ROA into MARGIN and TURNOVER and we also include a variable to control for the cost of debt. Our results are not significantly affected by these changes. In all three models we control for year fixed effects to account for economy-wide conditions.

Table 3: The effect of leverage on the probability of survival

	Model 1	Model 2	Model 3
Independent variables	Estimate (p-value)	Estimate (p-value)	Estimate (p-value)
Intercept	2.75 (0.01)	3.74 (<0.01)	3.92 (<0.01)
Net debt-to-capital	-0.03 (0.03)	-0.01 (0.64)	-0.02 (0.35)
Log(1+coverage)	0.25 (<0.01)	0.31 (<0.01)	0.32 (<0.01)
ROA	-0.12 (0.82)	-0.40 (0.47)	
Log(Revenues)	-0.12 (0.17)	-0.21 (0.02)	-0.25 (0.01)
Labor costs	-1.44 (<0.01)	-1.45 (<0.01)	-1.27 (0.01)
Ratio of trailers to tractors		-0.04 (0.09)	-0.03 (0.13)
Cost of Debt			-0.01 (0.97)
Margin			0.53 (0.70)
Turnover			-0.03 (0.46)
N	2,246	2,246	2,246
Likelihood ratio	59.59 (<0.01)	61.27 (<0.01)	58.66 (<0.01)
Year Fixed effects	YES	YES	YES
Pseudo R-squared	0.088	0.11	0.11

In the second phase of our analyses, we test the signaling hypothesis by estimating our model for three groups of firms ranked by the ratio of trailers to tractors. The low, median and high excess capacity firms respectively exhibit trailers to tractors ratios of 1.6, 2.2, and 3.5. In Table 4 we present the results of the estimations. Leverage appears to negatively affect the chances of survival for the two extreme groups and not for the middle one. This finding is consistent with the existence of best practices and standards in this industry with respect to the composition of the asset package. Any deviation above or below the standard could be detrimental for survival. Not enough trailers for the available tractors indicate a need to outsource some of the loads, thus cutting the margin generated by the load. A higher than normal ratio of trailers to tractors indicates incurrence of debt to finance these acquisitions and also the incurrence of maintenance costs and fuel costs to support the fleet.

Table 4: The effect of leverage on the probability of survival--test of the signaling hypothesis			
	Low excess capacity	Median Excess capacity	High Excess capacity
Independent variables	Estimate (p-value)	Estimate (p-value)	Estimate (p-value)
Intercept	8.48 (0.73)	0.75 (0.98)	4.95 (0.01)
Net debt-to-capital	-1.06 (<0.01)	0.01 (0.88)	-0.35 (0.07)
Log(1+coverage)	0.49 (0.79)	0.46 (0.01)	0.36 (0.04)
ROA	0.07 (0.95)	-0.02 (0.98)	-1.06 (0.40)
Log(Revenues)	-0.58 (<0.01)	0.17 (0.46)	-0.29 (0.10)
Labor costs	-0.42 (0.64)	-0.92 (0.30)	-2.89 (<0.01)
Cost of Debt	0.08 (0.96)	-0.10 (0.34)	-0.12 (0.61)
N	586	587	586
Likelihood ratio	47.93 (<0.01)	32.43 (<0.01)	58.66 (<0.01)
Year Fixed effects	YES	YES	YES
Pseudo R-squared	0.24	0.19	0.16

CONCLUSION

Deregulation in the U.S. trucking industry occurred in the 1980s. By 1989, many new trucking firms emerged as the barriers to industry from regulation were removed. We focus on private trucking firms that survived deregulation or were created after the regulatory shock occurred and examine the effect of leverage on its chances of survival. Contrary to other studies focusing on same question that rely on samples of publicly traded firms, we only look at private firms. This sample allows us to examine the effect of capital choices on a large number of private firms. Consistent with the debt overhang and capital structure tradeoff theories, we found a negative association between the degree of financial leverage and survival of trucking firms. Furthermore, this negative association persists even when we consider the quality of the services provided by these trucking firms. Overall, despite the necessity for private trucking firms to use debt financing to take advantage of the growth opportunities created by deregulation, this form of financing has to be used carefully to minimize the risk of bankruptcy.

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