Does Competition Make Businesses Resilient?

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This study investigates the relation between industry-level competition and the stock market's response to an exogenous shock. Specifically, we utilize the stock market's reaction to the terrorist attacks on September 11, 2001, which caused a significant market decline. Our findings reveal that firms operating in highly concentrated industries (lower competition), as measured by the Herfindahl index, experienced more pronounced negative returns following the attacks. Therefore, firms in less competitive fields may not be prepared for the unexpected. These results support the notion that competition bolsters business resilience to shocks and underscore the importance for investors to consider product market structures when evaluating firm performance.

Keywords: industry competition, resiliency, exogenous shock, product market-structure, Herfindahl index

INTRODUCTION

We examine the effect of industry concentration on business resilience as measured by stock price reaction to an exogenous event. This study compares the stock price reaction of firms in high concentration to firms in low concentration industries after the terrorist attacks of September 11, 2001. We find that firms in less competitive industries (high concentration) had stronger negative market reactions than firms in more competitive industries (low concentration), implying that greater competition makes businesses more resilient to exogenous shocks.

This analysis contributes to three research areas: the effect of firm-level variables on stock price reaction from an exogenous shock, the impact of competition on different aspects of firm performance, and finally, the stream of literature that studies business resiliency.

The September 11 terrorist attacks setting has been used to study the relationship between the stock price decline and firm-level variables, including the level of debt (Howe and Jain 2010), cash holdings (Jain and Prasad 2011), bank size (Jain, Prasad, and Poudel 2019) and the distress risk level as measured by the Altman's Z Index (Poudel, Prasad, and Jain 2020). We extend this stream of literature by examining the role of market structure in the event of an exogenous shock.

The second relevant stream of literature studies the effect of the level of competition on various aspects of firm performance. The number of publicly listed companies is decreasing, and the concentration level is increasing across industries. Grullon, Larkin, and Michaely (2016) use Herfindahl index (HHI) to document an increase in concentration in over 75 percent of US industries. They document the effect of this change on profit margins, mergers and acquisitions, and stock returns. Hou and Robinson (2006) find that U.S. firms in highly concentrated industries earn lower stock returns, even after controlling for size, book-to-market ratio, and momentum. Their findings suggests that lower competition insulates firms from aggregate demand shocks, reducing risk and, by extension, the expected returns.

The third relevant stream of literature studies the concept of resiliency in the context of businesses. The concept of firm resilience is defined by McPhee (2014) as "the capacity to survive disruptions". Much literature in this area is reviewed and summarized by Linnenluecke (2017) and Conz and Magnami (2020).

Over time, the understanding of resilience has evolved into several areas of inquiry. One area identifies how human capital training and development impacts firm resilience in productivity, product diversification, innovation, and environment (Menendez Blanco and Montez-Botella, 2016). The second emphasizes firm-level innovation and adaptive strategies (Watanabe et.al. 2004, Sheffi and Rice 2005, Pal et.al, 2013), while a separate thread addresses the reliability and diversification of supply chains (Li, et. al. 2022). Lastly the role of stakeholders and the implementation of responsible business practices have emerged as factors in firm resiliency and sustainability (Ortiz de Mandojana and Bansal, 2016). We believe that our use of market structure adds to this rich literature on business resiliency.

The rest of the paper is organized as follows: section 2 describes the data and methodology; section 3 discusses results, and we conclude in section 4.

DATA AND METHODOLOGY

The sample used in our analysis consists of firms listed on the NYSE, AMEX, and NASDAQ. We require that data be available in both CRSP's daily returns file and COMPUSTAT's industrial annual file for the year 2001. After excluding firms with negative assets or sales values, the CRSP-COMPUSTAT merged file yielded 3,695 unique firms. Imposing the additional criterion that all variables used in the regression be available reduced the number of firms to 3,471.

Following the established literature on HHI (e.g., Hou and Robinson, 2006), we calculated the Herfindahl-Hirschman Index (HHI) as follows: We determined the market share of each firm within its sector, defined by the three-digit SIC classification. The market share of each firm was then squared and summed to obtain the HHI. Consistent with the U.S. Department of Justice's categorization of firm concentration, we grouped firms based on their HHI levels as follows: low (below 1500), medium (between 1500 and 2500), and high (above 2500). This classification resulted in 550 firms in the low concentration category, 1,890 firms in the medium concentration category, and 1,031 firms in the high concentration category. In unreported tables, we replicated the study using quartile-based grouping and found similar results. We also replicated the study after excluding regulated sectors and found no difference in our conclusions.

We utilized the following regression equation to calculate a 3-day cumulative abnormal returns (CARs) for each firm in our initial analysis and for robustness tests. For the main regression analysis, we calculate the CARs for a portfolio of U.S. firms, grouped according to their HHI levels as follows:

$$R_{pt} = \alpha_p + \beta_p R_{mt} + \gamma_{pk} D_{kt} + \varepsilon_{pt} \quad (1)$$

where R_{pt} is the daily return over 248 days, from January 2, 2001 to Dec 31, 2001, for either each firm or a portfolio as explained earlier, depending on the analysis. R_{mt} is the return on the CRSP value–weighted index, equal to 1/3 for each of the three event days and zero otherwise. Accordingly, the parameter γ_p represents the CAR over the three event days. To address potential heteroscedasticity and autocorrelation issue, particularly arising from the common event, we use Newey–West (1987) consistent standard errors.

Table 1 reports the key statistics for the variables utilized in our regression model. The table shows that firms in the high-concentration sectors are larger based on both market value of equity and assets size but have slightly lower market-to-book ratio. The average Herfindahl index (HHI) is 4,712 for high concentration portfolio 1,933 for medium concentration, and 915 for low concentration portfolio. The average Cumulative Abnormal Returns (CARs) over three event days following the 9/11 attacks are: -4.38% for high concentration portfolio, -3.15% for medium concentration portfolio, and -2.37% for low concentration portfolio, all statistically significant at the 1% level. Of the 3,471 unique firms, 550 are in low low-concentration category, 1,890 are in medium concentration category and 1,031 are in high concentration category.

TABLE 1
DESCRIPTIVE STATISTICS

Variable	All firms	Low HHI	Medium HHI	High HHI
Market Value ($ million)	6,288	6,114	5,054	7,264
Asset Size ($ million)	3,880	3,603	3,282	4,708
Market/Book ratio	3.30	3.56	3.03	2.96
Herfindahl Index	2,204.32	915	1,933	4,712
3–day CAR (%)	-2.37	-1.06	-3.15	-4.38
CAR T-statistics	-12.76***	-4.01***	-7.37***	-13.8***
Number of firms	3,471	550	1,890	1,031

This table reports summary statistics for variables used in our regression model. 3,471 firms are included in the sample. Low, medium and high HHI refer to the firms with the HHI below 1500 (low concentration), between 1500 and 2500 (medium concentration), and over 2500 (high concentration) respectively. Market value is the market value of equity. Market/Book ratio is the market value of equity divided by the book value of equity. Cumulative Abnormal Return (CAR) was calculated for three days following the 9/11 attacks of 2001 (9/17, 9/18, 9/19). The CARs are computed using the following regression

$$R_{pt} = \alpha_p + \beta_p R_{mt} + \gamma_{pk} D_{kt} + \varepsilon_{pt} \quad (1)$$

where R_{pt} is the daily return over 248 days, from January 2, 2001 to Dec 31, 2001, for a portfolio of US firms in NYSE, AMEX and NASDAQ. R_{mt} is the return on CRSP value–weighted index, and D_{kt} is equal to 1/3 for each of the three event days and zero otherwise. Thus, γp represents the CAR over the three event days. Portfolios are created using equal weights. P–values reported in the parenthesis are based on Newey–West (1987) heteroscedasticity and autocorrelation consistent standard errors. *, ** and *** denote statistical significance at 10%, 5% and 1%.

DISCUSSION OF RESULTS

Table 2 reports the Cumulative Abnormal Return (CAR) over three days following the 9/11 attacks. The table shows that for the equally weighted portfolio, firms in high concentration sectors experienced a significantly larger change in stock returns (-4.63%) compared to firms in medium concentration sectors (-3.33%) and firms in low concentration sectors (-1.15%). Inverse variance weighted portfolio confirms this

finding, indicating that firms in high concentration sectors suffered more than those in low and medium concentration sectors following the 9/11 attacks.

TABLE 2
FIRM SIZE AND ABNORMAL RETURNS: VARIANCE WEIGHTED PORTFOLIOS

VARIABLE	3–day CAR (%)			
	All firms	**Low HHI**	**Medium HHI**	**High HHI**
Equal weighted CAR %	-2.53	-1.15	-3.33	-4.63
F-statistic	754***	478***	1212***	756***
Inverse variance weighted CAR %	-2.20	-0.80	-3.97	-4.22
F-statistic	274***	399***	143***	204***

This table reports the Cumulative Abnormal Return (CAR) over three days following the 9/11 attacks of 2001 (9/17, 9/18, 9/19). The CARs are computed using the following regression.

$$R_{pt} = \alpha_p + \beta_p R_{mt} + \gamma_{pk} D_{kt} + \varepsilon_{pt} \quad (1)$$

where R_{pt} is the daily return over 248 days, from January 2, 2001 to Dec 31, 2001, for a portfolio of US firms in NYSE, AMEX and NASDAQ. The first column presents analysis of a portfolio of 3,471 sample firms, the second column portfolio has sample firms with HHI (Herfindahl Index)<1500 (low concentration), the third column portfolio has sample firms with 1500<HHI<2500 (medium concentration), and the fourth column portfolio has sample firms with HHI>=2500 (high concentration). R_{mt} is the return on CRSP value–weighted index, and D_{kt} is equal to 1/3 for each of the three event days and zero otherwise. Thus, γp represents the CAR over the three event days. Portfolios are created using equal weights. P–values reported in the parenthesis are based on Newey–West (1987) heteroscedasticity and autocorrelation consistent standard errors. *, ** and *** denote statistical significance at 10%, 5% and 1%.

We also employed multivariate analysis with the CARs as the dependent variable as a robustness test. The correlation matrix in Table 3 presents the correlations among the variables used in the analysis. The table shows the expected correlation between the book value of assets (AT) and the market value of assets (MVAT), while other variables have low correlations. This suggests that multicollinearity should not be a significant issue in our analysis.

TABLE 3
CORRELATION MATRIX

Variables	AT	MVAT	MB	HHI	CARs
AT	1.000				
MVAT	0.884	1.000			
MB	0.003	0.080	1.000		
HHI	0.028	0.039	-0.009	1.000	
CARs	0.022	0.038	0.068	-0.096	1.000

This table reports the correlation among the variables used in the multivariate analysis. Correlation is based on 3,471 sample firms used in the analysis. HHI is the Herfindahl index (HHI), which equals 1 if it is a low concentration category, 2 if it is a medium concentration category and 3 if it is a high concentration

category. AT is the book value of assets. MVAT is the market value of assets calculated as the sum of market value equity and the book value of the liability. MB is the market value of equity divided by the book value of equity. We use the following regression equation to compute 3-day CARs for each firm:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \gamma_{ik} D_{kt} + \varepsilon_{it} \quad (2)$$

where R_{it} is the daily return from January 2, 2001 to Dec 31, 2001 on an individual US firm. R_{mt} is the return on CRSP value–weighted index, and D_{kt} is equal to 1/3 for each of the three event days and zero otherwise. Thus, γ_i represents the CAR over the three event days for an individual firm.

Table 4 presents the results of the multivariate analysis. The results show that the market-to-book ratio, log of book value of assets (model I), and log of market value of assets (model II) have the expected relationship with our dependent variables (CARs). Our results indicate a significant negative relationship between sector concentration and the CARs. More precisely, as the level of industry concentration increases (lower to medium to higher), the CARs become more negative, with a difference of 1.68% between each level. This confirms our previous conclusion that firms in higher-concentration sectors are more vulnerable to exogenous market shocks.

TABLE 4
MULTIVARIATE ANALYSIS

Variables	**Dependent variable = Three–day CAR (%)**	
	Model I	**Model II**
N	3,471	3,471
Market/Book ratio	.108**	.085**
	(0.012)	(0.032)
Log of Book Value of Assets	0.244**	
	(0.015)	
Log of Market Value of Assets		0.398***
		(0.000)
HHI Category	-1.68***	-1.67***
	(0.000)	(0.000)
Intercept	-1.267	-2.326***
	(0.128)	(0.005)
R–squared	0.068	0.071
F–statistics	29.7***	33.52***
	(0.000)	(0.000)

This table reports results of multivariate analysis using the Cumulative Abnormal Return over three days following the 9/11 attacks of 2001 as the dependent variable. The explanatory variable of interest is the Herfindahl index (HHI), which equals 1 if it is a low concentration category, 2 if it is a medium concentration category and 3 if it is a high concentration category. In model 1 we have two additional explanatory variables, the market/book ratio and the log of book value of assets. Market/book ratio is the market value of equity divided by the book value of equity. In model 2 we have market/book ratio and the log of market value of assets. The market value of assets is the sum of market value of equity and the book value of liabilities. We use the following regression equation to compute 3-day CARs for each firm:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \gamma_{ik} D_{kt} + \varepsilon_{it} \quad (2)$$

where R_{it} is the daily return from January 2, 2001 to Dec 31, 2001 on an individual US firm. R_{mt} is the return on CRSP value–weighted index, and D_{kt} is equal to 1/3 for each of the three event days and zero otherwise. Thus, γ_i represents the CAR over the three event days for an individual firm. P–values reported

in the parenthesis are based on robust standard errors. *, ** and *** denote statistical significance at 10%, 5% and 1%.

CONCLUSION

This study finds that the stock market discriminates during a crisis because of industry-level competitive structure. It penalizes firms in low-competition industries more than firms in high-competition sectors. This suggests that competition strengthens businesses' resilience. The findings prompt further questions into how competition enhances resilience or conversely, why its absence weakens it. The answers to these valuable insights are left to another study. The relationship identified between resilience and competition deepens our understanding of the impact exogenous events have on a firm's value.

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