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Tobin's *q* Ratio and Firm Performance

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Abstract

Tobin's *q* ratio has been extensively used as a proxy for investment opportunities in the finance literature. If Tobin's *q* is a valid proxy for investment opportunities, we should observe a positive relationship between the *q* ratio and future operating performance of a firm. Extant research, however, has not established this link. In this paper, we provide evidence on the relationship between the *q* ratio and future operating performance for a sample of publicly traded US firms and show that firms with higher *q* ratios experience superior operating performance in the long run.

Keywords: Tobin's *q*, Operating Performance

I. Introduction

Tobin's *q* ratio (Tobin and Brainard (1968); Tobin and Brainard (1977); Tobin (1969); and Tobin (1978)) is extensively used in the financial literature as a proxy for future investment opportunities. The *q* ratio defined as the market value of a firm divided by the replacement cost of the firm's assets. Although the ratio, in its many variations, is a popular choice in empirical studies, no paper to our knowledge has established the linkage between the *q* ratio and the future firm performance. The numerator of the ratio – the market value of the firm – depends on discounted expected future cash flows generated by the firm's assets. Since the denominator of the ratio is simply replacement cost of assets is expressed in present value terms, there exists an implied positive association between a firm's Tobin's *q* ratio and its future cash flows. In this paper we undertake a study to determine whether the expected linkage exists between the Tobin's *q* ratio and future firm operating performance.

Tobin's *q* ratio has been used in a variety of situations in the financial literature to examine different financial phenomena and decisions. The ratio has been used in research related to investment and diversification (Jose, Nichols, and Stevens (1986) Malkiel, von Furstenberg, and Watson (1979)), to explain the relationship between managerial ownership and firm value (McConnell and Servaes (1990) and Morck, Shleifer, and Vishny (1988)), and recently to explain cross-sectional returns implying that it is also a proxy for risk. Lang and Stulz (1994) and Berger and Ofek (1995) use the Tobin's q ratio to determine the relationship between diversification and firm performance. Cho (1998) controls for the endogeneity of ownership structure and uses the *q* ratio to examine the effect of ownership structure on firm value and finds that firm value determines ownership structure and not vice-versa as claimed by Morck, Shleifer, and Vishny (1988). Servaes (1991) and Lang, Stulz, and Walkling (1989) use the *q* ratio to examine the relationship between returns to stockholders of bidders and targets and the market valuation of biders and targets. Wernerfelt and Montgomery (1988) use Tobin's *q* as a measure of firm performance to estimate the relative importance of industry, focus, and share effects. Salinger (1984) uses the Tobin's *q* ratio to measure monopoly power and to examine the relationship between market structure and profitability. Lustgarten and Thomadakis (1987) relate Tobin's *q* to structural features of firms and find that the relationship depends on market conditions. Blose and Shieh (1997) find that there is a significant positive relation between Tobin's q-ratio and the magnitude of stock market reaction to capital investment announcements. Doukas (1995) and Lang and Litzenberger (1989) use the q ratio to test the cash flow signaling

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and free cash flow or overinvestment explanations of the impact of dividend announcements on stock prices. The use of Tobin's *q* is not limited to the financial literature. In a paper published in Management Science, Bhardwaj, Bhardwaj, and Konsynski (1999) use Tobin's *q*, to examine the association between IT investments and firm *q* values, after controlling for a variety of industry factors and firm-specific variables. Aside from the papers mentioned above, there are numerous other papers in the financial literature in which *q* ratio is used as a control variable in empirical analyses. Kim and Lyn (1986) use the ratio to explain the positive relationship between excess market value of multinational corporations and the degree of international involvement as measured by foreign sales percentage.

Because of its widespread usage in empirical finance, the *q* ratio may be considered an important variable. Many papers have attempted to measure the *q* ratio using methodologies ranging from complex to relatively straightforward. Some of the complex methodologies (Lindenberg and Ross (1981), Hall (1990), and Lewellen and Badrinath (1997)) require data from a variety of sources, some of which may be missing for many firms. Chunk and Pruitt (1994) present a simpler formula for approximating the Tobin's *q* ratio and find that their approximate *q* correlates well with the more theoretically *q* ratio obtained using the Lindenberg and Ross method. Megna and Klock (1993) present a refinement of approaches to measurement of the *q* ratio and present results for the semi-conductor industry. Perfect and Wiles (1994) show that Tobin's *q* and the market value of firms divided by book value of assets (our proxy for the *q* ratio) are highly correlated.

While much of the debate in the literature has centered on how best to measure the *q* ratio, an important aspect has not received any attention. Since the methods mentioned above lead to similar estimates of the ratio, it is pertinent to ask if the ratio measured using any of the methodologies is indeed a proxy for growth opportunities. If the measured *q* ratio is a valid proxy for future investment opportunities, we would expect to observe superior future operating performance for firms with higher *q* ratio. In other words, we would expect to observe a positive relationship between the observed *q* ratio and future operating performance.

We use a sample of publicly traded US firms to determine the expected linkage between the Tobin's *q* ratio and expected future firm performance. Following Daines (2001), we define the *q* ratio as a firm's market value divided by the replacement cost of the firm's assets. Our measure of firm performance is EBITDA scaled by sales. As expected, in the univariate analyses we observe higher *q* ratio associated with superior future firm performance. We then conduct our multivariate analyses to examine if the relationship between the *q* ratio and future operating performance is affected by introduction of other variables which have been known to affect future firm performance. The results are consistent with those of the Univariate analyses and we find significantly superior performance for firms with higher *q* ratio.

The paper is organized as follows. Section II defines the *q* ratio and presents a description of our sample. Section III contains the main results of the paper. Section IV concludes.

II. Tobin' *q* Ratio and the Sample Description

Tobin's *q* ratio is assumed to represent a firm's investment or growth opportunities. If Tobin's *q* does represent growth opportunities, there should be a positive relationship between the Tobin's

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q ratio and future operating performance for a firm. We define the *q* ratio as a firm's market value divided by the replacement cost of the firm's assets. Consistent with Daines (2001) we estimate the *q* ratio using data available in Compustat. The market value of common stock is obtained from the firm's fiscal year-end stock price and shares outstanding. Preferred stock and debt are assumed to have a market value equal to book value. Replacement cost is estimated from the book value of the firm's assets. Daines argues that while more complex estimates of Tobin's *q* can be calculated, this simple measure produces unbiased and conservative estimates (Perfect and Wiles, 1994). We follow Daines (2001) and plan to compute an alternative measure of the Tobin's *q* by using a methodology similar to Perfect and Wiles.

We create a sample that includes all exchange-traded firms on Compustat between 1988 and 2004. Our sample stops in 2004 because our tests require five years of data after the last year of construction of the *q* ratio. To limit survivorship bias, we also include firms in Compustat's research files, which include firms that were acquired or went bankrupt. Consistent with prior research, we omit regulated utilities, banks, and financial firms. To measure investment made in different segments by firms, we also require that firms have Compustat data on capital expenditures made in various business segments in the firm reported audited annual financial statements. As a check for data integrity, we exclude any firm for which the sum of segment assets does not fall within one percent of the assets reported by the firm. There are some extreme values in our estimates of *q* ratio and our measure of operating performance. We adopt a ranked approach in our regression analyses to limit the effect of outliers on our estimation. Our proxy for the operating performance of our sample firms is provided by operating cash flows scaled by the assets of the firm (*EBITDA/SALES*). Our data requirements result in a sample of 56,719 firm-years. We relate the *q* ratio with the operating performance of our sample firms over each of the five year periods after the computation of the *q* ratio. We also present results for a subsample of our firms which were present in each of the five years after the computation of the *q* ratio. We also control for other variables that may have effect on firm operating performance. We include other operating measures, such as total assets, current ratio, P/E ratio, operating loss to control for confounding effects. We also include R&D expenditure scaled by the # of employees and physical resource measure which is calculated as the difference total assets and current assets and scaled by total assets. The former is an indicator for innovation while the latter is a measure of the relative magnitude of the physical assets holdings (Surroca, Tribo, and Waddock, 2010).

III. Results

To measure the relationship between the *q* ratio and future firm performance, we first compute the *q* ratio for each firm using the method described previously. Future performance is likely to depend on investment made in the current period. For example, if for a firm marginal *q* is higher than the average *q*, then an investment at the higher marginal *q* will increase the average *q* ratio for the firm. We include the current investment decisions made by firms by including segment investment of a firm in our measure of the *q* ratio for that firm. To do that, we first compute the *q* ratio for a segment in which investment is made as the median *q* ratio of all the standalone firms in that industry (4-digit SIC). We then compute the after-investment *q* ratio for the firm as a weighted average of the current average *q* ratio and the *q* ratio for each segment in which investment is made in the current period. In our formulation weights are the firm's total assets in the current period and segment capital expenditure during the period. EBITDA has been used as

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a proxy for operating performance of firms in a number of studies. We also use EBITDA scaled by assets as our proxy for the operating performance of sample firms.

Table 1 presents our first result. In panel A, we divide our sample firms, based on our estimate of the *q* ratio, into 10 *q* ratio portfolios. Then we observe the operating performance of each firm in the portfolio over each of the subsequent five years. Table 1 shows that for all the 10 portfolios there is a monotonic relationship between the median portfolio *q* ratio and subsequent operating performance in each of the five years after the portfolio formation. In Panel A, the composition of the sample is not fixed as firms may not be present in each of the post-portfolio formation years. In Panel B, we restrict the sample to only those firms that exist in each of the five subsequent years. The results are qualitatively unchanged.

Close analysis indicates that for any future year, the change in median E/S from portfolio 1 to portfolio 10 shows a U shape, that is, the change in the median E/S increases with portfolios at a decreasing rate at first and then start to increase at an increasing rate. For example, for year +1, the median E/S change from portfolio 1 to portfolio 2 is 49.06%, then it decreases to 26.58% from portfolio 2 to portfolio 3, with the trend continues to only 3.73% from portfolio 6 to portfolio 7. After that, the changes in median E/S picks up another 7.19% increase from portfolio 7 to portfolio 8, and it keeps increasing at an increasing rate until it reaches 20.61% from portfolio 9 to portfolio 10. This pattern is largely held for all the future 5 years for both panel A and panel B. This indicates that Tobin's q differentiates future operating performance more for the two extreme ends. The implication for the firms from this interesting pattern is that when firms improve upon the Tobin's q measure, they should focus on more on dramatic improvement because it brings more superior future operating performance differentials.

The other observation from Table 1 is that for any given portfolio, the changes in median E/S from future years tend to be quite inertia. In other words, the median E/S for year +x has very minor changes from previous year after year +2, which indicates that the effect of Tobin's q on future operating performance tends to diminish in the longer term. The biggest changes in median E/S are between year +1 and year +2, however, the change is not always increasing. The interesting aspect is that the median E/S increases from year +1 to year +2 for the lower half of the portfolios but decreases for the upper half of the portfolios.

Next, in Table 2, we examine the correlations between our measure of the q ratio and subsequent operating performance of the sample firms. To be consistent with Table 1, we also show the Spearman Correlations between Tobin's q ratio and future operating performance for the full sample as well the partitioned sample with the firms have the entire five year records.

First of all, the correlations between Tobin's q ratio and future operating performance seem to be independent of sample size. Panel A and Panel B demonstrate similar trends in Spearman correlations. In general, there are high correlations between the q ratio and the future operating performance. Tobin's q ratio has the highest correlation with year +1 operating performance, and the correlation declines about 5-6% for year +2 and then it maintains at a stabilized around 0.25 for all the subsequent years. The correlation indicates that Tobin's q ratio has a long-term impact on the firm's operating performance, not just a short-term effect.

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Table 3 presents results of the multivariate analysis. We regress EBITDA/SALES on Tobin's q ratio, with other control variables. The results show that q ratio is highly significant with respect to all the future 5-year proxy to the operating performance; which indicates that firms with higher q ratio present superior performance in the future. The multivariate analysis is also consistent with the univariate analysis from Table 2 in that the coefficient on Tobin's q ratio for year +1 is higher than all the subsequent years, and the coefficient on all the subsequent years are quite stable and stationary, which indicates that Tobin's q ratio has constant impact on firms' future operating performance, although to a slightly lesser extent for year +2 and beyond.

Among all the control variables, other than the measure of operating loss (LOSS), all show positive relationship with E/S. The logarithm total assets measure (LNTA) is positive and significant for all the future operating performance. Leverage (TDTA) is not significant for the first three years of the analysis, but is significant for year+4 and year+5 suggesting that persistently higher leverage has a negative impact on firm performance. Current ratio, which is the ratio between current assets and current liabilities, and P/E ratio are both significant in determining the future operating status. EMPLS is R&D expenditure scaled by Number of employees, which is an indicator of innovation, shows that the level of innovation also has impact on firms' future operating performance. However, given the presence of Tobin's q ratio, the magnitude of the innovation impact is relatively minor. PHYRES is a measure of physical resources, which is a proxy of how efficiently the capacity-related assets are utilized within the firm. The regression analysis shows that PHYRES has influence on future operating performance in both the magnitude and the significance.

Overall, our empirical analyses demonstrate that Tobin's q ratio has significant effect on the firms' future operating performance. Therefore, it is confirmed that as a proxy for the future investment opportunities, firms with higher q ratios experience superior operating performance in the long run.

IV. Conclusion

The Tobin's *q* ratio is defined as market value of a firm divided by the replacement cost of its assets. Therefore, there must exist a positive relationship between the Tobin's *q* ratio and future firm performance for the ratio to be a valid proxy for a firm's investment opportunities. Prior literature has not examined this linkage between the Tobin's *q* ratio and future firm performance. Using a sample of publicly traded US firms, this paper examines the relationship and finds that higher Tobin's *q* ratio is related to higher future operating performance for the sample firms. It is pertinent to note that this paper uses a relatively simple proxy for the Tobin's *q* ratio. Although prior research indicates otherwise, it is possible that our proxy does not adequately capture the spirit of the Tobin's *q* ratio and that the results will be different with a proxy that captures the *q* ratio more accurately.

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Table 1

Panel A: Operating performance of firms relative to the year of the *q* ratio

Portfolio	NOBS	Median E/S Year+1	Median E/S Year+2	Median E/S Year+3	Median E/S Year+4	Median E/S Year+5
1	10,502	0.053	0.061	0.064	0.069	0.072
2	10,561	0.079	0.084	0.087	0.090	0.091
3	10,616	0.100	0.103	0.105	0.105	0.108
4	10,617	0.113	0.115	0.118	0.119	0.118
5	10,625	0.127	0.128	0.129	0.130	0.130
6	10,624	0.134	0.134	0.134	0.135	0.136
7	10,644	0.139	0.136	0.134	0.134	0.133
8	10,610	0.149	0.146	0.143	0.142	0.141
9	10,623	0.165	0.159	0.154	0.152	0.149
10	10,605	0.199	0.187	0.180	0.177	0.173

Panel B: Operating performance of only those firms present in all the 5 years relative to the year of the *q* ratio

Portfolio	NOBS	Median E/S Year+1	Median E/S Year+2	Median E/S Year+3	Median E/S Year+4	Median E/S Year+5
1	6,675	0.064	0.071	0.073	0.074	0.074
2	6,666	0.088	0.092	0.095	0.095	0.095
3	6,664	0.108	0.109	0.111	0.112	0.112
4	6,665	0.124	0.125	0.126	0.126	0.124
5	6,657	0.133	0.132	0.133	0.132	0.131
6	6,669	0.136	0.136	0.134	0.136	0.136
7	6,667	0.139	0.137	0.137	0.135	0.134
8	6,663	0.152	0.149	0.146	0.145	0.143
9	6,666	0.168	0.162	0.156	0.154	0.151
10	6,652	0.209	0.197	0.189	0.183	0.178

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Table 2

Panel A: Spearman Correlations between Tobin's ratio and future operating performance for the full sample

	q Ratio	E/S Year+1	E/S Year+2	E/S Year+3	E/S Year+4	E/S Year+5
***q* Ratio**	1.00					
E/S Year+1	0.33	1.00				
E/S Year+2	0.27	0.86	1.00			
E/S Year+3	0.25	0.78	0.87	1.00		
E/S Year+4	0.23	0.74	0.79	0.88	1.00	
E/S Year+5	0.22	0.71	0.75	0.80	0.88	1.00

Panel B: Spearman Correlations between Tobin's ratio and future operating performance for only those firms present in all the 5 years relative to the year of the *q* ratio

	q Ratio	E/S Year+1	E/S Year+2	E/S Year+3	E/S Year+4	E/S Year+5
***q* Ratio**	1.00					
E/S Year+1	0.33	1.00				
E/S Year+2	0.28	0.87	1.00			
E/S Year+3	0.25	0.79	0.88	1.00		
E/S Year+4	0.23	0.74	0.80	0.88	1.00	
E/S Year+5	0.22	0.71	0.75	0.80	0.88	1.00

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Table 3: Multivariate analyses

	E/S Year+1		*E/S* Year+2		*E/S* Year+3		*E/S* Year+4		*E/S* Year+5	
Variable	**Estimate**	***P*-value**	**Estimate**	***P*-value**	**Estimate**	***P*-value**	**Estimate**	***P*-value**	**Estimate**	***P*-value**
INTERCEPT	-0.315	<.0001‡	-0.354	<.0001‡	-0.380	<.0001‡	-0.370	<.0001‡	-0.367	<.0001‡
q ratio	0.009	<.0001‡	0.006	<.0001‡	0.006	<.0001‡	0.007	<.0001‡	0.006	<.0001‡
LNTA	0.016	<.0001‡	0.017	<.0001‡	0.018	<.0001‡	0.018	<.0001‡	0.018	<.0001‡
TDTA	0.002	0.5731†	-0.002	0.4536†	-0.004	0.1867†	-0.008	0.0100‡	-0.009	0.004‡
CURRRATIO	0.001	0.0246‡	0.001	<.0001‡	0.002	<.0001‡	0.001	<.0001‡	0.001	<.0001‡
P/E	0.000	<.0001‡	0.000	<.0001‡	0.000	<.0001‡	0.000	<.0001‡	0.000	0.0026‡
LOSS	-0.124	<.0001‡	-0.089	<.0001‡	-0.073	<.0001‡	-0.061	<.0001‡	-0.053	<.0001‡
EMPLS	0.000	<.0001‡	0.000	<.0001‡	0.000	<.0001‡	0.000	<.0001‡	0.000	<.0001‡
PHYRES	0.195	<.0001‡	0.199	<.0001‡	0.196	<.0001‡	0.187	<.0001‡	0.178	<.0001‡
Industry Dummy	*Yes*		*Yes*		*Yes*		*Yes*		*Yes*	
Year Dummy	*Yes*		*Yes*		*Yes*		*Yes*		*Yes*	
NOBS	95,943		85,744		76,792		68,931		61,959	
Adj R^2	0.23		0.26		0.27		0.27		0.26	
***F*-Value**	280.35		312.24		298.96		265.93		234.36	

‡Significant at the 5-percent level or better †Not significant