

THE TOBIN q AS A COMPANY PERFORMANCE INDICATOR

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ABSTRACT

Various economic indicators of a business game company's performance exist. The Tobin q was examined as an indicator of the firm's effectiveness from an investment perspective across a variety of top management games. The Tobin q was also compared to the Altman Z as another indicator of the firm's economic viability. The q was inconsistently related to each game's own performance indicator across games and may be contextual regarding its applicability due to game complexity and player skill level considerations.

Students playing a business game typically want to know how well they are doing. This is a natural outcome of the competitive environments created by the simulations themselves while serving to reinforce the "business ethic" of accountability and the results by which the players will be judged in their business careers. Although there have been a number of diverse recommendations as to what should be measured all games feature economic performance measures in either partial or global forms. This paper investigates the use of Tobin's q as a more-meaningful way to judge the comparative performance of firms in business games. The results were inconclusive and indicate further investigation would be useful.

Background

Top management or total enterprise (TE) business games attempt to replicate the salient features of the decision-making environment faced by the firm's strategic decision-makers. "A total enterprise game is a term used to refer to games that include all of the main functions of business as decisions inputs— marketing, production and finance" (Keys, 1987). Therefore the company effectiveness measures used in those games report ultimate or penultimate measures which indicate either the firm's overall effectiveness or preliminary or interim measures that have empirically shown their ability to indicate the firm's ultimate economic success. A review of five top management games simulating international markets in Exhibit 1 indicates all

used profits or net earnings as a measure as well as the firm's stock price, or the valuation the simulated stock market placed on the firm's performance. Other common indicators were total sales revenue, earnings-per-share and rates-of-return on assets and equity. Four of the five games reported a summary or ultimate firm performance measure that was a weighted combination of the simulation's previously generated penultimate criteria.

There is a fair degree of unanimity regarding four of the criteria. There also is, however, a great deal of disagreement regarding what indicates company success, or what performance results playing teams should attempt to optimize. *The Business Strategy Game* (Thompson & Stappenbeck, 1998) outputs a unique Strategy Rating that reflects the relative "power" of the firm's strategy. *The Multinational Management Game* (Keys & Wells, 1997) uses the singular criteria of Quality, Return on Sales and Debt to Total Assets. These performance measures account for 33.3% of the firm's total performance score in addition to its more-standard Stock Price and Return-on-Equity yardsticks.

Given both agreement and disagreement regarding the measurement standards that should be employed to judge and guide performance in a business game it is unfortunate that only limited attempts have been made to either generate the proper evaluation criteria or to assign appropriate weights to whatever penultimate criteria were chosen by game designers. Sackson (1990) performed a cluster analysis on player decisions and performance outcomes within *The Business Strategy and Policy Game* (Eldridge & Bates, 1984). It was found that product price, salesman salaries, production worker wage rates, sales training budgets and weekly labor hours generated influenced the game's outcomes of productivity, earnings per share, stock price and market share. Thus, in this case the latter indicate a company's penultimate effectiveness criteria within the simulation tested. One year later Wheatley, Amin, Maddox and VanderLinde (1991) collected results produced by 142 MBA students playing *The Carnegie Tech Management Game* (Winters, Kuehn, Dill & Cohen, 1964). They determined the prime indicators of a firm's success were its rates-

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of-return on assets and equity followed by total sales and net income plus market share growth.

The search for an additional or supplemental measure of a firm's success was pioneered by Biggs, Levin and Biggs (1995). Their examination probed the properties of the Altman Z (Altman, 1968; Altman, 1983) when applied to *Micromatic* (Scott & Strickland, 1992). For real-world

manufacturing firms the Altman Z-score is a strong indicator of a firm's financial viability. Firms scoring below 1.81 are assured of bankruptcy, those scoring above 2.99 are safe and those scoring in the 1.81 and 2.99 range are in the "grey area". These companies require further analysis to determine their ability to remain solvent. After finding the Altman Z applicable to this game the authors suggested

Exhibit 1
Business Game Performance Criteria

Criterion	BPG	MMG	BSG	CAP	GBG	Total
Stock Price	X	X	X	X	X	100%
Return on Equity	X	X	X	X	X	100%
Return on Assets	X	X		X	X	80%
Profits	X		X		X	60%
Market Share	X	X		X		60%
Sales	X		X			40%
Return on Sales		X		X		40%
EPS	X				X	40%
Assets	X					20%
Inventory Turnover		X				20%
Assets Turnover		X				20%
Dividend/Share						20%
Credit Rating			X			20%
Strategy Rating			X			20%
Debt Ratio		X				20%
Equity	X					20%
Summary	X	X	X		X	80%
Total	10	9	7	5	6	100%

BPG—*The Business Policy Game*—Cotter and Fritzsche, 1986

MMG—*The Multinational Management Game*—Keys, Edge and Wells, 1992

BSG—*The Business Strategy Game*—Thompson & Stappenbeck, 1999

CAP—*CAPSTONE*—Management Simulations, 2002

GBG—*The Global Business Game*—Wolfe, 2000

three uses of the Z-score if bankruptcy was indicated—the call for a personal intervention by the instructor, the firm's implementation of the strategic choices either of bankruptcy, reorganization or liquidation, or as a single-point company performance measure. Since they introduced the Altman Z to the business gaming literature, it has been added as an evaluation criterion in *The Business Strategy Game* (Thompson & Stappenbeck, 1999).

Most recently Sauaia & Castro Junior (2001) examined the Tobin *q* as a measure of a company's performance in *The Multinational Management Game* (Keys & Wells, 1997). In that study it was found that high performing firms, as measured by the game's own performance routine, had high Tobin *qs* after ten rounds of play. Based on this the authors indicated the *q* statistic possessed predictive validity and its value should be investigated when applied to other business games.

The Tobin *q*

The Tobin *q* has been employed particularly by manufacturing firms to explain a number of diverse corporate phenomena. These have entailed (a) cross-sectional differences in investment and diversification decisions, (b) the relationship between managerial equity ownership and firm value, (c) the relationship between managerial performance and tender offer gains, investment opportunities and tender offer responses, and (d) financing, dividend, and compensating policies (Chung and Pruitt, 1994). It is a statistic that might serve as a proxy for the firm's value from an investor's perspective. By definition, it is the ratio between the market value of the firm's assets and the replacement value of those assets calculated as follows:

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$$q = (MVS + MVD)/RVA$$

Where:

MVS = Market value of all outstanding stock

MVD = Market value of all debt

RVA = Replacement value of all production capacity

Firms with high qs , or $qs > 1.00$, have been found to be better investment opportunities (Lang, Stulz & Walkling, 1989), have higher growth potential (Tobin & Brainard, 1968; Tobin, 1969) and indicate management has performed well with the assets under its command (Lang, Stulz & Walkling, 1989). Given this has been found true for real-world firms the ability to apply Tobin's q , as either an ancillary or ultimate indicator of firm success in a business game, would be of real value. This paper's following section examines the Tobin q as a single measure of a firm's summary performance, as a predictor of that summary performance and how it relates to the Altman Z as another indicator of a firm's success or failure in a business gaming environment.

Methodology

The results for one industry were obtained from experienced users of five general business or top management games. The raw data were recorded for each game's mid-period or quarter and its end-period or quarter. Thus, if the game ran for eight quarters the data points were the fourth and eighth periods. If the game ran for an odd number of periods the game's mid-point was chosen by the following formula:

$$MP = (P - 1)/2$$

Where:

MP = the game's Midpoint

P = Total periods of play

Based on this formula an eleven decision period game's midpoint would be the fifth period

A modified version of the Tobin q by Chung & Pruitt (1994) was used for consistency between the games because of their simplified balance sheets. This modified version closely approximates Tobin's original statistic and produces a 96.6% approximation of the original formulation used by Lindenberg & Ross (1981):

$$q = (MVS + D)/TA$$

Where:

MVS = Market value of all outstanding shares, i.e. the firm's Stock Price * Outstanding Shares

TA = Firm's assets, i.e. cash, receivables, inventory and plant book value

D = Debt defined as:

$$D = (AVCL - AVCA) + AVLTD$$

Where:

AVCL = Accounting value of the firm's Current Liabilities = Short Term Debt + Taxes Payable

AVLTD = Accounting value of the firm's Long Term debt = Long Term Debt

AVCA = Accounting value of the firm's Current Assets = Cash + Inventories + Receivables

The Altman Z was used in this study as defined in its original presentation (Altman, 1983):

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5$$

Where:

X_1 = Working capital divided by total assets

X_2 = Retained earnings divided by total assets

X_3 = Earnings before interest and taxes divided by total assets

X_4 = Market value of equity divided by book value of total debt

X_5 = Total revenues divided by total assets

When the game produced summary company performance measures those measures were compared to their Tobin qs . This was done to test the degree the q could act as a proxy or substitute for the game's own performance measure. The Tobin q 's forecasting ability was tested by comparing each firm's mid-point q to its end-point q . Finally, firm Z -scores and qs were compared to determine whether the Z -score's implications regarding solvency and bankruptcy were corroborated by the qs generated. The Spearman rank correlation test was performed in all cases due to the small number of firms involved in each industry and the belief that each firm's relative performance was more important than its absolute performance.

Results

The results presented in Exhibit 2 indicate the Tobin q 's performance varies quite widely across the four simulations that generate performance scores for their players. The q is strongly related to the performance scores generated by *The Business Policy Game* and *The Business Strategy Game*. It is moderately related to the Performance Index found in *The Global Business Game*. Almost the same amount of variation in the performance score generated by *The Multinational Management Game* is explained by the Tobin q but in the opposite direction. The Altman Z , as another financial indicator, also varies across the four simulations. It is

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strongly related to the performance scores found in BPG and MMG while almost no variance in game performance scores in BSG and GBG are explained by the Altman Z. When compared to each other the Tobin q and the Altman Z is

moderately to strongly related to each other within the BPG, GBG and MMG games while basically absent within the BSG's context.

Exhibit 2
End-Game Correlations Between Performance Scores, Tobin qs and Altman Zs

Comparison	BPG	BSG	GBG	MMG
Tobin q vs. Performance Score	.829	.854	.571	-.543
Altman Z vs. Performance Score	.829	.117	-.071	.886
Tobin q vs. Altman Z	.829	.100	.429	-.429

The material presented in Exhibit 3 indicates the Tobin q is a relatively strong predictor of a company's performance and earnings within *The Business Policy Game*. It is a moderate predictor of company performance for *The Business Strategy Game* but an even stronger predictor in the

opposite direction when used with *The Global Business Game*. The ability to forecast company profits is negligible, or is in the opposite direction, for all five simulations examined. The Tobin q 's relationship to itself over a game's run is often strong but sometimes in the opposite direction.

Exhibit 3
Mid-Game Tobin qs vs. Alternative End-Game Results

Comparison	CAP	BPG	BSG	GBG	MMG
Mid-Game Tobin q vs. Performance Score	n.a.	.886	.550	-.690	.257
Mid-Game Tobin q vs. Total Earnings	-.600	.771	.176	-.738	-.086
Mid-Game Tobin q vs. End-Game Tobin q	-.700	.771	.276	-.405	-.200

Discussion

It appears the Tobin q could be used as a diagnostic tool and predictor of company success when applied to *The Business Policy Game*. As a *diagnostic tool*, firms with low qs might be considered candidates for instructor-led coaching or counseling. In practice, the q is sensitive to the swing effects of its equation's denominator, i.e. the firm's total assets of cash, receivables, inventory and plant book value. If players can be shown how to be more efficient in their use of cash, how to produce better forecasts which allows them to lower their average inventories or obtain more output given the firm's plant and equipment, its q will increase. As a *predictor* of the firm's ultimate success, it might be used as a more realistic, Wall Streeter's view of the firm's worth.

For this study's other simulations the associations between the Tobin q , company performance and the performance indicators generated by the games themselves were either trivial or in the opposite direction. This negative correlation may stem from two phenomena that should not be attributed to the Tobin itself but instead to the playing and learning situation serving as the appraisal's basis. These negative correlations merely reflect dramatic changes in firm performances between the game's beginning and its end for some of the simulations. This is perhaps due to the steep learning curves created by the complexity of the games themselves or the abilities of the players. Firms that are relatively strong performers early in the game can become weaker performers as the game concludes because they, or

their managers, take longer to develop and show profitability. It has been observed that firms that "do nothing" early in a game can temporarily perform well as its competitors are being proactive with their assets while also making various costly technical mistakes. This proactivity causes them to perform poorly early because their decisions are somewhat inaccurate and inefficient but in the correct strategic direction. Those that "do nothing" can survive temporarily by merely mimicking management's earlier decisions. This conservative approach avoids errors but cannot lead to long-term growth and development. Early investment levels necessarily create relatively low profit levels. Once those investments take hold however, say in new plant and equipment, increasing the company's selling staff, or increasing the firm's advertising programs, higher profits usually ensue. These investment and "do nothing" elements may explain the strong but negative correlations found.

It should also be noted the weights, or a change in the weightings used for each element in their performance measures, can effect their relationship to the Tobin q . As an example the previously cited Sauer & Castro (2002) study *The Multinational Management Game* employed seven elements carrying equal weights of 10 as presented in Exhibit 4. The game's current edition, and the one used in this study, changed the weightings. Thus the "Return on Equity" element counts for 19.2% of the performance index's score where before it counted for 14.3% of the result. The adoption of different weights within and across games can make

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the Tobin q a less than universal measure of company performance.

Exhibit 4

The Multinational Management Game Performance Index Components

Performance Element	Game Weights	
	Previous	Current
Market Share	10	7
Return on Sales	10	7
Inventory Turnover	10	7
Assets Turnover	10	7
Return on Assets	10	7
Debt to Total Assets	10	7
Return on Equity	10	10

Summary

A previous paper by Sauaia & Castro Junior (2002) examining the Tobin q as applied to *The Multinational Management Game* recommended their work be repeated and that it should be extended to other business games. The results reported here disagree with those found by Sauaia & Castro regarding the direction of association between the Tobin q and the game's performance score although both correlations were statistically significant. Thus, the q has an inconsistent relationship to that game's point system for indicating a firm's success in the game.

While the Tobin q appears to be a valid measuring device when applied to *The Business Policy Game* the between-study inconsistency associated with *The Multinational Management Game* may pertain to this and all other games in and outside this study. Before drawing any firm conclusions about the Tobin q as either a summary or substitute measure of company success further research should be conducted across these and other simulations using a larger number of industries and a greater range of game complexities and player attributes and skill levels.

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