A Simple Approximation of Tobin's *q*

Kee H. Chung and Stephen W. Pruitt

Kee H. Chung and Stephen W. Pruitt are both Associate Professors of Finance in the Department of Finance, Insurance, and Real Estate of the Fogelman College of Business and Economics at The University of Memphis, Memphis, Tennessee.

Abstract: This paper develops a simple formula for approximating Tobin's q. The formula requires only basic financial and accounting information. Results of a series of regressions comparing our approximate q values with those obtained via Lindenberg and Ross' (1981) more theoretically correct model indicate that *at least* 96.6% of the variability of Tobin's q is explained by approximate q.

■ Tobin's q plays an important role in many financial interactions. Defined as the ratio of the market value of a firm to the replacement cost of its assets, q has been employed to explain a number of diverse corporate phenomena, such as cross-sectional differences in investment and diversification decisions (Jose, Nichols, and Stevens (1986) and Malkiel, von Furstenberg, and Watson (1979)), the relationship between managerial equity ownership and firm value (McConnell and Servaes (1990) and Morck, Shleifer, and Vishny (1988)), the relationship between managerial performance and tender offer gains (Lang, Stulz, and Walkling (1989)), investment opportunities and tender offer responses (Lang, Stulz, and Walkling (1989)), and financing, dividend, and compensation policies (Smith and Watts (1992)).

Interestingly, however, despite its influence over many important aspects of corporate finance, discussions with several senior financial managers suggest little, if any, reliance upon q in real-world decision analysis. While much of the reason for this managerial shunning of such a potentially powerful financial tool may be attributable to an unfamiliarity with q and its many faces, it is also clear that the availability of timely and accurate q data is severely limited when compared with known sources of other important financial variables, such as beta. Indeed, the Manufacturing Sector Master File compiled at the National Bureau of Economic Research—perhaps the only readily-accessible source for q input data—encompasses a time series only up to 1987, and even this limited information is available only for manufacturing firms included in the annual COMPUSTAT Industrial File.

Although it is clearly possible for financial analysts desiring q data for firms not included in the Manufacturing Sector Master File to "create their own" q values by performing the necessary calculations, the Lindenberg and Ross (1981) (hereafter, L-R) and Lang and Litzenberger (1989) procedures typically employed in the calculation of q values are so complex and cumbersome that it is highly unlikely that even the most dedicated of analysts would ever attempt to undertake them. This computational difficulty, particularly when combined with the aforementioned potential of q to aid in the analysis of a number of important corporate financial decisions, begs an intriguing question: Is it possible to create an accurate approximation of q using basic financial information? The results of this study suggest that the answer to this question is "Yes."[1]

I. Computational Procedures

As stated above, the L-R algorithm typically employed in the calculation of Tobin's q is costly both in terms of its data requirements and computational effort. Specifically, L-R calculate q via the following formula, the majority of the data for which is obtained from the Manufacturing Sector Master File:[2]

$$\text{L–R } q = \frac{\text{PREFST} + \text{VCOMS} + \text{LTDEBT} + \text{STDEBT} - \text{ADJ}}{\text{TOTASST} - \text{BKCAP} + \text{NETCAP}} \quad (1)$$

where PREFST is defined as the liquidating value of a firm's preferred stock, VCOMS is the price of the firm's common stock multiplied by the number of shares outstanding at the close of the year (December 31), LTDEBT is the value of the firm's long-term debt adjusted for its age structure, STDEBT is the book value of the firm's current liabilities, ADJ is the

We would like to thank three anonymous referees and, especially, the Editors for helpful comments.

[1] A contemporaneous and independently written paper comparing alternative constructions of Tobin's q is forthcoming in the *Journal of Empirical Finance*. See Perfect and Wiles (1994).

[2] In addition to the COMPUSTAT data, the L-R procedures also utilize selected interest rate and inflation data.

value of the firm's net short-term assets, TOTASST is the book value of the firm's total assets, BKCAP is the book value of the firm's net capital stock, and NETCAP is the firm's inflation-adjusted net capital stock.

Our approximation of *q*, on the other hand, is extremely conservative with respect to both data requirements and computational effort. In place of the pages of complex calculations involved in the derivation of L-R's Tobin's *q* (see, e.g., L-R (1981), pp. 10-16), approximate *q* is simply defined as follows:

$$\text{Approximate } q = (\text{MVE} + \text{PS} + \text{DEBT})/\text{TA}, \quad (2)$$

where MVE is the product of a firm's share price and the number of common stock shares outstanding, PS is the liquidating value of the firm's outstanding preferred stock, DEBT is the value of the firm's short-term liabilities net of its short-term assets, plus the book value of the firm's long-term debt, and TA is the book value of the total assets of the firm. As stated above, all of these required inputs are readily obtainable from a firm's basic financial and accounting information.

Approximate *q* as defined in Equation (2) differs from L-R's Tobin's *q* as outlined in Equation (1) primarily in that approximate *q* implicitly assumes that the replacement values of a firm's plant, equipment, and inventories are equal to their book values. An additional, lesser difference between the L-R and approximate *q* calculations involves the manner in which the market value of the firm's long-term debt is developed. Both techniques explicitly assume that market and book values for short-term debt are identical.

Clearly, the simplified procedures involved in the calculation of approximate *q* represent a compromise between analytical precision and computational effort. Of course, the true measure of any such "short-cut" technique is its degree of accuracy when compared with values obtained from following "theoretically correct" procedures. The Rule of 72, despite the existence of millions of inexpensive calculators, is an excellent example of a popular "short-cut" technique that continues to be useful. Accordingly, the following section presents a ten-year cross-sectional comparison of the *q* values obtained via both L-R Tobin's *q* model and Equation (2).[3]

II. Cross-sectional Comparisons of *q* Values

Given the data requirements of the L-R *q* procedures, the comparisons between the L-R and approximate *q* formulas are based upon data included on both the Manufacturing Sector Master File and the COMPUSTAT Industrial File. The former data series consists of approximately 90 variables, including the market value of debt, inflation-adjusted net capital stock, and the market value of the firm. It serves as the data source for computing Tobin's *q* via the L-R procedures. The COMPUSTAT Industrial File serves as the data source for the calculation of each firm's approximate *q* according to Equation (2).

Table 1 presents results of ten yearly OLS regressions between *q* values obtained from both the L-R and the approximate *q* formulas for the years from 1978 to 1987 (the last full year for which the Manufacturing Sector Master File has been compiled and released). In these regressions, the L-R and approximate *q* values serve as the dependent and independent variables, respectively. Thus, a perfect one-to-one correspondence between the two sets of *q* values would imply intercepts of 0.0 and approximate *q* coefficients and R^2 values both of 1.0, exactly.

The results presented in Table 1 strongly support the equivalence of the two sets of *q* values. While an ideal "0-1-1" regression is not observed for any given year, one cannot help but be impressed by the level of correspondence between the two data series. The fact that the R^2 values of the regressions never fall below 0.966 indicates that *at least* 96.6% of the total variability in L-R's Tobin's *q* is explained by approximate *q*. This result is completely in line with the finding of Perfect and Wiles (1994) that the correlation coefficients between a simple variant of *q* (i.e., one similar to, but not identical to, our approximate *q*) and the L-R *q* and the Lang and Litzenberger (1989) exact *q* are 0.9315 and 0.9257, respectively. In addition, the coefficients of both approximate *q* and the intercept approximate 1.0 and 0.0 in each of the ten regressions. Indeed, the coefficients for approximate *q* range from a low of 0.917 (1979) to a high of 0.993 (1986), while those for the intercept range from -0.073

[3]Some researchers have suggested that it would be preferable to compare our approximate *q* with a more exact *q* value, such as the one employed in Lang and Litzenberger (1989) and Lang, Stulz, and Walkling (1989). These authors collect the prices of long-term bonds, when available, from *Moody's Bond Record* and *Standard and Poor's Bond Guide*. They also obtain replacement costs of net plant and equipment and inventories from the FASB Regulation 33 Tape edited by Columbia University that covers the period from 1979 to 1984. It should be noted, however, that only those corporations with net plant and equipment valued in excess of $120 million were required to report replacement costs of plant and inventories to the FASB from 1979 to 1984. Hence, no replacement cost data are available for firms either before 1979 or after 1984 or for any firms with net plant and equipment values less than $120 million. As a result, it is not possible to obtain a large number of recent *q* estimates for a broad cross-section of firms based on the method used by Lang and Litzenberger (1989) and Lang, Stulz, and Walkling (1989). Indeed, these authors employ the L-R procedure for firms whose data are not available from the above sources. In addition, Perfect and Wiles (1994) report that the correlation coefficient between exact *q* and L-R *q* is 0.9856 based on a sample of 62 firms. Thus, a high observed correlation between approximate *q* and L-R *q* would also necessarily imply a high correlation between approximate *q* and exact *q*.

Table 1. Regression Results

This table presents the results of ten yearly OLS regressions between the L-R and approximate q values for the years from 1978 to 1987. In these regressions, the L-R and approximate q values serve as the dependent and independent variables, respectively. A perfect one-to-one correspondence between the two sets of q values would imply intercepts of 0.0 and approximate q coefficients and R^2 values both of 1.0, exactly.

Year	α	β	R^2	Number of Firms
1978	-0.037 (-15.0)[a]	0.920 (490.2)	0.993	1,608
1979	-0.046 (-14.6)	0.917 (407.7)	0.991	1,556
1980	-0.056 (-13.9)	0.926 (379.5)	0.989	1,617
1981	-0.065 (-19.7)	0.949 (400.5)	0.990	1,575
1982	-0.073 (-19.0)	0.942 (414.6)	0.991	1,563
1983	-0.071 (-15.2)	0.945 (338.6)	0.986	1,584
1984	-0.017 (-3.5)	0.953 (242.2)	0.974	1,539
1985	0.010 (1.5)	0.960 (219.8)	0.970	1,475
1986	-0.008 (-1.6)	0.993 (293.8)	0.984	1,378
1987	0.040 (6.8)	0.956 (184.9)	0.966	1,201

[a]t-values are provided in parentheses.

(1982) to 0.040 (1987). In seven of the ten years studied, the coefficient for approximate q exceeds 0.940.

The very high degree of observed consistency between the L-R and the approximate q formulas over the 1978 to 1987 time period strongly suggests that financial analysts wishing to employ approximate q values in day-to-day business decisions may do so with considerable confidence. As an illustration of this fact, Table 2 presents a comparison of the L-R and approximate q values for 40 randomly selected firms (four from each year over the 1978 to 1987 time interval). In addition, Table 2 also presents the percentage deviation between the q values obtained via each procedure.

In results that underscore the strength of the regressions reported in Table 1, the q comparisons presented in Table 2 confirm the consistency between the q values obtained via the two procedures.[4] For these 40 randomly selected firms, the deviation between the L-R q and approximate q does not exceed 18% (AST Research, 1985). Further, 18 of the 40 firms in the sample register q deviations of less than 5.0%, while the error exceeds 15% in only five cases. The mean (median) deviation is 6.8 (6.2)%. Consistent with the regression coefficients of slightly less than 1.0 reported in Table 1, the approximate q formula leads to a slight overstatement of L-R q in 31 of the 40 sampled firms.

While some researchers might tend to question the usefulness of a q approximation formula with mean, median, and maximum deviations of 6.8, 6.2, and 18.0%, respectively, such deviations actually compare extremely favorably with the errors typically observed in other financial estimates. Indeed, it is likely that most managers would gladly accept a contract stipulating a mean (maximum) 6.8 (18.0)% error in virtually all of their business decisions. For example, Pruitt and Gitman (1987) report a *mean* 15% forecast-to-actual capital budgeting *cost* error in a survey of the *Fortune* 500 industrial firms—an error despite which the

[4]It should be noted that the approximate q values reported in Table 2 are *not* regression estimates but, rather, are the result of a straight application of Equation (2) as outlined above.

Table 2. Comparison of Lindenberg-Ross *q* with Approximate *q* for 40 Randomly Selected Firms

This table presents a comparison of the L-R and approximate *q* values for forty randomly selected firms, four from each year over the time period from 1978 to 1987. In addition, the table also presents the percentage error of approximate *q* when compared with L-R *q*.

Company Name	Year	L-R *q*	Appx *q*	Percentage Error
American Aggronomics	78	0.974	1.086	0.115
Cray Research	78	4.050	4.425	0.093
Knogo Corp.	78	1.145	1.139	-0.005
Tandy Corp.	78	1.738	1.879	0.082
Alleghany Corp.	79	0.546	0.542	-0.008
Electronic Research Assoc.	79	2.198	2.219	0.010
Loews Corp.	79	0.288	0.318	0.103
Rolm Corp.	79	5.189	5.727	0.104
Alleghany Corp.	80	0.465	0.481	0.034
Colonial Commercial Corp.	80	1.032	1.135	0.099
FSC Corp.	80	0.998	0.991	-0.007
Tandy Corp.	80	3.297	3.626	0.100
Avco Corp.	81	0.670	0.719	0.074
Genentech Inc.	81	3.939	4.637	0.177
Inter-tel Inc.	81	3.949	4.252	0.077
Seagate Technology	81	23.629	24.757	0.048
Altos Computer Sys.	82	11.219	11.926	0.063
Control Data Corp.	82	0.945	0.849	-0.102
LSB Industries Inc.	82	0.956	0.958	0.002
Technicom International Inc.	82	5.592	6.032	0.079
Alleghany Corp.	83	1.268	1.264	-0.003
Automotive Franchise Corp.	83	3.256	3.335	0.024
Nexus Industries Inc.	83	0.847	0.983	0.161
Survival Technology	83	2.436	2.807	0.152
AT&E Corp.	84	7.843	8.621	0.099
Carrington Labs	84	5.102	5.673	0.112
Intermark Inc.	84	0.814	0.863	0.060
Kenai Corp.	84	1.012	0.990	-0.022
AST Research Inc.	85	4.051	4.780	0.180
GTECH Corp.	85	2.043	2.054	0.005
INTL Controls Corp.	85	1.025	1.043	0.017
Zenith Laboratories Inc.	85	4.856	5.716	0.177
Brunswick Corp.	86	1.339	1.375	0.027
First City Industries Inc.	86	0.915	0.872	-0.047
Maxxam Group Inc.	86	1.036	0.940	-0.093
Qantel Corp.	86	2.512	2.533	0.008
DBA Systems Inc.	87	1.226	1.266	0.033
Incstar Corp.	87	1.069	1.031	-0.036
Pacific Telesis Group	87	0.892	0.925	0.037
SFE Technologies	87	0.742	0.789	0.064

majority of the survey participants expressed "...a great deal of confidence in the overall profitability projections of most capital budgeting proposals (p. 48)."[5] Similarly, in a review of the literature on capital budgeting forecasts, Statman and Tybejee (1985) report average cost overruns of from 70 to 390% for U.S. government defense hardware procurements and from 27 to 338% for product development by three drug and chemical firms. Finally, in an exhaustive study of security analyst forecasts, Brown, Foster, and Noreen (1985) report median absolute earnings forecast errors of 8.5% *just one month prior to the actual earnings announcement.*[6]

III. Conclusions

This study developed and empirically tested the usefulness of a simple formula for approximating Tobin's q. The formula uses readily-available balance sheet information. We believe this technique should prove of significant interest to both academic researchers and financial practitioners. From the standpoint of academic research, the very high observed correlation between the q values obtained via the approximate q formula and the more theoretically correct Lindenberg and Ross (L-R) (1981) technique suggests that approximate q values may be safely employed whenever the data necessary to perform the more exhaustive L-R calculations prove unavailable.[7]

For the many thousands of corporate financial analysts, approximate q offers a simple, tractable formula to obtain relatively accurate and *timely* q values with minimal computational effort. Given the potential for Tobin's q to provide valuable insight into a variety of important business and financial decisions, it is plausible that approximate q or some variation of it may one day play an important role in financial analysis. Indeed, many financial managers will no doubt recognize the similarity between approximate q, MVA (market value added), and EVA (economic value added). (See *Fortune*, December 27, 1993, pages 64-76.) Unlike MVA, however, approximate q, by virtue of its ratio composition, is a *standardized* performance measure. It is not subject to the scale biases inherent in simple differences, such as MVA. ■

References

Brown, P., G. Foster, and E. Noreen, 1985, "Security Analyst Multi-Year Earnings Forecasts and the Capital Market," *Studies in Accounting Research*, American Accounting Association.

Jose, M.L., L.M. Nichols, and J.L. Stevens, 1986, "Contributions of Diversification, Promotion, and R&D to the Value of Multiproduct Firms: A Tobin's q Approach," *Financial Management* (Winter), 33-42.

Lang, L.H.P. and R.H. Litzenberger, 1989, "Dividend Announcements: Cash Flow Signalling vs. Free Cash Flow Hypothesis?," *Journal of Financial Economics* (September), 181-191.

Lang, L.H.P., R.M. Stulz, and R.A. Walkling, 1989, "Managerial Performance, Tobin's q, and the Gains from Successful Tender Offers," *Journal of Financial Economics* (September), 137-154.

Lindenberg, E.B. and S.A. Ross, 1981, "Tobin's q Ratio and Industrial Organization," *Journal of Business* (January), 1-32.

Malkiel, B.G., G.M. von Furstenberg, and H.S. Watson, 1979, "Expectations, Tobin's q, and Industry Investment," *Journal of Finance* (May), 549-561.

McConnell, J.J. and H. Servaes, 1990, "Additional Evidence on Equity Ownership and Corporate Value," *Journal of Financial Economics* (October), 595-612.

Morck, R., A. Shleifer, and R.W. Vishny, 1988, "Management Ownership and Market Valuation: An Empirical Analysis," *Journal of Financial Economics* (January/March), 293-316.

Perfect, S.B. and K.W. Wiles, 1994, "Alternative Constructions of Tobin's q: An Empirical Comparison," *Journal of Empirical Finance* (forthcoming).

Pruitt, S.W. and L.J. Gitman, 1987, "Capital Budgeting Forecast Biases: Evidence from the *Fortune* 500," *Financial Management* (Spring), 46-51.

Smith, C.W., Jr. and R.L. Watts, 1992, "The Investment Opportunity Set and Corporate Financing, Dividend, and Compensation Policies," *Journal of Financial Economics* (December), 263-292.

Statman, M. and T.T. Tybejee, 1985, "Optimistic Capital Budgeting Forecasts: An Experiment," *Financial Management* (Autumn), 27-33.

[5]Perhaps not surprisingly, these same managers reported that the *cost* component of their capital budgeting forecasts was significantly more accurate than the *revenue* projections of the same forecasts.

[6]This error increased to 13.0, 20.0, and 33.9% one quarter, six months, and one calendar year, respectively, prior to the actual earnings announcement.

[7]In their study, Perfect and Wiles (1994) compare a simple, book value measure of q with the more theoretically correct procedures suggested by L-R and Lang and Litzenberger (1989) and find that their simple q tends to overstate a firm's true q. Our approximate q, while similar to their simple q, employs a numerator adjustment based upon the book value of the firm's short-term assets to correct for this anomaly.