Underinvestment, Operating Efficiency, and Corporate Governance

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Abstract

We demonstrate that poor corporate governance does not necessarily lower a firm's market-to-book ratio (Tobin's Q). Instead, the underinvestment associated with poor governance results in low book values that confound the relationship between corporate governance and Tobin's Q. We then provide operating efficiency measures derived from revenue and variable costs to evaluate the economic implications of corporate governance. Operating efficiency is captured by the corporate governance index in Gompers, Ishii, and Metrick (2003), although Tobin's Q is not higher for firms with better operating performance.

1. Is firm size in our model determined exclusively by governance or can a vary across firms?

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1 Introduction

Corporate managers are entrusted with two crucial tasks. They select their firm's level of output, hence book value, and control costs. When evaluating the implications of corporate governance, normalizing by a *size*-related variable is necessary to avoid concluding that large firms are better managed than small firms simply because they have higher profits. However, we demonstrate that better corporate governance does not necessarily increase Tobin's Q since book value is reduced by underinvestment. While better corporate governance would improve Tobin's Q if book value were exogenous, underinvestment implies that book value is endogenous when evaluating corporate governance. Bertrand and Mullainathan (2003), Aggarwal and Samwick (2006), and John and Knyazeva (2006) report that entrenched managers choose to *enjoy the quiet life* by underinvesting. Bertrand and Mullainathan (2003) also report that entrenched managers pay higher salaries to their white-collar employees, which suggests that weak governance coincides with less effective cost management.

The endogeneity of book value confounds the implications of corporate governance on Tobin's Q. Moreover, improvements in corporate governance that mitigate underinvestment increase output and decrease rather than increase Tobin's Q. In addition, shareholders want managers to maximize market value minus book value rather than maximize Tobin's Q. The maximization of firm value minus book value results in two firm-level operating efficiency measures that manifest corporate governance. These measures are empirically estimated using a firm's revenue and variable costs. Low output is associated with high average revenue since firms that underinvest behave as monopolies by restricting output.[1] Therefore, unlike competitive firms, firms that underinvest fail to set the marginal cost of production equal to its marginal benefit. Instead, underinvestment restricts output and results in average revenue (per unit) being higher than optimal.

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[1]We assume managers correctly choose the amount of assets required to produce their desired level of output. Thus, capacity utilization is not examined by our model.

Gompers, Ishii, and Metrick (2003) construct a corporate governance index, abbreviated as the GIM index hereafter, from twenty-four provisions that inhibit the ability of shareholders to replace management. This index assigns firms a score between zero and twenty-four as each provision that limits shareholder rights is counted once. Firms with higher scores are thought to have less shareholder rights as boardmembers are more difficult to replace.

Gompers, Ishii, and Metrick (2003) report that firms with a lower GIM index, hence better corporate governance, have higher market-to-book ratios. In addition, they find that firms with worse corporate governance tend to be large firms and those with high institutional ownership such as firms in the S&P 500. Gompers, Ishii, and Metrick (2003) argue that investors did not fully appreciate the benefits of good governance since firms with better corporate governance had higher returns than those with worse corporate governance during the 1990s. However, Core, Guay, and Rusticus (2006) find that firms with better corporate governance underperform those with worse corporate governance from 2000 to 2003.[2]

Institutional Shareholder Services produces the Corporate Governance Quotient (CGQ) as an alternative measure of corporate governance.[3] A firm's CGQ score is determined by characteristics in eight categories; audit, board, charter/bylaws, director education, executive and director compensation, ownership, progressive practices, and state of incorporation. The GIM index is composed primarily of provisions in the charter/bylaws category, with Bebchuk, Cohen, and Ferrell (2008) further simplifying this index by focusing on provisions related to staggered boards, limits to bylaw amendments, poison pills, golden parachutes, and supermajority requirements for mergers and charter amendments.

Although Bebchuk and Cohen (2005) document that staggered boards lower firm

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[2]This evidence suggests that better governance leads to higher returns in expansions and lower returns in recessions, which is consistent with better governed firms producing more output. Kothari and Shanken (1997) and Pontiff and Schall (1999) document that market-to-book ratios are higher during expansions than contractions.

[3]Institutional Shareholder Services was acquired by RiskMetrics in early 2007.

value, Bates, Becher, and Lemmon (2008) find limited evidence that staggered boards inhibit takeover bids and no evidence that this mechanism ultimately prevents acquisitions. Bates, Becher, and Lemmon (2008) also report that the GIM index as well as the entrenchment index in Bebchuk, Cohen, and Ferrell (2008) exert an insignificant influence on the success of takeovers.

Cremers and Nair (2005) differentiate between internal and external governance. Internal governance pertains to the structure of boards and large blockholders such as pension funds while external governance is determined by the market for corporate control such as takeovers. Their evidence indicates that these different aspects of governance are complementary as their interaction (large blockholder and takeover vulnerability) coincides with a higher return on assets.[4] For emphasis, our operating efficiency measures focus on the economic implications of corporate governance rather than the measurement of corporate governance.

The empire building hypothesized by Jensen and Meckling (1976) is compatible with underinvestment since managers can underinvest in the acquired firm as well as their original firm. Indeed, managers interested in increasing their firm's size can acquire firms rather than expand their existing operations. Masulis, Wang, and Xie (2007) find that firms with poor corporate governance are more likely to pursue empire building acquisitions that destroy value.

Our empirical analysis finds that operating efficiency is related to the GIM index but not the entrenchment index in Bebchuk, Cohen, and Ferrell (2008). Specifically, a high GIM index corresponding to weak corporate governance is associated with low output and high costs. Moreover, as illustrated by our model, Tobin's Q is not higher for firms with better operating efficiency. For emphasis, our model does not predict that corporate governance influences expected returns, although improvements in operating efficiency are

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[4]Ferreira and Laux (2007) report that firms with better corporate governance have more informative prices. They interpret this finding as evidence that investors are more willing to collect private information regarding potential takeover targets with better governance due to the higher probability of these acquisitions being approved.

predicted to yield higher contemporaneous returns.

The remainder of this paper begins with a model in Section 2 that demonstrates the difficulty associated with using Tobin's Q to evaluate corporate governance. The model also provides two operating efficiency measures for assessing corporate governance. These measures are then estimated in Section 3 and related to the GIM index as well as Tobin's Q. Section 4 contains our conclusions and suggestions for future research.

2   Model

Aggarwal and Samwick (2006) demonstrate that weak governance results in underinvestment. Thus, managers appear to incur private costs such as the need for additional monitoring when investing. The empirical evidence in John and Knyazeva (2006) is also consistent with poor corporate governance reducing investment, hence book value. In Hirshleifer and Thakor (1992)'s model, managers are concerned about failed investments tarnishing their reputation and reducing the value of their human capital. This concern causes managers to pursue conservative investments rather than projects with higher expected values.[5]

Bertrand and Mullainathan (2003) utilize changes in antitakeover laws to proxy for exogenous changes in corporate governance. They report that more entrenched managers underinvest and overpay white-collar employees. Thus, firms with weak corporate governance have low book values and high costs. These findings motivate our model, which has risk-neutral managers choosing their firm's output denoted $y > 0$ and influencing its variable cost $c \geq c_0$ where $c_0 > 0$ denotes the lowest possible cost. These managerial decisions both depend on corporate governance as better governance increases y and decreases c. Both c_0 and k are assumed to be identical across firms, although our empirical analysis allows these parameters to vary across industries.

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[5]Aggarwal and Samwick (2006) demonstrate that incentives are required to mitigate underinvestment by managers.

The amount of capital required to produce one unit equals $k > 0$. Although k is independent of corporate governance, the assumption of a linear production function implies that book value equals ky. Thus, book value depends on corporate governance. The discount rate for future cashflows and the rental rate on the firm's capital stock (book value) equal r. The linear demand function

$$P_0 - \frac{y}{2a},\qquad(1)$$

is defined by its slope, $\frac{1}{2a}$, and intercept, P_0. This downward sloping demand curve implies that greater output lowers prices.

Our analysis below involves the following observables: cashflow, book value, market value, return on assets, cost of goods sold, and revenue. The firm's revenue minus its cost of good sold equals $y\left(P_0 - \frac{y}{2a}\right) - cy$. Consequently, the firm's market value, not including the book value of its assets, equals

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\begin{aligned}
M &= \sum_{i=1}^{\infty} \frac{y\left(P_0 - \frac{y}{2a}\right) - cy}{(1+r)^i} \\[2mm]
&= \frac{y\left(P_0 - c\right) - \frac{y^2}{2a}}{r}.\qquad(2)
\end{aligned}
$$

With book value equaling ky, Tobin's Q equals

$$\frac{M}{B} = \frac{P_0 - c - \frac{y}{2a}}{kr},\qquad(3)$$

which depends on the firm's output y. In particular, Tobin's Q is a decreasing linear function of y. Observe that the influence of corporate governance on Tobin's Q is ambiguous since better governance decreases c while increasing y, which increases and decreases $\frac{M}{B}$, respectively.

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The firm's cashflow equals

$$y\left(P_0 - c - \frac{y}{2a}\right) - rky \;=\; y\left(P_0 - c - rk\right) - \frac{y^2}{2a} \tag{4}$$

where $P_0 - c - \frac{y}{2a}$ equals the marginal profit per unit and rky denotes the rental rate on the capital stock required to produce y units. The cashflow in equation (4) depends on corporate governance through y and c. Recall that c is a decreasing function of corporate governance, while k is independent of corporate governance. The firm's ROA (return on assets), defined as the cashflow in equation (4) divided by book value, equals

$$\text{ROA} \;=\; \frac{P_0 - c - \frac{y}{2a}}{k} - r\,, \tag{5}$$

and implies

$$\frac{\text{ROA}}{r} \;=\; \frac{M}{B} - 1\,. \tag{6}$$

As with Tobin's Q, corporate governance has an ambiguous influence on ROA as increases in y and decreases in c attributable to better corporate governance increase and decrease this proxy, respectively.

Instead of maximizing Tobin's Q or return on assets, shareholders want managers to maximize the market value of the firm minus the cost of the firm's capital stock[6]

$$\max_{c,y} \; M - B \;=\; \max_{c,y} \; \frac{y\left(P_0 - c - rk\right) - \frac{y^2}{2a}}{r} \tag{7}$$

Observe that equation (7) is a concave function with respect to y that is maximized by

$$y^* \;=\; a\left(P_0 - c - rk\right)\,, \tag{8}$$

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[6]Maximizing the difference $M - B$, as in equation (7), is equivalent to maximizing (Revenue - Variable Costs) / r.

and $c = c_0$. However, managers fail to produce y^* if they underinvest and they shirk their responsibility to control costs if c exceeds c_0. Ideally, the ratio

$$0 < \quad \frac{M-B}{M^*-B^*} \quad < 1 \tag{9}$$

could measure corporate governance. However, M^* and B^* both depend on y^*, which is unobservable due to its dependence on a. Instead, we propose two operating efficiency ratios to measure the economic implications of corporate governance.

The first operating efficiency ratio, R_{REV}, isolates the impact of corporate governance on output

$$\frac{\text{Revenue}}{\text{Book Value}} = \frac{y\left(P_0 - \frac{y}{2a}\right)}{ky} = \frac{P_0 - \frac{y}{2a}}{k} \geq \frac{P_0 + c + rk}{2k}, \tag{10}$$

with observed revenue depending on y. The ratio in equation (10) is smaller for firms whose output y is closer to y^*. Although a is unknown, the lower bound in equation (10) is independent of this parameter after invoking y^* from equation (8).

The second operating efficiency ratio, R_{COST}, isolates the impact of corporate governance on costs

$$\frac{\text{Variable Costs}}{\text{Book Value}} = \frac{cy}{ky} = \frac{c}{k} \geq \frac{c_0}{k} \tag{11}$$

The ratio in equation (11) is smaller for firms with better governance due to these firms have lower variable costs

$$cy = \text{Revenue} - rM. \tag{12}$$

The operating efficiency ratios in equation (10) and equation (11) control for firm size through the normalization by book value. The R_{REV} and R_{COST} ratios examine two

related aspects of a firm's operating efficiency that have offsetting impacts on Tobin's Q.

3   Empirical

Lindenberg and Ross (1981) document considerable variation in Tobin's Q across industries as firms with high market-to-book ratios have unique products, hence inelastic demand functions, and unique factors of production that enable them to earn monopoly rents. Nonetheless, Perfect and Wiles (1994) investigate a variety of estimates for book value and conclude that Tobin's Q is robust to alternative definitions. We adopt the procedures in Fama and French (2006) when computing book value and market value.

3.1   Data

The GIM index is available in 1990, 1993, 1995, 1998, 2000, 2002, and 2004. For these years, data on revenue and variable costs is obtained from Compustat to estimate the ratios in equation (10) and equation (11), respectively. The revenue (REVT field) in Compustat is identical to Sales. The cost of goods sold (COGS field) in Compustat proxies for variable costs. Additional Compustat entries such as general, selling, and administrative expenses as well as operating expenses are often missing or identical to cost of goods sold. Therefore, our empirical analysis focuses on cost of goods sold as a proxy for cy.

Following Fama and French (2006), book value and market value are obtained from Compustat and CRSP, respectively, when estimating a firm's market-to-book ratio. Firms with non-positive book values are removed from our sample along with a small number of firm-year observations without revenue or cost of goods sold. A total of 10,842 firm-year observations are available for our empirical study.

Four digit SIC codes are also obtained from CRSP, before applying the 49 industry classifications in Fama and French (1997). Both k and c_0 are assumed to be constant

within industries.[7] However, R_{REV} and R_{COST} are standardized with respect to the industry's mean and standard deviation. Thus, positive and negative operating efficiency ratios are above and below the industry average, respectively. While c_0 is unknown, the $\frac{c_0}{k}$ ratio in equation (11) can be computed as the following minimum over the $i = 1, \ldots, n_j$ firms in the jth industry[8]

$$\left(\frac{\hat{c}_0}{k}\right)_j = \min\left\{\left.\frac{\text{Variable Costs}_i}{\text{Book Value}_i}\right| i \in \text{industry } j\right\}. \tag{13}$$

3.2 Results

To evaluate the relationship between the GIM index and our efficiency ratios R_{REV} and R_{COST} in equation (10) and equation (11), respectively, we estimate the following regressions

$$R_{REV,i} = \alpha_0 + \alpha_{REV}\,\text{GIM}_i + \epsilon_i\,, \tag{14}$$

$$R_{COST,i} = \alpha_0 + \alpha_{COST}\,\text{GIM}_i + \epsilon_i\,. \tag{15}$$

Positive α_{REV} and α_{COST} coefficients indicate that a high GIM index captures the operating inefficiencies associated with poor corporate governance. The above regressions are repeated for the entrenchment index in Bebchuk, Cohen, and Ferrell (2008). The GIM and entrenchment indices are standardized across all firms within each year.

Table 1 reports on the α estimates from the cross-sectional regressions in equation (14) and (15). The positive α_{REV} and α_{COST} coefficients equaling 0.0203 (t-statistic of 2.07) and 0.0241 (t-statistic of 2.48), respectively, indicate that the GIM index captures operating efficiency. For example, firms with a higher GIM index, which are associated

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[7]Leases complicate the distinction between k and c.

[8]Equation (13) implies that equation (10) can be modified as $\frac{P_0 - \frac{y}{2a}}{k_j\left(\frac{\hat{c}_0}{k}\right)_j} = \frac{P_0 - \frac{y}{2a}}{\hat{c}_0}$.

with weaker corporate governance, appear to restrict output and have higher costs. In contrast, the entrenchment index in Bebchuk, Cohen, and Ferrell (2008) yields positive but insignificant α coefficients.

We also regress Tobin's Q directly on our operating efficiency ratios

$$\left(\frac{M}{B}\right)_i = \beta_0 + \beta_{REV} R_{REV,i} + \epsilon_i, \tag{16}$$

$$\left(\frac{M}{B}\right)_i = \beta_0 + \beta_{COST} R_{COST,i} + \epsilon_i. \tag{17}$$

Negative β coefficients are consistent with Tobin's Q reflecting better operating efficiency despite our operating efficiency measures have offsetting impacts on Tobin's Q. The high correlation between R_{REV} and R_{COST} is consistent with costs being a stable percentage of revenue across firms. As a consequence, the importance of output appears to dominate cost controls.

Table 2 reports on the β estimates from equation (16) and equation (17). The positive β_{REV} and β_{COST} coefficients equaling 3.3814 (*t*-statistic of 4.44) and 3.3645 (*t*-statistic of 4.20), respectively, indicate that good operating efficiency does not result in a high Tobin's Q. For example, firms that restrict output and have high R_{REV} metrics also have a high Tobin's Q. The results in Table 2 are robust to industry-adjusted Tobin's Q measures.

Overall, while the GIM index captures operating efficiency, Tobin's Q cannot capture cross-sectional variation in operating efficiency.

After an improvement in corporate governance, our model predicts higher output and lower variable costs. These hypotheses are more suited to event-studies than cross-sectional regressions, although identifying changes in the governance of individual firms is difficult.

4   Conclusions

Tobin's Q is often utilized to evaluate the economic implications of corporate governance. We demonstrate that underinvestment by firms with poor corporate governance confounds the relationship between Tobin's Q and corporate governance. Indeed, improvements in corporate governance result in greater output, which decreases rather than increases Tobin's Q.

We provide two operating efficiency measures to assess the corporate governance of firms. These measures are derived from revenue and variable costs, with revenue enabling us to gauge whether a firm is underinvesting and restricting output. Better operating efficiency corresponds to better corporate governance measured according to the Gompers, Ishii, and Metrick (2003) index. However, Tobin's Q cannot capture the operating efficiency implications of corporate governance.

A number of accounting issues such as the treatment of intangible assets remain to be investigated. Extensions of the model also include the addition of debt, taxes, and risk aversion as well as time-varying investment opportunities.

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Table 1: Operating Efficiency and Corporate Governance

This table reports the α coefficients from the regressions in equation (14) and equation (15) that examine the relationship between operating efficiency and proxies for corporate governance. The operating efficiency metrics R_{REV} and R_{COST} are defined in equation (10) and equation (11), respectively. These metrics are constructed within industries classified according to Fama and French (1997). The corporate governance proxy in Panel A is the GIM index in Gompers, Ishii, and Metrick (2003) while the governance proxy in Panel B is the entrenchment index in Bebchuk, Cohen, and Ferrell (2008).

Table 2: Operating Efficiency and Tobin's Q

This table reports the β coefficients from the regression in equation (16) and equation (17) that examine the relationship between Tobin's Q and operating efficiency. The operating efficiency metrics R_{REV} and R_{COST} are defined in equation (10) and equation (11), respectively. These operating efficiency metrics are constructed within industries classified according to Fama and French (1997).