The Process of Post Regulatory Changes and Industry Development Following Motor Carrier Deregulation: An Intervention and Profitability Study

Walter P. Neely, (E-mail: neelywp@okra.millsaps.edu), Millsaps College
Patrick A. Taylor, (E-mail: taylopa@okra.millsaps.edu), Millsaps College,

Abstract

The Motor Carrier Act of 1980 was supposed to make the U.S. motor carrier industry more economically efficient, largely by stimulating market entry. That entry would presumably depress industry earnings and returns to motor carriers' equities. While we find a deregulated industry that offers easy entry to new competitors, incumbent firms do not exhibit lower stockholder returns as new firms go public. When profits are examined, however, returns on total capital and profit margins tend to decline for both incumbent and entrant firms. The increased risk and lower returns, documented by pre-deregulation studies give way to a competitive and stable post deregulation industry.

Introduction

The major purpose of the Motor Carrier Act (MCA) of 1980, which deregulated the US trucking industry, was to produce a more competitive and efficient industry. This was to be accomplished by deregulating rates and route choices and removing regulatory entry barriers.

Indeed, Pustay (1986) found evidence

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that ICC activity prior to 1980 retarded entry. Economic theory and evidence suggests entry/exit impediments tend to promote supranormal returns for incumbent firms. On the other hand, opening an industry to entry is likely to improve efficiency but also drive down stockholders' returns and increase risks faced by individual firms, as Bruning (1987) noted. Hence the question opens as to which of these two countervailing influences prevailed in the trucking industry.

The 1975-1980 effects of trucking deregulation have been examined and deregulation has been found to be working, in the sense that freight rates are down and service levels are up. We investigate the post deregulation dynamics as new structural realities take hold in the industry over the period 1983 through 1992. Our looking glasses are the effects on shareholders returns of entry of new firms into the deregulated trucking market. We take entry and profitability to be the measurable impacts of deregulation upon the industry's structure.

In order to link evidence from the stock market, we also investigate the behavior of two profitability measures, return on total capital and profit margin, for both incumbent and entrant firms. There is less support for the increased efficiency hypothesis when looking only at shareholder returns. We find deregulation does in fact have the predicted effect, showing up in a downward trend in profitability for both existing and newly entering firms.

Before moving to the story, the next section of the paper provides some relevant background and a brief discussion of pertinent literature. The third section lays out our fundamental hypotheses. Following that we take up a discussion of the model used to investigate our hypothesis and our data, discuss results, and sum up in the concluding section of the paper.

Background and Literature

Ex ante theoretical work and early *ex post* empirical study surrounding how deregulation should and did work are relatively settled issues. On the theoretical side, one may trace the parentage of deregulation to basic neoclassical competition theory. More recent theory, springing from competition theory, such as the work of Baumol, Panzar, and Willig (1982), also helps provide theoretical support for the entire deregulation movement of the late 1970's and early 1980's.

In looking at the 1977-1981 effects of deregulation upon trucking companies' returns,

Bruning (1987) found that equity returns "exhibited an explosive random pattern" (Bruning, 1987, 303) which he attributed to "substantial uncertainty" and "operating in an unfettered economic environment" (Bruning, 1987, 300). Driving the increased uncertainty are deregulation's effects which include entry of new firms and the expansion and failure of existing firms in the industry.

New firms began to enter and incumbent firms expand, financed with new equity offerings, after the implementation of the Motor Carrier Act of 1980 (MCA), a trend that continued through 1992. McMullen (1987) noted much of the entry was very small firms, such as owner-operators and brokers, which added impetus for this structural change resulting from deregulation. He found that brokers and owner-operators operated at lower costs and their entry was due to the "virtual elimination of entry barriers," (McMullen, 1987, 318).

Schipper, *et al.* (1987) examine returns to shareholders in the trucking industry from 1974-1981, the immediate pre and early post deregulation periods. In doing so they found that ICC actions prior to the passage of the MCA resulted in negative returns to incumbent firms' shareholders. This outcome underscores the importance of analyzing the process of deregulation, rather than merely the event of MCA's passage. That is, managers as well as stockholders and prospective stockholders keep themselves well informed about legislative actions which may at some point impact their planning. Rational decision-makers can and do prepare for anticipated events. Hence it is reasonable to assume at least a weak form of rational expectations is at work during the protracted legislative deliberations which lead to the passage of MCA.

Bruning's (1987) work seems to confirm this idea. His findings suggest that investors kept track of administrative and legislative events preceding passage MCA as reflected in predictable variations in returns following certain events. To the extent this is the case, it is important to examine the flow of information con-

cerning the potential profitability of trucking operations, which drives industry dynamics.

It may also be helpful to take a brief look at the macro background upon which the trucking industry was deregulated. For a full treatment of trucking industry deregulation, see Owen (1988). Suffice it to say here that after deregulation the structure of the industry began to change very rapidly. Not only did firms enter, but also incumbents expanded, owner-operators arrived, and private fleets began to accept back-haul loads. In addition, many incumbents reoriented themselves from their pre-deregulation mode of "less than truck load" (LTL) operations to the more cost efficient "truck load" (TL) concept. As many as 20,000 new, mainly small, carriers entered over the immediate post deregulation period. Also, as Liu (1993) notes, service levels began to improve and non-union work forces became more prevalent. In short, deregulation gave carriers and shippers the same sorts of strategic options as other unregulated firms have and presumably also energized a search for productivity gains among both trucking companies and shippers.

Hypotheses

At first glance one might expect to find falling profitability and shareholder returns as an industry becomes more atomistic, although Bruning (1987) found positive returns during 1977 and 1978 and negative returns from 1978 through 1980. Schipper, *et al* (1987) document negative returns leading up to deregulation in 1980. The competitive market model suggests no more than normal returns over the long-run after all. Furthermore, deregulation of the airline industry in 1978 was followed by falling returns to airlines. Edelman and Baker (1996) found positive returns to one airline deregulation event but a negative impact from increased competition.

It is an easy step to imagine the same would hold for trucking, once it was deregulated. A fuller view of the problem, however, reveals some interesting, perhaps somewhat

contra intuitive possibilities, especially if some important other influences are held constant. Such variables of importance to trucking include fuel prices, tax, and what might be called expectations.

As a consequence of the industry's structural shift following MCA, we expect to find negative returns or imperceptible effects upon existing firms. The negative effects could be seen as new competitors enter or expand when we control for the effects of fuel and taxes. We expect to find trucking companies faced with lower return on total capital and profit margins, and, therefore, lower stock prices, unless efficiency gains outweigh competitive factors.

As we note below, there are good reasons to believe changes in all these industry parameters occurred more or less simultaneously as entry was spurred by deregulation. Our model focuses upon how the changing structure of the industry may have impacted returns in the industry. Doing that leads to the hypothesis that entry alone is not likely to cause returns to publicly traded motor carriers decline over the time at which we look. The paper tells the story of our two-period intervention analysis methodology and profitability study we employ to investigate the effects of entry after the industry was deregulated.

We examine the post deregulation entry and expansion process financed by initial public offering (IPO) generated equity capital. We control for fuel and tax events which occurred from mid 1985 through 1992. Specifically, we look at the entry of newly public firms (as measured by their IPO dates) in two periods, the latter portion of 1983 through 1986 and 1987 through 1992.

As an additional control measure we include eight publicly traded firms that existed prior to 1983. See Appendix E for a list of those nine trucking companies, all of which were primarily LTL operators at the time. In addition, we compare mean long-run profitability for old versus new firms. We expected to find lower

profits as the pace of entry picked up.

Intervention Analysis

The Model and Data

The capital asset pricing model is the asset and risk pricing linchpin of several studies of relevance to this one. Among them are Edelman and Baker (1996), Bruning (1987), Michel and Shaked (1987), and Schipper, Thompson, and Weil (1987). Michel and Shaked find evidence that deregulated trucking companies' shareholder returns were greater after 1980 than during the anticipatory period when negative returns measure expectations of the more competitive regime to come. In another study, Boyer (1993), using a different methodology, offers an hypothesis dealing with the evolutionary dynamic at work in the trucking industry. He shows deregulation's measurable effects on the financial performance of trucking firms were lagged to and distributed over the period 1982 through 1987. He attributes the lag to the delayed onset of productivity increases motivated by the newly competitive market structure resulting from deregulation. Following well-established economic theory, Boyer hypothesizes that the prices charged by truckers were reduced when the structural repercussions of deregulation were felt, but perhaps before productivity actually rose. Boyer's results are what would be expected when resources can not be redeployed very quickly, even when confronted with changing economic incentives as happened when MCA was implemented.

As noted above, this is a two-period study. The first post-deregulation study period, which we define as late April, 1985 through early November, 1986, was a time of steady, macroeconomic expansion. During this period ten trucking companies floated their IPO's. Increasing aggregate economic activity opened widely the door for the expansion of all transport industries, especially trucking. With that came increased demand for capital economy-wide, however.

Our second post deregulation study period begins in December 1986 and ends with the last day of 1992. This period saw eleven new firms issue public equity with their IPO's. The most significant exogenous event in this period was the fuel price spike associated with the Gulf War of late 1991 and early 1992.

In order to conduct the analysis of our data, we use the intervention methodology described by Box and Tiao (1970). Our model is similar to the one Shipper, Thompson, and Weil (1987) employ though we make some modification to suit the particular needs of this study. In specifying our model, essentially we combine Shipper, Thompson, and Weil's basic approach with that used by Chen and Sanger (1985). Our model, however, highlights the three different types of information it is intended to examine and for which it controls. We then apply the model to estimate parameters on variables designed to capture entry as well as systematic and structural shifts in returns to the entire market which are likely to have affected the trucking industry. This is done to control for all influences on trucking industry returns and to isolate the effect of entry of specific firms. The model specifies a return generating process for firm j of:

$$r_j = \alpha_j + r_m\beta_j + \sum_{i=1}^3 \gamma_{ij}D_{ij} + \alpha_s D_s + b_s D_s r_{mk} + \varepsilon_j \quad (1)$$

where:

- r_j = returns to security j or portfolio j ;
- r_m = returns to the market portfolio;
- α_j = intercept before the intervention;
- β_j = beta coefficient, sensitivity to market returns;
- γ_{ij} = coefficients on each of the three dummy variables associated with the j firms;
- D_{ij} = dummy variables for entry of new firms and information pertaining to tax law changes and fuel price changes, 0 for periods containing no modeled event and 1 otherwise;
- α_s = intercept shift or intervention parameter for time periods both before and after modeled events;
- b_s = coefficient on structural shift in market risk during the intervals including modeled

events;

D_s = dummy variables for shifts, set to 1 during the events interval and 0 otherwise;

K = date of intervention, 0 before intervention and 1 after intervention.

ε_j = error term.

Entry is measured by a dummy variable that is set to 1 during periods of entry activity, zero otherwise. The model's final two terms measure the effects of any structural shift on systematic risk (b) or on the intercept (a) resulting from entry and the two informational variables. Reduction in the investment tax credit and regulation-induced ease of entry should work to reduce returns to a trucking company and, in turn, to a trucking industry portfolio. Falling fuel prices, on the other hand, should also improve trucking returns. These hypotheses are our *a priori* expectations for both individual trucking companies and the portfolio. Expected Signs are $\beta_j +$, $\gamma_{\text{Fuel}} +$, $\gamma_{\text{entry}} -$, $\gamma_{\text{Tax}} -$, $D_{ij} -$, $\alpha_s ?$, and $\beta_s +$.

Using the model and daily split adjusted prices (from Vestek Systems) and dividends (from Moody's) the model is applied to two periods, November 1, 1983 to November 28, 1986 and Dec. 1, 1986 to Dec. 31, 1992. We estimate early period regressions for each of the eleven trucking companies in the survey, most of which were general commodity carriers. These were the types of firms suffering the most onerous ICC entry restrictions prior to deregulation (Pustay, 1986). These eleven companies were selected because they are the only public trucking companies that were in continuous operation throughout the early period. See Table 1 for a listing of the trucking companies included in our study. Daily returns, including dividends, are computed for each firm, the portfolio of all firms, and for the market index, the S&P 500. We follow Smith, Bradley, and Jarrell (1986) in the practice of using firm specific stock returns as our foundation for analysis of regulation effects.

Since we are interested in the impact of entry upon returns to shareholders, dummy vari-

ables are included to capture intervention effect of our key variable, entry, as well as informational variables concerning proposed tax changes and fuel prices changes during the period. Dummy variables control for these events, though it is difficult to identify specific dates when these legislative events began to be reflected in security returns. Details of tax law activity are shown in Exhibit 1 including ITC changes and news about legislative consideration of tax law changes that could be expected to reduce returns to trucking companies.

The shift dummy variables are specified as shown in the model and are intended to reflect the overall intervention of regulation induced effects. If there was a shift, we believe occurred between May 28, 1985, and November 6, 1986. This period includes all the effects of taxes, fuel, and competitive entry that we believe to have been sufficient to cause a structural shift. Fuel price is the final influence accounted for in the model.

The typical trucking company finds that its fuel bill amounts to about 30 percent of sales. Given the importance of fuel prices in the cost structures of trucking companies and their subsequent impact on profitability and stockholder returns, we include dummy variables intended to account for the effect of fuel price fluctuations. Fuel prices fell sharply from 1984 to 1986 after which there was only a moderately upward trend except for the period including the Gulf War. Trucking companies are expected to benefit from the reduction in such a major expense. Those benefits would be reflected in returns to their stockholders.

Before discussing our empirical results a small digression is in order on the manner in which we have dealt with the fact that several of the securities in our sample were thinly traded. See Exhibit 2 for details. Scholes and Williams (1977) and Dimson (1979) have addressed the potential for an OLS technique to produce biased betas when securities have trading gaps. Their complaint is that a synchronous OLS process is inappropriate in such cases. Bartholdy and Rid-

Table 1
Entry Model Estimates for Early Period, 1983 - 1986

Company	TAX a	FUEL b	ENTRY g ¹	Adj. g ²	g ³	R ²	DW*
Entrant Firms							
JBHUNT	0.0012	0.371** (3.77)	-0.0069 (-0.94)	0.0016 (0.39)	0.0007 (0.32)	1.5	2.39
TRUK	0.0014	0.055 (0.57)	0.0057 (0.80)	0.0028 (0.69)	-0.0057* (-2.76)	0.7	1.94
Incumbent Firms							
ABZ	0.0002	1.029** (10.4)	0.0045 (0.61)	0.0030 (0.72)	0.0011 (0.53)	2.0	2.10
AIND	0.0015	0.071 (0.56)	0.0028 (0.31)	0.0037 (0.76)	-0.00018 (-0.07)	0.0	2.63
CAO	-0.0001	0.977** (10.9)	-0.0010 (-1.51)	0.0044 (1.18)	0.0006 (0.30)	13.5	2.07
CLEA	-0.00015	0.233* (1.84)	-0.0008 (-0.09)	-0.0007 (-0.13)	0.0048* (1.78)	0.3	2.3
CNF	0.0030	0.967** (12.7)	-0.0110* (-1.96)	0.0003 (0.10)	0.0006 (0.39)	17.5	1.8
PTRK	-0.0001	0.326** (3.90)	-0.0013 (-0.20)	0.0085* (2.45)	-0.00036 (-0.20)	2.4	2.20
ROAD	0.0002	0.806** (12.7)	-0.0046* (-2.00)	0.0046 (0.08)	-0.0011 (0.49)	14.4	1.87
TCL	-0.0009	0.996** (7.33)	0.0016 (0.16)	0.0009 (0.16)	0.0010 (0.33)	6.1	2.08
YELL	0.0001	0.945** (12.1)	0.0011 (0.19)	0.0008 (0.25)	0.00075 (0.45)	15.5	1.86
** Indicates significance at the 0.05 level or better. * Indicates significance at the 0.10 but less than 0.05. Values in parentheses are t-statistics.							
10%, 2-sided test		Do not reject:	DW > 1.76				
		Inconclusive:	1.59 < DW < 1.76				
		Reject:	DW < 1.59				

ing (1994), however, demonstrate that OLS techniques are no more subject to nonsynchronous bias than are models that have been corrected according to the Scholes and Williams or Dimson methods. That being the case, we chose to use an OLS process to estimate our model, the results of which we now turn to discuss.

Empirical Results

Intervention Analysis: Early Post Deregulation Period

For the 1983 through 1985 period, we

expect to find negative or insignificant coefficients on the tax and entry dummy variables and positive coefficient on the fuel dummy variable. A look at Table 1 shows only ten of twenty-two coefficients on tax and entry are negative. Of those that achieve statistical significance, however, all except one (CLEA) have the expected negative sign. But that firm transported mostly liquid chemical material. As such, it probably is not a potential substitute for the other firms in our survey. All the dummy variable coefficients are quite small in absolute terms. Only one of the coefficients (the TAX dummy on CNF) is as large as one percent.

Exhibit 1
Tax Information Items

1985

5/28: President Reagan unveils tax revision plan designed to restore equity to the tax code; proposals aim to slash individual and corporate tax rates and end some breaks. Some business taxes are tagged for increases, however. The basis of the proposal is to broaden the tax base while on average reduce rates such the plan would be at worst "revenue neutral".

5/30: The House Ways and Means Committee opens hearings on President Reagan's tax overhaul plan. Some news reports publish analysis showing Reagan's plan would raise corporate taxation.

11/19: Ways and Means agrees to repeal the investment tax credit and make depreciation schedules less generous.

12/11: Tax overhaul legislation suffers stunning setback as House of Representatives abandons President Reagan in a key procedural vote, 223 to 202 to reject the ground rules for dealing with the measure. Only fourteen Republicans vote for the provision.

12/11: Congressmen who are undecided are at the center of one of the most critical lobbying efforts of the year.

12/17: House passes most sweeping tax overhaul bill in more than 30 years. The law would give individual taxpayers a nine percent tax cut, on average. It would raise the corporate taxes take by \$141.3 billion over five years and eliminate many tax preferences. The bill is sent to the Senate.

1986

5/9: The *Wall Street Journal* publishes an analysis of the identities of those who will win and those who will lose and an estimate of the magnitudes of winnings and losses from the Reagan tax plan.

Exhibit 2
Periods of Inactivity in Stock Trading

FFEX

2/19/87 - 3/5/87
5/20/87 - 6/4/87
9/24/87 - 10/13/87
2/22/88 - 3/7/88
3/17/88 - 4/5/88
4/11/88 - 4/25/88
5/24/88 - 6/15/88

HTLD

5/7/87 - 6/11/87
7/31/87 - 8/17/87

KLLM

11/12/87 - 12/1/87
5/4/89 - 6/12/89
8/23/89 - 9/20/89
2/6/90 - 3/20/90
8/29/90 - 10/4/90
6/20/91 - 7/9/91
8/27/91 - 10/30/91

MRTN

8/1/88 - 8/16/88
12/9/88 - 12/29/88
2/2/89 - 4/11/89
10/30/89 - 11/14/89
10/10/90 - 11/8/90
12/19/90 - 1/2/91
9/23/91 - 2/4/92
3/27/92 - 4/21/92
6/26/92 - 7/14/92
10/2/92 - 10/26/92

PTSI

10/8/91 - 7/20/92
9/29/92 - 10/13/92

TCL

9/22/91 - 10/15/91
4/9/92 - 6/15/92

Portfolio Effects

In order to examine the impact of deregulation upon all the firms combined we construct a composite portfolio including returns to all firms simultaneously. To do so we compute an index of equally weighted geometric mean returns as follows:

$$\text{INDEX} = [(1+r_1)*(1+r_2)*\dots*(1+r_n)]^{1/n} - 1 \quad (2)$$

INDEX aggregates returns to each firm's securi-

ties. We then look at how INDEX was affected by the market's performance, fuel events, and entry events.

This model explains no more than about thirty percent of the variation in the value of INDEX. See Tables 2 and 3 for details of these findings. It is not surprising to find a rather large stochastic element driving the returns in an industry such as this fragmented industry, where deregulation is playing out and only a few of the very largest firms have equities which are publicly traded. Even some of those firms that are traded have significant periods of relative inactivity on exchanges, as noted above. This set of circumstances would make statistical estimation of the true nature of the relationship difficult to capture, leaving a large unexplained, or company specific, component.

The trucking index regression (see Table 2) produces coefficients on tax and fuel with the expected signs, and the fuel coefficient is statistically significant. Given fuel's share of trucking company costs and the downward secular trend in fuel prices over the period, this is

unsurprising.

As Table 3 illustrates, in the early portfolio neither of the shift parameters are statistically significant. This suggests that there are no structural shifts in a or market b of magnitude sufficient to distort our other models. The added competition does not seem to affect the beta coefficient for the industry as represented by the firms we examine in the early period. We may, therefore, conclude that the riskiness of the trucking industry changes very little, if at all, over the early post deregulation period, 1983 - 1986.

Intervention Analysis: Late Post Deregulation Period

The 1986 - 1992 period model was modified to account for slightly different events. Specifically we removed dummy variables pertaining to tax events and structural shifts. We included in their places variables designed to capture the effect of any secular trend in the data and the interest rate on five-year Treasury bonds. We selected that interest rate as a proxy

Table 2
Entry Model Estimates on Early Period, Industry Index

α	β	TAX γ_1	FUEL γ_2	ENTRY γ_3	Adj. R^2	DW
0.000097	0.6138 (0.00)	-0.0013 (0.63)	0.00267 (0.07)	0.00008 (0.92)	27.7	1.82

Stated in parenthesis are the probabilities (p values) associated with each coefficient. Hence the slope parameter and the coefficient on the fuel dummy are statistically significant at the 0.10 level or better.

Table 3
Entry Model Early Period Industry Index Controlling for Structural Market Shifts

α	TAX β	FUEL γ_1	ENTRY γ_2	Shift γ_3	Shift α_s	Adj. β_s	R^2	DW
-0.0003	0.597 (0.00)	-0.0018 (0.50)	0.0019 (0.21)	-0.00062 (0.48)	0.0011 (0.11)	0.0303 (0.67)	27.8	1.82

P values are stated in parenthesis below each estimate as in Table 2 above.

for the macroeconomic state of affairs. The second study period includes twice as many firms as does the first. The two study periods have ten firms in common.

Results of the analysis applied to the later study period can be seen in Table 4 (see page 46). It is clear that the general pattern of results is not substantially different from those found in the early period. For periods during which there was considerable entry we find just two firms, CANX and CNF, to have statistically significant ENTRY coefficients, one of which is

positive.

As above, the INDEX variable is computed for use in further analysis. Here we look only at how INDEX responds to fuel and entry events, an interest rate variable, and any trend that may appear in the data. We also examine changes in the value of the index when only market returns and the interest rate are considered. Results of these tests can be seen in Table 5 which shows the same general pattern of results obtained upon the individual firms across the two time periods.

Table 5
Index, 12/1/86 - 12/31/92

a	S&P	ENTRY	FUEL	TREND	INTEREST
0.003 (0.30)	0.418 (0.00)	-0.00009 (0.91)	0.0004 (0.72)	0.00000007 (0.36)	-0.0005 (0.15)
Adj. R ² = 16.1%; Durbin-Watson statistic = 2.21 Index, 12/1/86 - 7/13/87					
a	S&P	INTEREST	R ²	DW	
0.008 (0.17)	0.353 (0.00)	-0.0013 (0.13)	22.4	2.12	
Index, 6/6/91 - 11/23/91					
a	S&P	INTEREST	R ²	DW	
0.004 (0.44)	0.473 (0.00)	-0.00056 (0.49)	7.3	2.33	
Index, 8/10/88 - 9/20/89					
a	S&P	INTEREST	R ²	DW	
0.01 (0.19)	0.408 (0.00)	-0.0012 (0.159)	15.8	2.51	
Index, 3/14/90 - 7/9/91					
a	S&P	INTEREST	R ²	DW	
0.034 (0.015)	0.50 (0.00)	-0.004 (0.016)	14.8	2.32	
Index, 12/1/86 - 12/31/92					
a	S&P	INTEREST	R ²	DW	
0.005 (0.023)	0.41 (0.00)	-0.0007 (0.019)	16.2	2.21	

Profitability Analysis

Financial data from *Value Line* and *Moody's* are used to examine profitability of eight existing firms and twenty new entrants. The firms are listed in Exhibit E.

Looking simply at economic returns to the enterprises, we see a somewhat different pattern emerging. We looked at the long-run return to total capital and profit margins for our sample firms and found a distinct trend for profitability to decline among both existing and newly entering companies as the industry developed. Table 6 shows means of ROTC and profit margin for existing versus new entrant firms. Profit margins are significantly higher for the new entrant firms. This suggests those firms were more efficient than were existing firms. It also suggests entrants

Table 4
Entry Model Estimates for Late Period, 1986 - 1992

Company	ENTRY a	FUEL b	INTEREST g ₁	Adj. g ₂	g ₃	R ²	DW*
Entrants Firms							
0.0022	0.152**	0.00001	0.0009	-0.00017	0.5	2.40	
(3.40)	(0.01)	(0.55)	(-0.32)				
0.0093	0.400**	-0.0013	0.0022	-0.00101	1.3	2.31	
		(4.79)	(-0.43)	(0.68)	(-1.02)		
FFEX	0.0091	0.226**	0.0006	0.0005	-0.00097	1.0	2.08
		(4.16)	(0.33)	(0.24)	(-1.51)		
FRLM	0.0076	0.202	0.0032	0.0022	-0.00094	0.0	2.75
		(1.56)	(0.70)	(0.43)	(-0.61)		
HTLD	0.0050	0.320**	0.0007	-0.0012	-0.00044	1.3	2.67
		(4.84)	(0.33)	(-0.47)	(-0.56)		
JBHT	0.0046	0.660**	-0.0002	-0.0004	-0.00055	8.7	2.23
		(12.23)	(-0.13)	(-0.21)	(-0.87)		
KLLM	0.0101	0.154**	0.0009	0.0010	-0.00123	0.3	2.70
		(2.25)	(0.39)	(0.39)	(-1.52)		
MNXI	0.0098	0.524**	-0.0018	0.0025	-0.00127	2.8	2.46
		(6.67)	(-0.65)	(0.84)	(-1.36)		
MRTN	0.0068	0.360**	0.0004	-0.0002	-0.00080	0.6	2.75
		(3.47)	(0.12)	(-0.04)	(-0.65)		
MSCA	0.0081	0.606**	-0.0018	0.0002	-0.00092	6.7	2.23
		(10.59)	(-0.90)	(0.11)	(-1.36)		
ODFL	0.0057	0.054*	0.0010	0.00001	-0.00070*	0.5	2.30
		(2.03)	(1.10)	(0.01)	(-2.23)		
PTSI	0.0448	0.116	-0.0059	0.0125	-0.00500	0.0	2.64
		(0.40)	(-0.57)	(1.10)	(-1.45)		
TRUK	0.0062	0.379**	0.00007	-0.0019	-0.00079	1.6	2.31
		(5.18)	(0.03)	(-0.70)	(-0.91)		
WERN	0.0083	0.539**	-0.0002	0.0023	-0.00101	6.7	2.17
		(10.48)	(-0.10)	(1.14)	(-1.67)		
Incumbent Firms							
ABZ	0.0024	0.544**	-0.0009	-0.0008	0.00032	8.8	2.04
		(12.30)	(-0.58)	(-0.47)	(0.61)		
AIND	0.0038	0.301**	-0.0004	0.0001	-0.00033	1.2	2.75
		(4.67)	(-0.16)	(0.04)	(-0.44)		
CAO	0.0006	0.458**	-0.0005	0.0002	-0.00014	5.4	1.96
		(9.58)	(-0.32)	(0.12)	(-0.26)		
CNF	0.0066	0.869*	0.0025	0.0041*	-0.00099	15.6	2.01
		(16.67)	(1.34)	(2.02)	(-1.60)		
PTRK	0.0001	0.658**	-0.0012	0.0013	-0.00009	3.8	2.40
		(8.00)	(-0.40)	(0.40)	(-0.10)		
ROAD	0.0035	0.780**	0.0005	0.0017	-0.00045	22.7	1.81
		(21.25)	(0.37)	(1.21)	(-1.04)		
TCL	0.0199	0.229	-0.0031	0.0004	-0.00232	0.0	2.39
		(1.17)	(-0.45)	(0.05)	(-1.00)		
YELL	0.0010	0.715**	-0.0010	0.0017	-0.00017	15.5	1.86
		(16.87)	(-0.65)	(1.04)	(-0.34)		

** Indicates significance at the 0.05 level or better.

* Indicates significance at the 0.10 but less than 0.05. Values in parentheses are t-statistics.

Durbin-Watson test ranges:

Do not reject: DW > 1.76

Inconclusive: 1.59 < DW < 1.76

Reject: DW < 1.59

Table 6
Tests of Means

	Existing Firms	Entrants Firms
Return on Total Capital		
Mean	0.1031667	0.0855056
Observations	90	180
Pooled Variance	0.0050357	
degrees of freedom	27	
t test	19.025612*	
Z test	1.9110049*	
Profit Margin		
Mean	0.0312551	0.0435978
Observations	98	184
Pooled Variance	0.0014528	
degrees of freedom	21	
t test	-65.18745*	
Z test	-2.693634*	

* Indicates significance at the 0.01 level or better

ROTC = Net Income/Book Value of Equity + Book Value
of Long-term Debt

Profit Margin = Net Income/Sales

were exploiting the most profitable niches, in particular the TL (truck load) niche.

Existing firms' ROTC averages 10.3% compared to 8.6% for new entrants. The higher ROTC reflects the entrenched business of the existing firms as well as the accounting for equity using historical cost, which typically undervalues equity for existing firms, compared to new entrants. Profit margins and ROTCs for existing and new entrants tended to fall over the period, as Graphs 1 and 2 clearly show. Falling profits suggest that the entry of new firms began to push the industry in the direction of a competitive equilibrium. While we found no evidence during intervention periods of reduced stockholders' returns for individual firms, we do find that the compound average annual return in the 1980 - 1986 period is 25.7% for existing firms and 19.3% for two new entrants. However, compound annual average returns for the 1987 - 1992 period is 6.1% and 6.7%, respectively for existing and new entrant firms. Lower profit margins and ROTC's would be expected to translate into lower shareholder returns. In this

instance, returns fall for both existing firms and new entrants to below S&P 500 average levels for 1987-92.

Conclusions

During the years following deregulation in 1980, there were a large number of entrants with new equity offerings during the period 1983 through 1992. This entry increased the degree of competition in the market, which was the intended result of deregulation. And the extent of entry was, therefore, the way in which we measured impact of deregulation. During the early part of the post deregulation period, 1983 to 1986, we find support for our hypothesis that entry and expansion of new firms into the trucking market tends to

have negligible effects on trucking company returns, when accounting for information concerning planned and actual reductions in the investment tax credit and fuel price changes. Entry also tends to decrease ROTCs and profit margins, as we expected. The impact of entry and the increase in industry competition after deregulation does not seem particularly significant to the eight existing firms, all of which were largely LTL operators. One reason for this may be that new and expanding TL firms are typically considerably smaller than and represent indirect competitors to most LTL firms. In addition, the fundamental structural adjustments occurred prior to the 1980 implementation of deregulation as stock prices of the large LTL firms declined in anticipation of more vigorous competition spawned by deregulation.

As noted above, prior to deregulation, profitability rates for existing trucking companies clearly exceeded subsequent profits. Market entry, motivated by the passage of MCA, reduced substantially, if not eliminated, those profits. Profit margins for existing and new entrant firms

Profit Margins

Existing and New Trucking Companies

Return On Total Capital

Existing and New Trucking Firms

reached rough equality by 1989. ROTC's, however, of new entrants are structurally lower than are those of existing firms. We think this can be attributed to the use of historical cost in valuing capital. The cost of capital for older firms, based on book value, would be understated relative to the cost of capital for firms which acquired capital more recently. It is not clear whether this explanation accounts for the entire five percent gap between ROTC of existing versus new entrant firms, however.

In the post deregulation environment the trucking industry structure allows easy entry. In spite of some consolidation, the industry appears competitive through entry. As IPOs occur, stock market returns of the existing firms are unaf-

fected, yet profitability fell. This suggests that overall industry returns are at the competitive level already. We also find no shifts in risk as measured by the shift variable for beta risk. In that regard the industry appears to have stabilized during the post deregulation period.

Deregulation stimulated more competition as new firms went public. The entry event does not seem to affect intervention period returns to existing firms, either individually or collectively, but competition does reduce ROTC and profit margins for both existing and new entrant firms over longer horizons. Adding capital to firms in any industry composed of many small firms may not affect the existing firms. This may be especially true when capital is added in

Appendix A
Trucking Companies in Surveys

Early Period Entry: 1983 – 1986

Company Name	Ticker Symbol	LTL/TL
1. Arkansas Best	ABZ	LTL
2. Arnold Industries	AIND	LTL
3. Carolina Freight	CAO	Mainly LTL
4. Chemical Leaman Corp.	CLEA	Liquid Bulk
5. Consolidated Freightways	CNF	LTL
6. J. B. Hunt	JBHT	TL
7. Preston Corp.	PTRK	LTL
8. Roadway Services	ROAD	Mainly LTL
9. Transcon, Inc.	TCL	LTL
10. Builders Freight	TRUK	TL
11. Yellow Freight System, Inc.	YELL	Mainly LTL

Later Period Entry: 1987 – 1992

Company Name	Ticker Symbol	LTL/TL
1. Arkansas Best	ABZ	LTL
2. Arkansas Freightways	AFW	LTL
3. Arnold Industries	AIND	LTL
4. Cannon Express Inc.	CANX	TL
5. Carolina Freight	CAO	LTL
6. Consolidated Freightways	CNF	LTL
7. Frozen Food Express	FEX	Combination
8. Freymiller Trucking	FRML	TL/Refrigerated
9. Heartland Express	HTLD	TL
10. J. B. Hunt	JBHT	TL
11. KLLM Transport	KLLM	TL/Refrigerated
12. MNX Transport	MNXI	TL
13. Marten	MRTN	TL/Refrigerated
14. MS Carriers	MSCA	TL
15. Old Dominion Freight Lines	ODFL	LTL
16. Preston Corp.	PTRK	LTL
17. P.A.M. Transportation Services	PTSI	TL
18. Roadway Services	ROAD	Mainly LTL
19. Transcon Inc	TCL	LTL
20. Builders Freight	TRUK	TL
21. Werner Enterprises Inc.	WERN	TL
22. Yellow Freight System Inc.	YELL	Mainly LTL

relatively small increments. No firms have raised sufficient capital, either internally or externally, to allow domination in the industry. The industry appears to be able to absorb many new entrants, enhancing the competitive struc-

ture of the industry - a major goal of the MCA of 1980.

Implications For Future Research

As with any empirical study, our conclusions are necessarily limited by the purpose, scope, and methodology of our study. Defining limits means there are questions, perhaps very important and interesting ones, left for later investigation. In this section we suggest some of the questions which were beyond the limits of this study and may bear study focusing upon them.

For example, we examine only relatively actively traded publicly owned, companies, excluding all other firms that provide service similar to those publicly traded firms in our sample. Such firms account for a significant portion of the industry's capacity and market share, however. Among those excluded are several large non-publicly owned firms and owner operators who operate from one to twenty trucks. Private fleets (e.g. Wal-Mart) also contribute to industry competition since company trucks may accept loads for back-hauls, which would otherwise be dead-head return trips. Competition of this sort may be included in future studies by examining the number of available trucks (new production plus existing stock)

for each shipment. A higher ratio of available trucks for each shipment would indicate more intense competition and more pressure on freight rates.

Appendix B Tax Event Dates

1. 5/28/85 through 5/30/85
2. 11/18/85 through 11/19/85
3. 12/11/85 through 12/17/85
4. 5/9/86
5. 10/20/86

Appendix C Fuel Price Event Dates

1. 12/9/85 through 12/11/85
2. 2/4/86 through 3/13/86
3. 8/10/88 through 9/20/89
4. 3/14/90 through 7/9/91

Appendix D Entry Event Dates

1. 5/5/86 through 11/6/86
2. 12/1/86 through 7/13/87
3. 8/10/88 through 9/20/89
4. 6/6/91 through 12/31/92

Aggregate profits are a function of shipping rates less costs of providing transportation service. This study shows that falling freight rates have driven down profit margins and ROTCs. To understand more fully the dynamics of the industry following deregulation. A broader definition of the industry, including trucking companies which are not publically traded or publically owned or are parts of fleets not generally common carriers, and intermodal competition may offer a better view of what is driving returns in the trucking industry.

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Appendix E
Existing Firms and Date of New IPO's
SIC Industry Code: 4213

New IPO's	Existing Firms, 1983
1983	Arkansas Best
Builders Freight - 8/29	Arnold Industries
J. B. Hunt - 11/28	Carolina Freight
	Chemical Lehman
1984 and 1985	Consolidated Freightways
None	Preston, Corp.
	Roadway Express
1986	Transcon, Inc.
MS Carriers - 5/5	Yellow Freight
Werner Enterprises - 6/30	
KLLM Transport - 7/7	
MNX - 7/28	
PAM Transportation - 8/19	
Marten Transport - 9/29	
Kenan Transport - 10/13	
Heartland Express - 11/6	
1987	
Cannon Express - 3/2	
Freymler Trucking - 4/10	
1988	
Frozen Food Express - 8/15	
1989	
Matlack Systems - 1/16	
Arkansas Freightways - 3/30	
FRP Properties - 1/3	
1990	
Swift Transportation - 5/17	
1991	
Old Dominion - 10/28	
Anuhco, Inc. - 11/12	
1992	
USA Truck - 3/25	
OTR Express - 1/22	

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Appendix F
Where Are They Now?

Existing Firms

Arkansas Best - Still exists, took over World Way which was new name of Carolina Freight
Arnold Industries - Still exists
Carolina Freight - Changed name to World Way which was taken over by Arkansas Best
Chemical Lehman - Out of business
Consolidated Freightways - Split into CNF and CF Motor Freight
Preston, Corp. - Bought by Yellow Freight, 1990
Roadway Express - Roadway Services became Caliber Systems and Roadway Express, FedEx agreed to purchase Caliber Systems with its RPS package delivery unit as of late 1997.
Transcon, Inc. - Bankrupt
Yellow Freight - Still exists, bought Preston, Corp, 1990.

Entrants

Builders Transport - Still exists, in bankruptcy in 1997
J. B. Hunt - Still exists
MS Carriers - Still exists
Werner Enterprises - Still exists
KLLM Transport - Still exists
MNX - Acquired by Mark VII after bankruptcy
P.A.M. Transportation - Still exists
Marten Transport - Still exists
Kenan Transport - Still exists
Heartland Express - Still exists
Cannon Express - Still exists
Freymiller Express - Bankrupt, assets acquired by AmeriTruck Distribution Company
Frozen Food Express - Still exists
Matlack Systems - Still exists
Arkansas Freightways - Still exists as American Freightways
FRP Properties - Still exists
Swift Transportation - Still exists
Old Dominion - Still exists
Anuhco - Still operates under auspices of Transfinancial Holdings
USA Truck - Spun off from Arkansas Best in management-lead LBO
OTR Express - Still exists
TNT Freightways - Still exists as US Freightways