

The Misuse of Tobin's Q

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Abstract

We examine the common and growing misuse of Tobin's q as a proxy for firm value within the law and finance literatures. We trace the history of Tobin's q , beginning with its original role as a mean-reverting construct that macroeconomists used to model investment policy. We document how the original version of q morphed into the simplified market-to-book ratio version that law and finance scholars regularly use today to examine regulatory policy, corporate governance, and other economic phenomena. Whereas macroeconomists rejected this simplistic version of q because of measurement error problems, law and finance scholars embraced it as a proxy for firm value.

In addition, we demonstrate empirically why the simplistic version of q is so problematic. Many of the problems arise because regressions that have as their dependent variable a ratio with book value in the denominator are likely to produce biased estimates, due to both omitted assets and time-varying, firm-specific characteristics that can systematically alter a firm's book value. As a result, the simplistic version of q produces non-classical measurement error in regression specifications that seek to estimate the relationship between firm value and various corporate and regulatory phenomena. We also confirm, consistent with macroeconomists' view of the original Tobin's q , that the market-to-book estimate of q is mean-reverting in terms of stockholder returns.

Finally, we suggest a new approach. We replicate the details of one leading study that was based on the simplistic version of q and then show how its results differ when we employ several alternative approaches. We propose that scholars should use these alternative approaches, including direct estimates of firm value instead of the simplistic market-to-book ratio, and, when possible, should supplement the popular fixed effects estimator with the first difference estimator. Overall, our message is straightforward: scholars should view with suspicion any assertions about corporate governance and regulation that are based on the use of market-to-book ratios as the dependent variable in regressions.

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“You keep using that word. I do not think it means what you think it means.”
Inigo Montoya, *Princess Bride*

INTRODUCTION

For several decades, the economic variable known as Tobin’s Q , or “ q ,” has been one of the most important concepts in business law and policy for examining how various regulatory and corporate governance provisions affect firm value, and therefore economic welfare.¹ More than three hundred law review articles, including many of the most widely-cited in corporate and securities law, have referenced Tobin’s q as a proxy for firm value,² as have hundreds of articles in the most highly-regarded peer-reviewed finance and economics journals.³ The trend in citations to Tobin’s q is markedly upward,⁴ and in 2017 alone, articles in leading law reviews referenced Tobin’s q as a proxy for firm value in analyzing such important topics as how firm value was affected by hedge fund activism,⁵ fiduciary duties,⁶ staggered boards,⁷ and corporate governance.⁸

As originally conceived, Tobin’s q , named for the economist James Tobin, was an important variable in macroeconomic theory; it was defined as the market value of a firm’s assets divided by their replacement value.⁹ However, outside of macroeconomics—most notably, when used as a proxy for firm value in the law and finance literatures—scholars have used a very different, more simplistic version of q , which we label “Simple q .” Simple q is essentially a version of the

¹ See James Tobin, *A General Equilibrium Approach to Monetary Theory*, 1 *J. Money Credit & Banking* 15 (1969).

² See Lucian Arye Bebchuk, *The Case for Increasing Shareholder Power*, 118 *Harv. L. Rev.* 833, 899 n.150 (2005) (describing Tobin’s q as “a standard measure used by financial economists, as a proxy for firm value”). A search for “Tobin! /2 q ” in the Westlaw “Law Reviews & Journals” database on January 2, 2018 generated 343 results. A search for “Tobin’s q ” at the same time in the Law “elibrary” of the Social Science Research Network found 1,195 papers. As we discuss, legal scholars primarily utilize q as a proxy for firm value and firm performance. See, e.g., Michael Klausner, *Empirical Studies of Corporate Law and Governance: Some Steps Forward and Some Steps Not*, ECGI Law Working Paper No. 381/2018, Jan. 2018, at 17 n.57 (“Tobin’s Q is a measure of firm value”).

³ In preparing this article, we conducted a search of articles referencing Tobin’s q in recent issues of the three most cited finance journals: volumes 25-72 of the *Journal of Finance*, volumes 83-124 of the *Journal of Financial Economics*, and volumes 20-30 of the *Review of Financial Studies*. We found that 445 articles in these volumes referenced Tobin’s q , with 95 articles referencing Tobin’s q as a proxy for firm value.

⁴ The search in the Westlaw “Law Reviews & Journals” database, see *supra* note 2, showed that the average and median annual citation rate to Tobin’s q in law reviews has been nearly ten times higher during the 2010s than it was during the 1990s, and that this rate has been increasing throughout the period 1990 through 2017.

⁵ See Leo E. Strine, Jr., *Who Bleeds When the Wolves Bite?: A Flesh-and-Blood Perspective on Hedge Fund Activism and Our Strange Corporate Governance System*, 126 *Yale L.J.* 1870 (2017) (discussing results of hedge fund activism studies based on Tobin’s q); K.J. Martijn Cremers, Erasmo Giambona, Simone Sepe, and Ye Wang, *Hedge Fund Activism and Long-Term Firm Value*, working paper (2015) (using Tobin’s q to examine effect on firm value from hedge fund activism).

⁶ See Sean J. Griffith & Natalia Reisel, *Dead Hand Proxy Puts and Shareholder Value*, 84 *U. Chi. L. Rev.* 1027, 1035 n.41 (2017) (referencing studies based on Tobin’s q in the second paragraph of the article).

⁷ See Martijn Cremers, Lubomir P. Litov & Simone M. Sepe, *Staggered Boards and Long-Term Firm Value Revisited*, *J. Fin. Econ.* (2017) (using q to find that the relationship between staggered boards and firm value is heterogeneous); Yakov Amihud, Markus Schmid & Steven Davidoff Solomon, *Settling the Staggered Board Debate*, *U. Penn. L. Rev.* (forthcoming) (using q to find that a staggered board has no significant effect on firm value); Emiliano M. Catan & Michael Klausner, *Board Declassification and Firm Value: Have Shareholders and Boards Really Destroyed Billions in Value?*, *NYU Law & Economics Research Paper Series*, Working Paper No. 17-36 (Sept. 2017) (same).

⁸ See Zohar Goshen & Richard Squire, *Principal Costs: A New Theory for Corporate Law and Governance*, 117 *Colum. L. Rev.* 767, 809, 823 (2017) (discussing corporate governance studies based on Tobin’s q).

⁹ See Tobin, *supra* note 1, at 22; see also William C. Brainard & James Tobin, *Pitfalls in Financial Model-Building*, *Cowles Foundation Discussion Paper No. 244*, Feb. 8, 1968, at 9.

market-to-book ratio: the market value of a firm's capital divided by its book value.¹⁰ It is worth noting upfront that Simple q is a ratio and that its denominator contains measures of book value: the denominator of the ratio plays an important role in the story of the misuse of Tobin's q .

Research based on Simple q has influenced scholars and policy makers in fundamental ways, and Simple q has been the main dependent variable in statistical tests of the most important questions in business law. How do different countries' legal regimes influence the value of firms?¹¹ How are corporate governance indices related to firm value?¹² Is incorporation in Delaware a race to the top or bottom?¹³ What is the effect of staggered boards?¹⁴ For decades, scholars have attempted to answer all of these important questions and many others using studies based on Simple q .¹⁵

Our central point in this article is that the scholarly use of Simple q is fatally flawed.¹⁶ As a general matter, Tobin's q , in any specification, is not a good proxy for firm value, either in theory or in practice. James Tobin did not envision that scholars would use q to assess firm

¹⁰ More specifically, scholars have used a simplified version of q in which the only market value estimate is that of a firm's equity securities; the market value of other securities (e.g., debt and preferred stock) as well as the replacement value of assets are derived from book values. As we demonstrate below, this simplified version of q is seriously flawed, and does not provide an accurate estimate of firm value. Nevertheless, Simple q has become standard in the literature. We discuss the evolution of Simple q from Tobin's q in Part I.

¹¹ See Rafael La Porta, Florencio Lopez-de-Salinas, Andrei Shleifer & Robert Vishny, Investor Protection and Corporate Valuation, 57 J. Fin. 1147 (2002) (using q to measure valuation of firms to test the effect of different countries' legal regimes); Larry Fauver, Mingyi Hung, Xi Li & Alvaro Taboada, Board Reforms and Firm Value: Worldwide Evidence, 125 J. of Fin. Econ. 120 (2017) (same).

¹² See Paul A. Gompers, Joy L. Ishii & Andrew Metrick, Corporate Governance and Equity Prices, 118 Q.J. Econ. 1007 (2003) (finding that an improvement in a corporate governance index is associated with an increase in q); Lucian A. Bebchuk, Alma Cohen & Allen Ferrell, What Matters in Corporate Governance?, 22 Rev. Fin. Stud. 783 (2009) [hereinafter BCF] (using q to find that increases in a six-factor entrenchment index are negatively associated with firm value). As of early 2018, Bebchuk, Cohen & Ferrell's article was the most downloaded among 950 articles citing Tobin's q on the Social Science Research Network, with a total of 31,153 downloads.

¹³ See Robert Daines, Does Delaware Improve Firm Value?, 62 J. Fin. Econ. 525 (2001) (using q to find that Delaware firms are worth more than firms incorporated elsewhere); Guhan Subramanian, The Disappearing Delaware Effect, 20 J.L. Econ. & Org. 32 (2004) (using q to find that firms incorporated in Delaware are worth 2 to 3 percent more than non-Delaware firms during the period 1991-96, but not after 1996); see also Robert Anderson IV & Jeffrey Manns, The Delaware Delusion, 93 N.C. L. Rev. 1049 (2015) (describing Tobin's q studies and employing a merger reincorporation event study approach).

¹⁴ See Lucian Bebchuk & Alma Cohen, The Costs of Entrenched Boards, 78 J. Fin. Econ. 409 (2005) (using q to find that staggered boards are negatively associated with firm value); Alma Cohen & Charles C. Y. Wang, How Do Staggered Boards Affect Shareholder Value? Evidence from a Natural Experiment, 110 J. Fin. Econ. 627 (2013) (same); Cremers, Litov & Sepe, supra note 7 (using q to find that the relationship between staggered boards and firm value is heterogeneous); Amihud, Schmid & Davidoff Solomon, supra note 7 (using q to find that a staggered board has no significant effect on firm value); Catan & Klausner, supra note 7 (same).

¹⁵ See, e.g., Randall Morck, Andrei Shleifer & Robert W. Vishny, Management Ownership and Market Valuation: An Empirical Analysis, 20 J. Fin. Econ. 293 (1988) (describing q as a "proxy for market valuation of the firm's assets" and finding that q varies based on board equity ownership); John J. McConnell & Henri Servaes, Additional Evidence on Equity Ownership and Corporate Value, 27 J. Fin. Econ. 595 (1990) (finding that q is positively related to the fraction of shares owned by institutional investors and curvilinearly related to insider ownership at various levels); Larry H.P. Lang & Rene M. Stulz, Tobin's Q , Corporate Diversification, and Firm Performance, 102 J. Pol. Econ. 1248 (1994) (finding that q and diversification are negatively related).

¹⁶ Our critique of Simple q is consistent with the theoretical general equilibrium framework in which the market-to-book version of Tobin's q is a mean-reverting function that is associated with both the value premium and the volatility of stock returns. See Giovanni Walter Puopolo, The Dynamics of Tobin's Q , working paper (2016); see also Patrick Bolton, Hui Chen & Neng Wang, A Unified Theory of Tobin's q , Corporate Investment, Financing, and Risk Management, 66 J. Fin. 1545 (2011) (proposing a model of how external financing costs influence firm investment). We are primarily interested in the use of q in the empirical corporate finance literature.

value, and it is not fit for that purpose, particularly in its currently-used simplified form. During the 1980s, when some studies began adopting Simple q as the dependent variable in empirical studies of firms, several scholars warned about its inaccuracy, bias, and variability.¹⁷ Yet notwithstanding these warnings, academics have continued to use Simple q as a proxy for firm value, often without questioning its accuracy or meaning.

At the outset, it is worth pausing to ask what the original formulation of Tobin's q measures. According to Tobin, when q is high, the market value of an asset—call it a widget—held by a firm is greater than its replacement cost. In other words, the perception among market participants is that this asset is more valuable than the cost of replacing it. If this perception is accurate, and a firm can increase the scale of its operations, it follows that the firm should invest in widgets, and continue to invest, until the market value of widgets is equal to their replacement cost—that is, until q is equal to 1.

However, it does not follow from this analysis that firms with relatively high q have relatively high value or that they will even retain a high level of q . On the contrary, under Tobin's original theory, the q of any given firm should revert to 1 in the future.¹⁸ Additionally, to the extent the market value of a firm's assets is greater than their replacement value, high q firms could face declining profit opportunities. (Widgets might become more expensive due to increased demand, or competitors might recognize the profit opportunities associated with widgets.)

In the macroeconomics literature, scholars studying “Macro q ” have carefully developed theories about the meaning of a high level of q , which generally focus on how high q firms should be expected to increase investment (which might or might not correlate with firm value). Indeed, as Philip Dybvig and Mitch Warachka note, the fact that a firm has a high level of q could very well reflect inefficient underinvestment (and a failure to maximize firm value) given that additional investment should drive q towards 1.¹⁹ Dybvig and Warachka's critique of q is more narrowly circumscribed than ours: they focus on developing a theoretical critique of q and assessing measures of operating efficiency as a potential substitute.²⁰ Nevertheless, it is striking that Dybvig and Warachka's paper has not only remained unpublished since it was posted online in 2010, but also generally has been ignored within the law and finance literature.²¹

¹⁷ See Kee H. Chung & Stephen W. Pruitt, A Simple Approximation of Tobin's q , 23 *Fin. Mgt.* 70, 71 n.3 (1994); Steven B. Perfect & Ken Wiles, Alternative Constructions of Tobin's Q : An Empirical Comparison, 1 *J. Empirical Fin.* 313 (1994).

¹⁸ Moreover, the disconnect between the market value of a firm's assets and their replacement value might be due to short-term market opportunities or to behavioral effects on market prices. High q can also be consistent with lower expected returns (i.e., a lower cost of capital). We explore the relationship between q and equity returns in Part II.B.

¹⁹ See Philip H. Dybvig & Mitch Warachka, Tobin's q Does Not Measure Firm Performance: Theory, Empirics, and Alternatives, working paper (2010). As a simple example, Dybvig and Warachka posit a firm with a market value of \$15 based on \$10 of investment, yielding a q of 1.5. If expanding the firm's scale through a \$20 investment increased its market value by \$24, the firm's q would decline to 1.3 but its market value would increase by \$4. See *id.* at 3.

²⁰ See *id.* at 4.

²¹ For instance, while nearly 350 papers discuss Tobin's q within Westlaw, see *supra* note 1, only two papers within Westlaw could be located that cite Dybvig and Warachka's paper. Of the two, one dismisses the study in a footnote as “an unpublished paper”, see Lucian Bebchuk, Alon Brav, and Wei Jiang, “The Long-Term Effects of Hedge Fund Activism,” 115 *Colum. L. Rev.* 1085, 1102 n.53 (2015), and the other cites it once for the proposition that the use of q as a measure of company performance “has been subject to criticism.” See Leo E. Strine, Jr., Can We Do Better By Ordinary Investors? A Pragmatic Reaction to the Dueling Ideological Mythologists of Corporate Law, 114 *Colum. L. Rev.* 449, 462 n. 39 (2014); see also Klausner, *supra* note 2,

This preliminary discussion sets the stage for our initial analysis, which asks the simple question: “*If scholars are interested in examining firm value, why use a proxy like Tobin’s q at all? Why not measure firm value directly?*” After all, the numerator of Tobin’s q provides an estimate of the market value of a firm’s capital, representing a ready estimate of firm value. The widespread use of q to proxy for firm value thus implies a decision to scale firm value by the replacement value of assets. In Part I, we trace the history of q to explore the reasoning behind this decision. Our historical account reveals how the use of q as a proxy for firm value arose not from a conscious decision to scale firm value by the replacement cost of assets, but from an untested assertion in a handful of papers during the early 1980s that a firm’s market value might exceed the replacement value of its assets due to superior management, despite the possibility of other explanations (e.g., monopoly rents, temporary first mover advantages, intellectual property rights, etc.).

This historical account also illustrates how far the scholarly literature has moved from James Tobin’s original conception of q . In contrast to Tobin’s original conception of q as a way to model investment behavior in macroeconomics (what we label “Macro q ”), we document the emergence of a distinct use of q in finance in which it serves as a proxy for firm value (which we label “Finance q ”). Critically, finance scholars increasingly relied on Simple q given that, as a de facto market-to-book ratio, it could be used to estimate firm value within a cross section of firms. Yet at about this time, scholars within the Macro q literature were developing increasingly nuanced measures of q due to concerns about the difficulty of measuring “true” q and the econometric challenges of using a q proxy that is measured with error.²² Moreover, we show that the very scholars who initially warned against the use of Simple q were later mis-cited for the proposition that Simple q , despite its limitations, could nevertheless be used as a proxy for firm value. Ironically, we also illustrate how during this time important developments were occurring in the field of accounting that sought to measure firm value directly but—to this day—have largely been ignored in empirical corporate finance in favor of using Simple q as a proxy for firm value. (We ultimately propose a modification of the more sophisticated approach used by accounting scholars as a superior methodology to the relatively crude approach of using Simple q .)

Having documented the questionable intellectual foundation of Simple q , we turn in Part II to an empirical exploration of its deficiencies as a proxy for firm value within the Finance q literature. In Part IIA, we focus on how Simple q suffers from non-classical measurement error, which undermines its reliability in regressions using Simple q as an outcome variable of interest. As a result, using Simple q as a dependent variable can produce biased coefficient estimates of which

at 18 (citing Dybvig and Warachka for the proposition that q “is considered by some economists to be an unreliable measure of value”).

²² See Erickson and Whited, *Treating Measurement Error in Tobin’s q* , 25 *Rev. Fin. Stud.* 1286 (2012). Much of the careful analysis of q has been in the macroeconomic context, which, as we explain below, uses q as a regressor to explain corporate investment rather than as a dependent variable. It is well known that measurement error in a regressor can result in biased regression estimates, which no doubt helps explain the focus on measurement error in the Macro q context. Interestingly, this analysis does not seem to have migrated to the empirical corporate finance literature, though as we explain below the potential bias from measurement error in q is equally problematic when q is used as an outcome variable. In any event, the scholars engaged in this analysis of q obviously understand that the stakes are high: they note that “Tobin’s q has become ‘arguably the most common regressor in corporate finance.’” See Ryan H. Peters & Lucian A. Taylor, *Intangible Capital and the Investment- q Relation*, 123 *J. Fin. Econ.* 251, 252 (2017) (quoting Erickson and Whited, 25 *Rev. Fin. Stud.* at 1286).

variables are associated with a firm's q . Among other things, we show how Simple q 's denominator substitutes the book value of a firm's assets for their replacement cost and why this substitution produces non-classical measurement error. In particular, aggregated book values for firms omit important assets, particularly a sizeable percentage of intangible assets. As a result, firms with relatively high intangible assets generally will have higher measures of Simple q .²³ Research findings that a particular corporate governance provision is associated with higher Simple q could, accordingly, be biased if firms with those provisions also invest heavily in intangibles. (In Part III, we show this to be the case in an important corporate governance study).

In Part II.B., we report the results of several econometric tests demonstrating that high q firms should not be viewed as presumptively more likely to produce value for their investors, as much of the literature has assumed. Specifically, we show that Simple q is inversely associated with the following year's annual returns on both a gross and risk-adjusted basis, an association that raises questions about empirical studies that use Simple q as a proxy for long-term firm value.²⁴ We argue that scholars who continue to rely on Simple q as a proxy for firm value should explicitly consider the inverse relationship between q and subsequent returns, and we consider potential explanations for this inverse relationship, a puzzle that connects to several related literatures and ongoing debates in law and finance, including asset pricing. Most notably, the reciprocal of Simple q , the ratio of book value to market value, is a significant risk factor in the Fama-French asset pricing models and their progeny, which we discuss in detail below, but which generally are not even mentioned in the literature relying on Simple q .²⁵

In Part III, we show that our critique of Simple q matters. We do so by revisiting the results of an especially influential study in corporate governance by Lucian Bebchuk, Alma Cohen, and Allen Ferrell.²⁶ This paper helped usher in a wave of papers examining the relationship between q and various corporate governance interventions. After replicating their results, we show that the associations between governance and q documented in their study depend on the use of Simple q and do not hold for a new, alternative measure of q called "Total q " that potentially addresses some of the measurement errors in Simple q that we document in Part II.A.²⁷ As we discuss

²³ The reason is straightforward arithmetic: if the denominator is lower because it omits intangibles, the overall measure will involve division by a lower number, and therefore Simple q will be higher. Moreover, because firms have time-varying, idiosyncratic differences in their investment in intangibles, conventional approaches to controlling for unobserved firm-specific heterogeneity are flawed. For example, we show in Part II.A how unbooked intangible assets are positively associated with Simple q , even holding constant industry- and firm-fixed effects. Ryan Peters and Lucian Taylor have developed a modified version of Tobin's q , which they refer to as Total q , to address the measurement error bias that arises from the market valuing a firm's intangible assets even though intangible assets are not part of balance sheet assets and are highly serially correlated. See Peters & Taylor, *supra* note 22, at 269 ("This bias is probably most severe in the standard regressions that omit intangible capital, as omitting intangible capital is an important source of measurement error, and a firm's intangible capital stock is highly serially correlated."). Peters and Taylor substitute a value of intangible assets that is less problematic in terms of serial correlation but that suffers from other limitations as it is simply based on the firm's past expenditures on research and development and a 30 percent share of its prior selling, general, and administrative expenditures.

²⁴ See, e.g., Cremers, Litov & Sepe, *supra* note 14 (finding that, among innovative firms, adoption of a staggered board is associated with an increase in firm value as proxied by q and concluding that "in more innovative firms ... adopting (removing) a staggered board is associated with an increase (decrease) in long-term firm value.").

²⁵ See, e.g., Eugene F. Fama & Kenneth French, Value Premium and The CAPM 51, *J. Fin.* 55 (1996) (finding that book-market ratios are significantly associated with equity returns).

²⁶ BCF, *supra* note 12..

²⁷ See Peters & Taylor, *supra* note 22, at 269. For example, Luke Peters mentioned to us as an example the differences between Simple q and Total q for Google Inc., as of 2013. Peters estimated that Google's Simple q was 10.1 at the time, whereas the Total q estimate was just 3.2. The difference was due in significant part to Total q 's inclusion of \$20.2 billion of estimated intangible

below, these differences arise largely from the ways in which Total q avoids some of the measurement errors that affect Simple q . We further show that the results in this study do not hold when using a “first difference” estimator approach—a common alternative to the “fixed effect” estimator used by Bebchuk Cohen, and Ferrell that should ideally produce similar regression results.²⁸ Part III underscores how findings that q is associated with a firm’s corporate governance can be highly sensitive to methodological choices.

Our replication study also underscores how the misuse of Tobin’s q can have significant consequences for the conclusions of some of the most cited academic studies in business law and finance. Other instances are easy to find. Consider as one example this fundamental and much-analyzed question: do low market valuations lead to firms becoming takeover targets? Both theory and practice have long supported an answer of yes, as have some studies, including a thorough 2012 analysis by Edmans, Goldstein, and Jiang.²⁹ Yet much of the empirical literature, relying on Simple q as a dependent variable, has suggested either that there has been no link between valuation and takeover probability, or even that this relationship has been negative.³⁰

We view this example of the misuse of q as unfortunately representative. Too many scholars have conducted studies based on Simple q to support important policy positions, and too many commentators and policy makers have then relied on those studies. Our goal here is to expose and discourage the practice of relying on Simple q .

Finally, we suggest a variety of alternative approaches to examining how firm value is affected by corporate governance and regulatory policy, which we explore in Part IV. We focus on two categories of alternatives. First, as suggested in our replication study, there are alternative measures of Tobin’s q , other than Simple q , that address some of the measurement problems of Simple q . Second, there are alternative techniques that do not rely on q , including the analysis of stockholder returns as well as direct estimates of firm value.³¹

capital value, derived from capitalized estimates based on Google’s 2013 research and development expenditures (\$8.0 billion) and 30% of its selling, general, and administrative expenses (\$3.6 billion). For the methodology used to generate these intangible capital value estimates, see id.

²⁸ See Jeffrey M. Woolridge, *Econometric Analysis of Cross Section and Panel Data* 279-91 (2001) (describing the “first difference” approach for analyzing panel data).

²⁹ See Alex Edmans, Itay Goldstein & Wei Jiang, *The Real Effects of Financial Markets: The Impact of Prices on Takeovers*, 67 *J. Fin.* 933 (2012) (using an instrumental variables approach to the endogeneity of market prices and the increase in anticipation of takeovers, and finding in contrast to the prior literature that market prices do trigger takeover threats).

³⁰ See, e.g., Martijn Cremers, Vinay Nair & Kose John, *Takeovers and the Cross-Section of Returns*, 22 *Rev. Fin. Stud.* 1409 (2009) (finding a negative but insignificant relationship between takeover probability and q); Thomas Bates, David Becher, and Michael Lemmon, *Board Classification and Managerial Entrenchment: Evidence from the Market for Corporate Control*, 87 *J. Fin. Econ.* 656 (2008) (same); Krishna Palepu, *Predicting Takeover Targets: A Methodological and Empirical Analysis*, 8 *J. Acc’ting & Econ.* 3 (1986) (finding no relationship between takeover probability and Tobin’s q); Brent Ambrose & William Megginson, *The Role of Asset Structure, Ownership Structure, and Takeover Defenses in Determining Acquisition Likelihood*, *J. Fin. & Quant. Analysis* 575 (1992) (same); and Matthew Rhodes-Kropf, David Robinson & Sean Viswanathan, *Valuation Waves and Merger Activity: The Empirical Evidence*, 77 *J. Fin. Econ.* 561 (2005) (finding higher market-to-book ratios in treatment than control firms). Edmans, Goldstein, and Jiang rebutted these suggestions, and questioned the practice of using q as a proxy for firm value. See Edmans, Goldstein & Jiang, 67 *J. Fin.* 933 (“Our results challenge the common practice of using Tobin’s Q or stock price performance to measure management quality.”). Their criticism echoed a leading study from 1997 by Lewellen and Badrinath that surveyed the wide-ranging empirical results in the literature and challenged the common practice of using q . See Wilbur G. Lewellen & S.G. Badrinath, *On the Measurement of Tobin’s q* , 44 *J. Fin. Econ.* 77 (1997).

³¹ Several scholars have used event studies and returns-based tests to examine the effects of changes in various practices. See, e.g., Alon Brav, Wei Jiang, Frank Partnoy & Randall Thomas, 63 *J. Fin.* 1729 (2008) (using event studies and calendar-time

We view the use of direct estimates of firm value as especially relevant for scholars working within the Finance q research tradition. As noted above, scholars in the related field of accounting have long eschewed using Tobin's q —in any form—as a proxy for firm value, choosing instead to measure improvements in firm value directly by using a firm's market value of equity.³² Adopting the approach utilized in accounting for measuring firm value accordingly has the benefit of allowing scholars to estimate directly how corporate structure and regulatory policy affect firm value. By expressly measuring firm value, it might also help encourage greater scrutiny of the econometric challenges associated with examining changes in firm value. Most notably, our hope is that, given the increasing use of panel datasets to identify causal effects in corporate governance research, expressly measuring year-over-year changes in firm value will induce scholars to be more attentive to adjusting for serial correlation as well as whether the popular fixed effects estimator is likely to produce biased estimates of the predictors of firm value.³³

We also argue that law and finance scholars should use and report multiple econometric approaches instead of simply relying on Simple q . In addition to using Total q and following the accounting approach of expressly testing firm value as a dependent variable, scholars working with panel datasets also should consider using the “first difference” estimator, and then reporting the results based on each of these various methodologies. By using multiple approaches, scholars can avoid claims that results were cherry picked based on a particular methodology.

In sum, q —especially Simple q —does not mean what many scholars seem to think it means. Absent more robust testing, the conclusions in the empirical finance literature that rely on q as a dependent variable are unsound and should not be the basis for academic inquiry or policy decisions. Instead, scholars and policy makers should approach studies based on q with caution, and should seek alternative methodologies to assess the correlates of firm value.

Our examination of q is an example of a broader phenomenon: the emergence of path-dependent yet haphazard ideas in intellectual history.³⁴ We hope to follow other scholarship addressing how

portfolio regressions, but not Tobin's q); Martijn Cremers & Allen Ferrell, *Thirty Years of Shareholder Rights and Stock Returns*, working paper (2015) (exploring the association between shareholder rights and stock returns, but not Tobin's q , focusing on merger activity as a potential additional risk factor). There are also accounting-based alternatives to using a q -focused metric. See, e.g., Dybvig & Warachka, *supra* note 19 (proposing two alternative measures to q based on operating efficiency); Vito D. Gala & Joao F. Gomes, *Beyond Q: Investment without Asset Prices*, The Wharton School Research Paper No. 41 (2016) (arguing for the use of underlying variables, such as size and sales, instead of q).

³² See Mary E. Barth & Sanjay Kallapur, *The Effects of Cross-Sectional Scale Differences on Regression Results in Empirical Accounting Research*, 13 *Contemporary Accounting Research* 527 (1996) (investigating bias resulting from scale differences in regressions based on market values); Mary E. Barth & Greg Clinch, *Scale Effects in Capital Markets-Based Accounting Research*, 36 *J. Bus. Fin. & Accounting* 253 (2009) (assessing simulations of the effects of firm size in regressions based on market values); James A. Ohlson & Seil Kim, *Linear Valuation without OLS: The Theil-Sun Estimation Approach*, 20 *Rev. Accounting Stud.* 395 (2015) (discussing modifications of regressions based on market values to account for scale).

³³ Much of the recent work in empirical corporate finance has sought to identify the causal effects of governance on firm value (as proxied by Simple q) by using panel datasets that contain time series (e.g., year-over-year) data on individual firms. See, e.g., BCF, *supra* note 12 (using panel dataset with firm-year observations); Daines, *supra* note 13 (same); Cremers, Litov & Sepe, *supra* note 7 (same); Amihud, Schmid & Davidoff Solomon, *supra* note 7 (same); Catan & Klausner, *supra* note 7 (same).

³⁴ The concept of supposed truths that are false and therefore should be rejected has existed for centuries, and arguably emerged into widespread parlance from the King James Bible, which included the admonition from the Apostle Paul to his young protégé, Timothy: “But refuse profane and old wives’ fables, and exercise thyself [rather] unto godliness.” Apostle Paul, 1 Timothy 4:7, King James Bible (1611).

such ideas can gain traction in academia, but later are exposed as inaccurate.³⁵ Our hope is that in the future scholars will look back on the misuse of Tobin's q as an interesting historical anecdote, a surprising wrong turn, but one that has been superseded by more careful, scientifically-justified analysis in empirical law and finance.

I. A History of Q

This Part sets forth a history of Tobin's q , beginning with its original use and then turning to more recent simplified specifications, including Simple q . Although Simple q is widely used in empirical finance scholarship, the evolution of its original use from the use of q in macroeconomics (that is, as Macro q) has not previously been described in the literature. The history of the simplistic version of q illustrates many of the drawbacks of its use in empirical law and finance.

A. Brainard and Tobin's Original Formulation of Q in Macroeconomics

Although the variable q is typically attributed to the economist James Tobin, the theoretical construct underlying q originated from joint work between Tobin and William C. Brainard,³⁶ a colleague of Tobin's at Yale. In 1968, Brainard and Tobin introduced a theoretical model of an economy in which one central proposition was that "the market valuation of equities, relative to the replacement cost of the physical assets they represent, is the major determinant of investment."³⁷ They noted that investment in physical assets is stimulated when capital is more highly valued in the market than it costs to produce, and investment is discouraged when capital is valued in the market below its replacement cost. Brainard and Tobin were focused on explaining fluctuations in investment, so they intuitively compared the market yield on equity with the real returns to physical investment. However, in their 1968 paper they did not specify a variable with a letter to describe this concept. The concept was not yet named " q ".

The setting in which Brainard and Tobin introduced the conceptual underpinnings of q obviously was quite different than the setting in which Simple q is used in empirical law and finance scholarship. The authors were comparing market prices with the replacement cost of physical assets in order to describe fluctuations in investment that were relevant for the purposes of macroeconomic modeling. Indeed, Brainard and Tobin emphasized that the ratio of the market prices to the replacement cost of related physical assets likely would change over time, based on a range of variables.

A year later, in 1969, Tobin published "A General Equilibrium Approach to Monetary Theory." In developing the macroeconomic model in that paper, Tobin reiterated the concept of market value vs. replacement costs and stated that he would "allow the value of existing capital goods,

³⁵ See, e.g., Lawrence A. Hamermesh & Michael L. Wachter, The Short and Puzzling Life of the "Implicit Minority Discount" in Delaware Appraisal Law, 156 U. Penn. L. Rev. 1 (2007) (describing the emergence and reliance on the implicit minority discount as a means to avoid imposing the costs of fiduciary breaches on squeezed-out minority shareholders).

³⁶ Although Tobin ultimately came to receive naming credit for q , Brainard also left a considerable, though q -less, legacy, including the William C. Brainard Professorship of Economics at Yale, where he served as provost from 1981 to 1986 and was chair of the economics department. Among Brainard's Ph.D. students is David F. Swensen, the long-time Yale chief investment officer. See <http://giving.yale.edu/news/brainard>.

³⁷ See Tobin & Brainard, *supra* note 9, at 9.

or of titles to them, to diverge from their current reproduction cost.”³⁸ Tobin then used the letter q to describe how this variation could be interpreted in then-current versions of the Investment Saving–Liquidity Preference Money Supply (IS-LM) macroeconomic model. In Tobin’s formulation, if q equaled 1, the standard IS-LM curves held. But if q were greater than or less than 1, there would be a short-run disequilibrium.³⁹ The long-run equilibrium would then require some form of adjustment, so that q would move in the direction of 1.⁴⁰ Tobin illustrated the effects of changes in q on the IS-LM model in Figure 3 of his 1969 paper, which is reproduced from the original below.

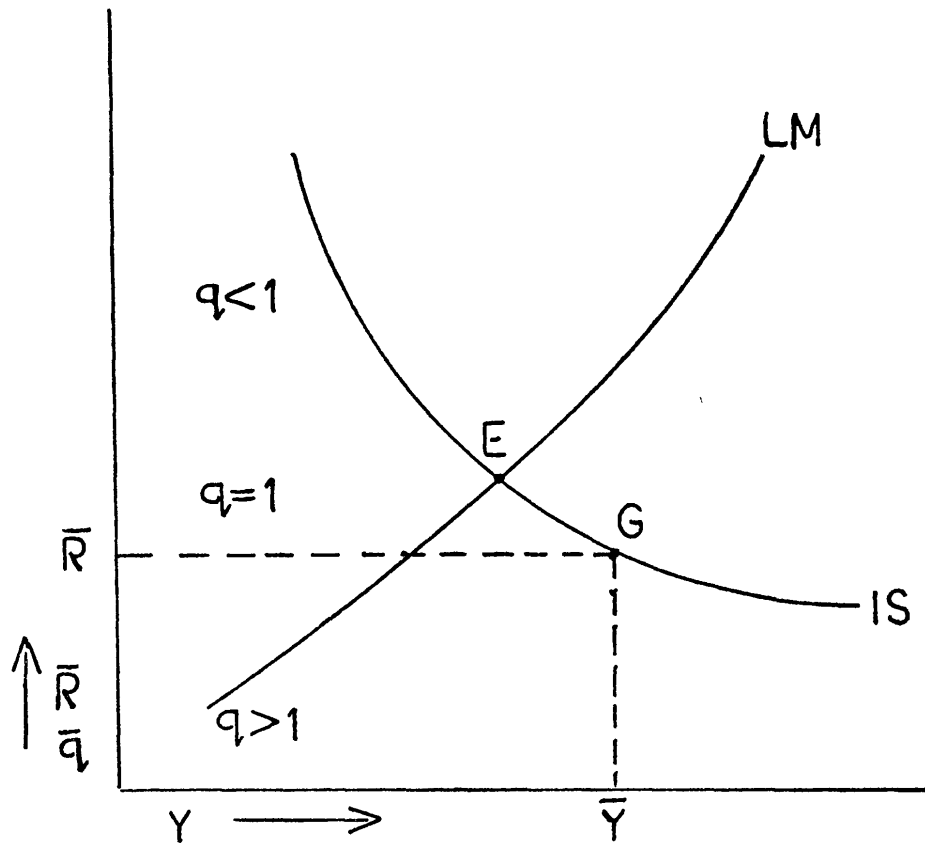


FIG. 3. *LM* Curve Plotted with *IS* Curve.

Tobin cautioned in his concluding remarks that “[t]he models discussed here were meant to be illustrative only, and to give meaning to some general observations about monetary analysis.”⁴¹ Tobin concluded that the key insight associated with the introduction of q related to monetary policy: the major way for monetary policy to affect aggregate demand was “by changing the valuation of physical assets relative to their replacement costs.”⁴² In other words, the context for the introduction of q was as a tool in the theory of monetary policy. Tobin’s q was truly Macro q :

³⁸ Tobin, *supra* note 1, at 19.

³⁹ *Id.* at 22-23.

⁴⁰ *Id.* at 23.

⁴¹ *Id.* at 29.

⁴² *Id.* at 29.

it had nothing to do with measuring the effects of a change in policy or a shock on relative prices; instead, it was a potential lever that might be used to change aggregate demand (the dependent variable in Tobin's model). In general terms, q described how financial markets affected investment and economic activity. Put another way, Tobin's q began its life as a potential regressor on the right side of financial equations, not as a dependent variable on the left.

According to Tobin, the deviation of q from 1 was an important short-term determinant of investment. Specifically, in Tobin's model, if q were above one, the value of physical assets would be relatively high. Firms would invest a greater amount, because they would benefit from buying assets at a lower cost than their market value. Accordingly, when $q > 1$, investment should increase in Tobin's model. Conversely, when $q < 1$, investment should decrease. In the long run, adjustments in capital investment should occur, so that a firm's actual capital stock should approach the optimal investment in capital stock.⁴³

Tobin's q remained an important concept in macroeconomic theory throughout the 1970s and it continues to play a role in that field today.⁴⁴ However, Macro q did not immediately play any role in empirical corporate finance.

B. A New View of Q in Empirical Finance: 1977-1984

Not surprisingly, the first empirical studies using Tobin's q focused on examining the sensitivity of investment outlays to changes in the incentive to invest.⁴⁵ Indeed, the stagflation of the 1970s made Tobin's theory particularly attractive to scholars seeking to understand how factors other than interest rates might affect corporate investment.⁴⁶ Similar considerations motivated pioneering work on how tax policy might affect corporate investment through changes in q .⁴⁷ In keeping with this macroeconomic focus, these early papers examined aggregate levels of q across the entire economy, generally using federal flow of funds data to estimate q .⁴⁸ During this time, scholars did not focus on estimating the effects of q on corporate investment using firm-level estimates.

During this same time, scholars in empirical corporate finance, who traditionally had used accounting-based measures to assess firm profitability, began raising several objections to those

⁴³ Note that Tobin's model explicitly contemplated that in the short-run the measure of q would fluctuate. Indeed, the explanatory power of Tobin's model derived in part from the fluctuations in q .

⁴⁴ Tobin refined his macroeconomic model during the 1970s. See James Tobin, *Monetary Policies and the Economy: The Transmission Mechanism*, 37 *Southern Econ. J.* 421 (1978).

⁴⁵ See e.g., George M. Von Furstenberg, *Corporate Investment: Does Market Valuation Matter in the Aggregate?*, 1977 *Brookings Papers on Economic Activity* 347 (1977) (empirically examining whether the q ratio predicts investment by nonfinancial corporations).

⁴⁶ See e.g., Fumio Hiyasahi, *Tobin's Marginal q and Average q : A Neoclassical Interpretation* 50 *Econometrica* 213 (1982) (deriving a relationship between unobservable marginal q —the market value of an additional unit of capital that should stimulate investment in Tobin's model—and average q , the ratio of the market value of existing capital to its replacement cost which is potentially observable).

⁴⁷ See e.g., Lawrence H. Summers, *Taxation and Corporate Investment: A q -Theory Approach*, 1981 *Brookings Papers on Economic Activity* 67 (1981) (examining corporate investment as a function of changes in tax-adjusted q).

⁴⁸ See e.g., Von Furstenberg, *supra* note 45; Hiyasahi, *supra* note 46; Summers, *supra* note 47.

measures.⁴⁹ In particular, scholars expressed concern that accounting rates of return measured only past profits, and did not reflect expectations about the future. Accounting measures did not reflect assessments of risk, either. Moreover, they were sensitive to inflation, a major concern during the late 1970s, when inflation rates and nominal interest rates were very high. At this time, financial economists first considered introducing q onto new scholarly turf: to evaluate firm performance. Might q be better than accounting-based measures?

A potential answer appeared in a 1981 article by Eric Lindenberg, a researcher at AT&T, and Stephen Ross, an economist at Yale.⁵⁰ Lindenberg and Ross titled their article “Tobin’s q Ratio and Industrial Organization,” but they opened the article more modestly, by referencing the use of q in macroeconomic models, not industrial organization. They noted the important intuition arising from Tobin’s macroeconomic model that if firms took all profitable opportunities when the value of their new capital investment exceeded its cost (in other words, when $q > 1$), then the marginal value of q should converge to 1. This reference, and the intuition backing it, had become standard in the macroeconomics literature.

But then Lindenberg and Ross said something extraordinary: “We will employ this argument peripherally below, but our focus is somewhat different. Our interest is in the cross-sectional value of q and its implications for industrial organization in general”⁵¹ In other words, Lindenberg and Ross were transporting Tobin’s macroeconomic q to a new context, where the variable might take on entirely different meanings and functions.

Instead of focusing on the effects on capital investment when q differed from 1, as Tobin and his followers had, Lindenberg and Ross described the range of reasons why q might differ from 1. Their analysis of *why* the variable might differ from 1 included the prospect of Ricardian and monopoly rents, which presumably would lead to asset market values that were higher than their replacement values. Thus, Lindenberg and Ross suggested that q might be useful, not only in examining levels of investment, but also in assessing firm profitability. The implicit conclusion, that high q firms were more profitable, was asserted, but not rigorously defended.

Most important, Lindenberg and Ross developed a procedure for calculating q . They created a database of q estimates for a large sample of firms, and used an example of their database to examine and test several q -based measures. The implication of their path-breaking paper was that other scholars also could use q to examine and assess differences among firms.

The new Lindenberg and Ross formulation of q was catnip for empirical corporate finance researchers. During the early 1980s, researchers began advocating q as a measure that was superior to the range of accounting-based measures that scholars had been using to assess firm profitability.⁵² By adopting and then adapting q from the theoretical macroeconomics literature,

⁴⁹ See Ezra Solomon, Alternative Rate of Return Concepts and Their Implications for Utility Regulation, 1 Bell J. Econ. & Mgt. Sci. 65 (1970); T.R. Stauffer, The Measurement of Corporate Rates of Return: A Generalized Formulation, 2 Bell J. Econ. & Mgt. Sci. 434 (1971); T.R. Stauffer, The Measurement of Corporate Rates of Return (1980).

⁵⁰ Eric B. Lindenberg & Stephen A. Ross, Tobin’s q Ratio and Industrial Organization, 54 J. Bus. 1 (1981).

⁵¹ Id. at 2.

⁵² See, e.g., Henry McFarland, Evaluating q as an Alternative to the Rate of Return in Measuring Profitability, 70 Rev. Econ. & Stats. 614 (1988) (citing the literature assessing firm profitability).

empirical researchers in corporate finance potentially had found a more accurate measure to use in assessing firm profitability.

Following Lindenberg and Ross, finance scholars began to embrace q .⁵³ It offered several advantages compared to accounting measures. Because the numerator of q included market value, it reflected expectations about the future. Market prices also reflected assessments of risk, because they were influenced by expectations about the variance of future profits. Throughout the early- and mid-1980s, several scholarly articles discussed the extent to which q might be a viable substitute for purely accounting-based metrics.⁵⁴

C. The Growing Divergence between “Macro Q” and “Finance Q”: 1984-1992

During the 1980s, as q gained some traction among financial economists as a measure of firm performance, two notable trends emerged that highlighted a growing divide between the use of q by macroeconomists versus financial economists. The first difference was conceptual; the second was definitional.

First, consistent with the early macroeconomic literature testing Tobin’s original theory, several macroeconomists explored the relationship between q and corporate investment. Their papers largely reflected the original conception of q as articulated by Tobin.⁵⁵ However, an important theoretical modification was made in 1982 by Fumio Hayashi, who sought to connect formally the insights of Tobin with the neoclassical theory of investment.⁵⁶ This latter theory had generally focused on modeling a firm’s investment in its physical capital as an optimization challenge in which a firm sought to maximize returns to scale while accounting for “installation costs.” Recognizing the theoretical importance of installation costs, Hayashi formally modified Tobin’s theory to account for them: in this new “ q -theory of investment” a firm decides the optimal rate of investment through knowledge of q and the firm’s installation costs.⁵⁷ Notably, given this focus on a firm’s investment in physical capital and installation costs, q within this literature represented the market value of the firm relative to the replacement costs of its physical capital.

In contrast, within finance circles the possibility that q might reflect a firm’s ability to extract economic rents was increasingly conflated with the possibility that q reflected firm value. An

⁵³ See id.; Michael A. Salinger, Tobin’s q , Unionization, and the Concentration-Profits Relationship, 15 *Rand J. Econ.* 159 (1984); Michael Smirlock, Thomas Gilligan & William Marshall, Tobin’s q and the Structure-Performance Relationship, 74 *Amer. Econ. Rev.* 1051 (1984); Mark Hirschey, Market Structure and Market Value, 58 *J. Bus.* 89 (1985).

⁵⁴ See references cited in note 53.

⁵⁵ See, e.g., Michael A. Salinger & Lawrence H. Summers, Tax Reform and Corporate Investment: A Microeconomic Simulation Study, in Martin Feldstein, ed., *Behavioral Simulation Models in Tax Policy Analysis* (1983) (developing a methodology for simulating the effects of alternative corporate tax reforms on corporate investment by individual firms); Steven M. Fazzari, R. Glenn Hubbard, Bruce C. Petersen, Alan S. Blinder & James M. Poterba, Financing Constraints and Corporate Investment, 1988 *Brookings Papers on Economic Activity* 141 (1988) (studying the impact of financing constraints on corporate investment by individual firms after controlling for q).

⁵⁶ Fumio Hayashi, Tobin’s Marginal q and Average q : A Neoclassical Interpretation, 50 *Econometrica* 213 (1982).

⁵⁷ More specifically, if $(1-\Psi)$ represents the costs associated with installing an additional unit of capital (denoted by λ), the market value of the firm will increase by only Ψ for each investment of λ , constraining the extent to which a firm will pursue additional investment regardless of the value of q . The q theory of investment remains provocative given the informational content it attributes to q . As Hayashi noted, “All the information about the demand curve for the firm’s output and the production function that are relevant to the investment decision is summarized by q .” Id. at 218.

article commonly cited as a pioneering the use of q in this regard is Randall Morck, Andrei Shleifer, and Robert Vishny's 1988 study of the relationship between management ownership and firm value.⁵⁸ In examining a cross-section of 371 firms using data from 1980, they found that Tobin's q rose with management ownership in firms where management held a small percentage of equity, but declined in firms where management held a larger percentage. Morck, Shleifer and Vishny assumed that high q firms were associated with higher expected future profits, an assumption we examine in Part II.⁵⁹

It is worth noting that the version of q used by Morck, Shleifer, and Vishny is markedly different from Simple q in several ways. First, they used actual estimates of replacement costs, from the 1980 Griliches R&D Master file, rather than book value, to estimate the denominator of q . This financial dataset was created by the National Bureau of Economic Research for a sample of firms during the late 1970s and early 1980s and provided a variety of metrics one could use to estimate actual replacement values.⁶⁰ Second, they used actual estimates of the market values of preferred stock and long-term debt rather than book value to estimate their q numerators. Third, they discussed extensively the potential bias associated with their q estimates.⁶¹ As we discuss in Part I.D., scholars later largely abandoned all of these practices and instead simply used book values for all measures except stock prices, without discussion.⁶²

However, Morck, Shleifer, and Vishny did not show the same degree of care in describing their rationale for using q . In explaining the choice of Tobin's q as the outcome variable, the authors explained that "Tobin's Q is high when the firm has valuable intangible assets in addition to physical capital, such as monopoly power [Lindenberg and Ross (1981)], goodwill, a stock of patents, or good managers."⁶³ They noted that high q might arise from any of these sources of "intangible assets," and then simply asserted that q reflected management performance and, therefore, firm value. The boldness of this unsubstantiated claim, published in 1988, makes it worth quoting in its entirety:

"Although Q is undoubtedly a very noisy signal of management performance, we believe it is well-suited to our purpose. Because we are interested in the predictable effects of a firm's ownership structure on its value, it seems natural to look at the cross-sectional relationship between ownership and value."⁶⁴

In two sentences, Tobin's q was thus transformed into a proxy for management's effect on firm value. Despite the uncertainty as to why the measure might be "well-suited" to Morck, Shleifer, and Vishny's purpose or "natural" for examining the relationship between ownership and

⁵⁸ Morck, Shleifer & Vishny, supra note 15.

⁵⁹ See id. at 312 n.12.

⁶⁰ Bryn H. Hall, Clint Cummins, Elizabeth Laderman, and Joy Mundy, The R&D Master File Documentation, NBER Technical Working Paper no. 72 (Dec. 1988), available at <http://www.nber.org/papers/t0072.pdf>.

⁶¹ See Morck, Shleifer & Vishny, supra note 15, at 295-307 (providing extensive discussion of the above factors).

⁶² See, e.g., Steven N. Kaplan & Luigi Zingales, Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints?, 112 Quarterly Journal of Economics 169, 177 (1997) (simply noting: "We measure average Tobin's Q as the market value of assets divided by the book value of assets (item 6) where the market value of assets equals the book value of assets plus the market value of common equity less the sum of the book value of common equity (item 60) and balance sheet deferred taxes (item 74).").

⁶³ Morck, Shleifer & Vishny, supra note 15, at 296.

⁶⁴ See id. at 296.

“value,” this notion of q as reflecting firm value took root. By the early 1990s, prominent papers in finance were citing, though not analyzing or critiquing, Morck, Shleifer, and Vishny (1988) and Lindenberg and Ross (1981) as the justification for using q as a proxy for firm value.⁶⁵

In addition to the conceptual differences in the use of q in macroeconomics versus finance, scholars in these two areas adopted distinct definitions of q . The fault line between the two camps was generally whether one was examining the q -theory of investment (the macroeconomic approach) or the determinants of firm value (the finance approach). Macroeconomists examining the effects of q on investment behavior typically defined q as the ratio of the market value of a firm’s stock of tangible capital to that stock’s replacement value.⁶⁶ This Macro q ratio resembles the original framework of Brainard and Tobin, who had sought to explain the incentives to invest in physical capital.⁶⁷ The macroeconomic formulation also was consistent with the idea introduced by Hayashi that installation costs might deter a high q firm from investing.

In contrast, finance scholars defined q as the ratio of the market value of the firm’s outstanding securities to the replacement cost of *all* of the firm’s assets, not only its physical capital. Although early papers that used q as a proxy for firm value, such as Morck, Shleifer and Vishny (1988), limited the denominator of q to the replacement value of a firm’s plant and inventories, by the early 1990s finance scholars were including all of a firm’s assets in the q denominator—both tangible and (to the extent reported) intangible.⁶⁸ Other authors were even less specific about the extent to which their calculations included particular assets: for example, the first footnote of a prominent paper published in 1990 in the *Journal of Financial Economics* simply notes that a “variation of the Lindenberg and Ross (1981) algorithm is used to compute the market value of the firm (debt plus equity) and the replacement value of its assets. A description of the procedure to compute these values is available from the authors.”⁶⁹ Overall, empirical finance scholars during this time shifted their focus to a firm’s assets overall, a move that was in many ways predictable given the emerging assumption that q reflected a firm’s overall performance and value.

This broader formulation of “Finance q ” in the literature had intuitive appeal, but it represents yet another departure from Tobin’s original theory. Brainard and Tobin had noted that “[t]here are many kinds of physical capital and many markets where existing stocks are valued”,⁷⁰

⁶⁵ See, e.g., Henri Servaes, Tobin’s Q and the Gains from Takeovers, 46 J. Fin. 409, 417-18 (1991) (interpreting q as a “measure of managerial performance”); see also McConnell & Servaes, *supra* note 15, at 599 (using q as an outcome variable for estimating changes in firm value due to various measures of ownership); Benjamin E. Hermalin & Michael S. Weisbach, The Effects of Board Composition and Direct Incentives on Firm Performance, 20 Fin. Mgmt. 101 (1991) (using q as a proxy for firm value for estimating the effect of board composition on firm value). The Morck, Shleifer and Vishny paper also was the primary basis for using q as a proxy for firm value in the important 2003 article by Paul Gompers, Joy Ishii, and Andrew Metrick, which we discuss in Part II. See Gompers, Ishii & Metrick, *supra* note 12, at 126.

⁶⁶ See, e.g., Steven Fazzari, R. Glenn Hubbard & Bruce Peterson, Financing Constraints and Corporate Investment, Brookings Papers on Econ. Activity 141, App. B (1988) (defining Tobin’s q to be equal to: (market value of equity + preferred stock debt + debt – market value of inventories)/(replacement value of property, plant and equipment).

⁶⁷ See Brainard & Tobin, *supra* note 9, at 9 (“One of the basic theoretical propositions motivating the model is that the market valuation of equities, relative to the replacement cost of the physical assets they represent, is the major determinant of new investment.”).

⁶⁸ See Hermalin & Weisbach, *supra* note 65, at 105.

⁶⁹ McConnell & Servaes, *supra* note 15, at 600 n.1.

⁷⁰ Brainard & Tobin, *supra* note 9, at 9.

implying that in an ideal world, each different type of asset should have a different Tobin's q . Similarly, subsequent work by Fumio Hayashi and Inoue had noted that, "one has to invoke a very stringent set of assumptions including the Hicks aggregation condition [that all of the firm's assets are perfect substitutes in the production process] to derive a one-to-one relation between the sum of investments and Q that is independent of the composition of investments."⁷¹ The tendency to measure firm value by aggregating together assets as dissimilar as capital goods, inventories, and intangibles accordingly fails this condition.⁷²

In other words, the macroeconomists' analysis of q , because it was focused on investment, was circumspect about aggregating firm assets for comparison: tangibles and intangibles were apples and oranges for the purposes of assessing changes in investment and should not be lumped together. In contrast, financial economists saw q as a way to analyze a firm's assets in the aggregate, both tangibles and intangibles (as well as cash, investment securities, accounts receivable, and so on), and accordingly were comfortable to group disparate categories of assets in one measure notwithstanding the questionable theoretical basis for doing so.

D. Simple Q as a Proxy for Firm Value: 1994-present

The most significant split between what we have labeled "Macro q " versus "Finance q " was the move by empirical corporate finance researchers to use a simplified calculation of q . As we have noted, Simple q is, essentially, a market-to-book ratio: the market value of a firm's securities divided by their book value. Today, corporate finance scholars routinely and sanguinely use this market-to-book version of Simple q largely without question, perhaps because it is wrapped up in the lore of "Tobin's q ," which might mask the fact that it is merely "market-to-book."⁷³ The story of how Simple q became so widely accepted is interesting and surprising, given how many scholars warned, two decades ago, about its potential problems.

Macroeconomics scholars resisted the simplistic definition of q , both for theoretical reasons and due to measurement error and data unavailability, problems that the "Macro q " literature continues to address. In contrast, empirical corporate finance scholars eagerly swallowed Simple q , methodological problems and all. The recent corporate finance literature suggests that the adoption of Simple q was straightforward and uncontroversial. In fact, it was neither.

First, consider early versions of the "Finance q " numerator: the market value of a firm's securities. Although market values of common equity could be observed, then as now, for

⁷¹ Fumio Hayashi & Tohr Inoue, The Relation Between Firm Growth and Q with Multiple Capital Goods: Theory and Evidence from Panel Data on Japanese Firms, 59 *Econometrica* 731, 732 (1991).

⁷² Timothy Erickson and Toni M. Whited, On the Accuracy of Different Measures of q , 35 *Financial Management* 5, 9 (2006).

⁷³ The use of market-to-book ratios elsewhere in the literature is not consistent with their use in empirical corporate finance. For example, as we describe below, a firm's market-to-book ratio has played an important role as one of the central risk factors in the asset pricing literature. In particular, market-to-book ratios are inversely related to future returns. As we discuss below, this empirical fact places the use of a *de facto* market-to-book ratio as the proxy for q in tension with the notion that increasing q necessarily means increasing long-term firm value. Scholars also have explored the extent to which high market-to-book ratios are associated with greater borrowing and lower financing costs. See Long Chen & Xinlei Zhao, On the Relation between the Market-to-Book Ratio, Growth Opportunity, and Leverage Ratio, 3 *Fin. Res. Letters* 253 (2006) (showing that the negative relation between market-to-book and leverage is driven by a subset of firms with high market-to-book ratios). With limited exceptions, scholars in the empirical finance literature have not addressed the extent to which the subset of firms with the highest levels of q might share these same empirical relationships.

publicly-traded firms, an accurate measure of q needed to include all of a firm's capital, including preferred stock and debt. The valuations of these other slices of capital generally had to be estimated, because market prices typically were not available.⁷⁴ Scholars accordingly developed a range of approaches to incorporate market-based data to estimate the numerator at the firm-level, but there were serious measurement challenges.⁷⁵ Early efforts to measure "Finance q " included lengthy appendices that outlined particular methods, data, and assumptions.⁷⁶

Second, consider early versions of the "Finance q " denominator: the replacement value of a firm's capital assets. The market value of a firm's capital stock reflects intangible assets such as customer goodwill and technical knowledge, yet readily-available accounting and balance sheet-based measures of a firm's assets do not include such values.⁷⁷ Accounting measures of asset values are also generally recorded at historical cost and then adjusted using depreciation schedules that typically do not reflect the true economic depreciation of the firm's assets.⁷⁸ Firms also have the ability to choose different depreciation schedules. Although during the 1980s firms were required to estimate replacement costs for some assets based on rules established by the Financial Accounting Standards Board, those estimates often were not based on market prices when active markets did not exist.⁷⁹ As a result, there were serious difficulties in estimating the q denominator.⁸⁰

⁷⁴ See W.G. Shepherd, Comment, 76 *Amer. Econ. Rev.* 1205 (1986); Smirlock, Gilligan & Marshall, *supra* note 53.

⁷⁵ For example, several scholars collected the prices of long-term bonds, so that their measure did not assume that the market value and book value of debt were the same. These bond prices were available then from the *Moody's Bond Record* and *Standard & Poor's Bond Guide*. See Chung & Pruitt, *supra* note 17, at 71 n.3. In addition, researchers had information about the replacement cost of net plant, equipment, and inventories from the FASB Regulation 33 Tape, edited by researchers at Columbia University. However, that data set was available only during 1979 to 1984, and only for firms with net plant and equipment of more than \$120 million. See *id.*

⁷⁶ See, e.g., Lindenberg & Ross, *supra* note 50; Larry H.P. Lang, Rene M. Stulz, & Ralph A. Walking, A Test of the Free Cash Flow Hypothesis: The Case of Bidder Returns, 29 *J. Fin Econ.* 315, 319 (1991).

⁷⁷ See McFarland, *supra* note 52, at 615-16.

⁷⁸ See *id.* at 616.

⁷⁹ See *id.* at 615 n.4.

⁸⁰ Lang, Stulz and Walking describe the arduous process of obtaining replacement cost estimates, a process that contrasts so sharply with the use of Simple q that it is worth quoting in full:

"Replacement costs of net plant and equipment and inventories are obtained from the FASB regulation 33 tape edited by Columbia University that covers the period 1979-1984. Although these data are unaudited and firms are allowed considerable discretion in their estimates, the data are the best available information on replacement costs. Corporations with net plant valued in excess of \$120 million were required to report replacement costs of plant and inventories to FASB from 1979 to 1984. Consequently, no replacement cost data are provided by firms before 1979 or after 1984 or by firms with net plant valued at less than 120 million dollars. When firms do not report replacement costs, we use the Lindenberg and Ross algorithm to estimate these costs. Plant and equipment are valued by setting up an acquisition schedule and adjusting for price level changes and depreciation as suggested by Lindenberg and Ross (1989). Specifically, for firms listed on the FASB tape, we begin with the plant replacement costs closest to 1979 or 1984 as appropriate in the Lindenberg and Ross formula for that year. We then work backward or forward using the formula to obtain estimates of replacement costs before 1979 or after 1984, respectively. We follow Smirlock, Gilligan, and Marshall (1984) and assume the technological parameter to be zero. To obtain the replacement costs for smaller firms that do not report these replacement costs at all, we assume that the value of plant at the start (1967) is equal to book value. Following the work by Smirlock, Gilligan, and Marshall (1984), we reduce the value of plant and equipment by 5% each year to compensate for depreciation and then adjust it for the GNP deflator for nonresidential fixed investment. We then use the formula proposed by Lindenberg and Ross. If inventories are not reported in the FASB 33 tape, we use the Lindenberg and Ross (1981) algorithm."

Lang, Stulz & Walking, *supra* note 76, at 153.

Despite these measurement challenges, the growing interest in using q in empirical corporate finance inspired scholars to search for ways to estimate q to enable its use across a broader cross-section of firms. Ironically, these efforts only heightened the measurement error. Most notably, in 1994, Kee Chung and Stephen Pruitt set forth a simpler version of calculating q based on inputs that were easily downloaded from available financial and accounting databases.⁸¹ Chung and Pruitt defined “approximate q ” using the following equation:

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

where MVE is the product of a firm’s share price and the number of common shares outstanding, PS is the liquidating value of any 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 long-term debt, and TA is the book value of the firm’s total assets. In short, “approximate q ” was nothing more than a slightly modified version of the firm’s market-to-book ratio, with book value substituted for market value of preferred and debt securities in the numerator.

Unlike “Macro q ,” Chung and Pruitt’s “approximate q ” entirely avoided the need to calculate the replacement value of assets; rather, it assumed that the replacement values of plant, equipment, and inventories were equal to their book values. Chung and Pruitt also simplified the treatment of long-term debt and preferred stock. Instead of attempting to calculate market values of debt or preferred stock, their measure simply subtracted the market value of equity from total book value, implicitly substituting book values for market values of a firm’s non-common equity sources of capital. As they noted, this approach had a clear advantage over more nuanced estimates of q in that “all of these required inputs are readily obtainable from a firm’s basic financial and accounting information.”⁸²

Chung and Pruitt justified their version of q , as contrasted with the more complicated Lindenberg-Ross measure, because their measure’s mean, median, and maximum deviations from it were 6.8%, 6.2%, and 18.0%, respectively.⁸³ Chung and Pruitt optimistically concluded that the average error of 6.8% was tolerable, because it compared “extremely favorably with the errors typically observed in other financial estimates.”⁸⁴ They asserted as a justification that managers “would gladly accept a contract stipulating a mean (maximum) 6.8 (18.0)% error in virtually all of their business decisions.”⁸⁵ Chung and Pruitt also noted that the 6.8% error compared favorably to larger errors in capital budgeting projections and forecasts, both in the private and government sectors, and in securities analyst forecasts.⁸⁶

In short, instead of warning scholars about a 6.8% estimated error, Chung and Pruitt used the error as a marketing pitch for their simplified version of q . They advertised that their version of q should be attractive to two groups in particular: academic researchers and financial professionals.⁸⁷ They asserted that their simplified version of q would be particularly important

⁸¹ Chung & Pruitt, *supra* note 17, at 71.

⁸² *Id.*

⁸³ See *id.* at Table 2 (setting forth calculations with respect to forty randomly selected firms).

⁸⁴ *Id.* at 72.

⁸⁵ *Id.* at 72.

⁸⁶ *Id.* at 72-73.

⁸⁷ *Id.* at 74.

when more “theoretically correct” estimates were unavailable.⁸⁸ They claimed that because their simplified version of q used readily-available balance sheet information, it therefore “should prove of significant interest to both academic researchers and financial practitioners.”⁸⁹

Chung and Pruitt imagined that “thousands of corporate financial analysts” might one day use their measure of q .⁹⁰ That prediction seems omniscient in hindsight: “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.”⁹¹ Interestingly, Chung and Pruitt also noted that, although academics frequently used Tobin’s q , their discussions with senior financial managers “suggest little, if any reliance upon q in real-world decision analysis.”⁹² They noted that the availability of timely and accurate q data was “severely limited when compared with known sources of other important financial variables, such as beta.”⁹³

Also in 1994, at the same time Chung and Pruitt were offering their simplified version of “approximate q ,” Steven Perfect and Kenneth Wiles published an analysis of how sensitive the results of empirical corporate finance studies were to different approaches to measuring q for purposes of estimating firm value.⁹⁴ Perfect and Wiles compared five different constructions of q .⁹⁵ One of the five estimates was q_s , which they labeled the “simple q ratio.”⁹⁶

Although the methodologies used to calculate the five measures were similar to each other in many respects, the methodology for q_s was the most straightforward.⁹⁷ The numerator of q_s included common stock, preferred stock, short-term debt, and long-term debt. Common stock was based on year-end prices, preferred stock was estimated, and debt was based on book values.⁹⁸ The denominator of q_s was simply the book value of a firm’s assets.⁹⁹

Perfect and Wiles conceded that the assumptions associated with q_s introduced inevitable and problematic aspects of measurement error.¹⁰⁰ Their concerns were consistent with emerging

⁸⁸ Id. at 74.

⁸⁹ Id. at 74.

⁹⁰ Id. at 70.

⁹¹ Id. at 74. As of early 2018, Chung & Pruitt’s article was the most cited of the approximately 28,700 articles mentioning Tobin’s q generated by a search of “Tobin’s q ” on Google Scholar, with 2,656 citations.

⁹² Id. at 70.

⁹³ Id. at 70.

⁹⁴ Perfect & Wiles, *supra* note 17.

⁹⁵ They noted that q had become an increasingly popular measure of firm performance in academic research because it provided an estimate of the value of a firm’s intangible assets, including monopoly power, goodwill, high quality managers, and growth opportunities. See *id.* at 313-14. Perfect and Wiles did not determine that those techniques actually resulted in estimates that reflected market values; instead, they were simply comparing five different approaches.

⁹⁶ See *id.* at 315.

⁹⁷ See *id.* at 324. All of the models used market prices for common stock, and the various estimating techniques for the market value of preferred stock and debt were similar. Some of the estimating techniques are quite complicated: for example, calculating estimates of the market value of debt involves both estimates of changes in yields and a recursive methodology to calculate the maturity structure of a firm’s debt.

⁹⁸ In each of the five models, the value of preferred stock was estimated, because of its infrequency of trading. The estimation techniques involved both using reported prices in Compustat and capitalizing the total preferred dividends based on the Standard and Poor’s preferred stock yield index. These two techniques arrived at comparable estimates. See *id.* at 317-18.

⁹⁹ See *id.*

¹⁰⁰ See *id.*

research in the macroeconomics literature that had been grappling expressly with the estimation errors created by using an inaccurate measure of q .¹⁰¹ For example, some empirical studies in the “Macro q ” literature warned that the relationship between q and investment behavior was weak or insignificant, which led macroeconomists to confront the possibility that these null-results were a product of mismeasurement error in q .¹⁰²

The greater sensitivity to measurement error in the macroeconomic literature also was due in part to the econometric challenges associated with using q as a regressor for investment behavior, as has been typical in that literature.¹⁰³ The macroeconomics literature also focused on problems Perfect and Wiles raised regarding estimates of intangible assets.¹⁰⁴

In contrast, the finance literature cited Perfect and Wiles, not as a source of concern, but as a justification for using a simplistic version of q . The more sanguine approach of financial economists was not without justification. In contrast to the macroeconomists’ use of q as a regressor, where measurement error is likely to create biased regression estimates, the financial economists’ use of q as a dependent variable (as in the estimation of whether governance provisions were associated with firm value) did not necessarily generate similar concerns. Specifically, when using q as an outcome variable, the measurement error of q should not bias any slope coefficients so long as the measurement error is random, although it might cause standard errors to be larger than they would be in the absence of measurement error.

Indeed, for scholars using q as an outcome variable, the fact that random measurement error only affected a regression model’s standard errors arguably made the use of simplified versions of q a conservative means to avoid Type I error (i.e., false positives) in estimating the determinants of firm value. For example, in studying the relationship between incorporation in Delaware and firm value, Robert Daines used a simplified proxy for q and made this very point for justifying its use: “While more complex estimates of Tobin’s Q are possible, this simple measure produces coefficient estimates whose signs are unbiased and conservative in that they are less likely to produce significant results (Perfect and Wiles, 1994).”¹⁰⁵ In this fashion, the problems associated with simple market-to-book estimates of q documented by Perfect and Wiles had been

¹⁰¹ See, e.g., Andrew B. Abel & Olivier J. Blanchard, The Present Value of Profits and Cyclical Movements in Investment, 54 *Econometrica* 249 (1986); Takeo Hoshi & Anil K. Kashyap, Evidence on q and Investment for Japanese Firms, 4 *J. Japanese & Int’l Econ.* 371 (1990); Richard Blundell, Stephen Bond, Michael Devereux & Fabio Schiantarelli, Investment and Tobin’s Q : Evidence from Company Panel Data, 51 *J. Econometrics* 233 (1992); Jason G. Cummins, Kevin A. Hassett & Glenn R. Hubbard, A Reconsideration of Investment Behavior Using Tax Reforms as Natural Experiments, 2 *Brookings Papers Econ. Activity* 1 (1994).

¹⁰² See Timothy Erickson & Toni Whited, Measurement Error and the Relationship between Investment and q , 108 *J. Pol. Econ.* 1027 (2000).

¹⁰³ Specifically, Erickson and Whited note: “Mismeasurement of marginal q can generate all the pathologies afflicting empirical q models. In the classical errors-in-variables model, for example, the ordinary least squares (OLS) R^2 is a downward-biased estimate of the true model’s coefficient of determination, and the OLS coefficient estimate for the mismeasured regressor is biased toward zero. Irrelevant variables may appear significant since coefficient estimates for perfectly measured regressors can be biased away from zero. This bias can differ greatly between two subsamples, even if the rate of measurement error is the same in both.” *Id.* at 1030.

¹⁰⁴ Perfect and Wiles began their study by noting how q “has become an increasingly popular measure of firm performance because it provides an estimate of the value of a firm’s intangible assets ... where the value is assumed to reflect the results of performance.” Perfect and Wiles, *supra* note 17, at 313-314. As we discuss below, Peters and Taylor, *supra* note 22, offered the alternative measure, Total q , to address some of these problems. See TAN 136-137. The Total q dataset is available at <http://www.whartonwrds.com/datasets/included/luke-taylors-total-q/>.

¹⁰⁵ Daines, *supra* note 13, at 531.

transformed into a feature rather than a bug. (Yet this conclusion holds only when measurement error is random—an assumption that we show to be false below.)

Following the publication of Chung and Pruitt and Perfect and Wiles, scholars continued to use a simplified market-to-book estimate for q , occasionally making refinements to its precise calculation. Surprisingly, as with Daines, they often cited Perfect and Wiles as support for continuing to rely on a simplified market-to-book estimate for q , even though the gist of Perfect and Wiles was that q_s had serious methodological flaws.

Especially notable in this regard was Steven Kaplan and Luigi Zingales’s 1997 article, “Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints?” Published in 1997 in the prestigious *Quarterly Journal of Economics*, the study sits squarely in the “Macro q ” literature in that it investigated and questioned previous findings regarding the investment-cash flow sensitivities of firms.¹⁰⁶ These previous findings were based on a version of q derived from estimates of replacement costs, following Brainard and Tobin’s original formulation.

Yet Kaplan and Zingales instead used a simplified version of q , grounding it in the market-to-book ratio examined in Perfect and Wiles’ study. The precise definition, which would shape the course of corporate governance research for the next two decades, was as follows:

$$q = \frac{AT + MVE - BVE - DT}{AT}$$

where AT is the book value of assets, MVE is the market value of common stock, BVE is the book value of common equity, and DT are balance sheet deferred taxes. They justified their choice in a footnote, noting that: “[Fazzari, Hubbard, and Peterson] compute Q based on replacement costs, while we simply use a market-to-book ratio. The results in Perfect and Wiles [1994] indicate that the improvements obtained from the more involved computation of Q are fairly limited, particularly when regressions are estimated with firm fixed effects.”¹⁰⁷ This formulation is the one we label Simple q , and we use it in our replication analysis in Part III.¹⁰⁸

Note that although the Kaplan and Zingales formulation appears to be more consistent with Macro q , because the denominator seems focused on the value of assets and the left side of the balance sheet; in fact, this formulation is equivalent to a simplistic version of q in which the numerator and denominator are both derived on the right side of the balance sheet. The reason stems from the fundamental equation of accounting, which is that assets equal liabilities plus equity. Specifically, $AT = BVE + BVD$, where BVD is the book value of debt, defined as all liabilities. Given this equality, simple algebra yields the following equivalent equation for q :

¹⁰⁶ The findings examined by Kaplan and Zingales were originally published in Steven Fazzari, R. Glenn Hubbard & Bruce Peterson, *Financing Constraints and Corporate Investment*, Brookings Papers on Econ. Activity 141 (1988).

¹⁰⁷ Kaplan and Zingales, *supra* note 62, at 177 n.4.

¹⁰⁸ As discussed below, academic studies occasionally use this calculation of q but do not deduct deferred taxes from the numerator. Given the modest effect of deferred taxes on the overall calculation of Simple q , we include these studies as among those that use “Simple q .”

$$q = \frac{MVE + BVD - DT}{BVE + BVD}$$

The above equation is based exclusively on measures of a firm's outstanding securities: market value of equity and book values of equity and debt. Some formulations of the above version of Simple q do not include DT, balance sheet deferred taxes, and others add preferred securities in addition to debt, but this formulation is analytically the same. The key point here is that Simple q is not based on the market value of assets divided by their replacement costs, but instead is based on a simplified version of the market value of firm's securities divided by their book value.

Meanwhile, as another historical strand in our story of q , while financial economists were adopting Simple q , accounting academics were carefully studying the econometric challenges that arose from "scale differences" in regressions when the main dependent variable was the market value of firms' capital. This accounting literature was not specifically focused on Tobin's q , but rather considered the more general question of how to account properly for the fact that firms vary in size. Just as one should not reach conclusions about crime rates simply by comparing the number of murders in New York to those in, say, Lawrence, Kansas, one should adjust for the size of firms in any econometric tests with the market value of firms' capital as the dependent variable. Tobin's q was, in a way, a crude attempt to make such adjustments, by scaling the market value of firms' capital by their book value. But the accounting literature undertook a more comprehensive and nuanced approach.

Specifically, one year before the publication of Kaplan and Zingales's paper, Mary Barth and Sanjay Kallapur published an important study of the effects of the bias that resulted from scale differences in regressions using the market values firms' equity as a dependent variable.¹⁰⁹ Barth and Kallapur did not limit their analysis to the use of book value as a potential scaling factor, as the finance literature did with Simple q ; in fact, their article did not even mention Tobin's q . Instead, their focus was on how, generally, regressions with the market value of firms' equity as the dependent variable accurately take into account differences in scale.

During the following two decades, the accounting literature has continued to develop and refine this general approach to scale adjustments.¹¹⁰ Interestingly, the concept of Tobin's q does not appear to have arisen in this literature, perhaps because accounting scholars were not part of the historical devolution of Tobin's q into Simple q and accordingly did not consider whether one might study Tobin's q as a dependent variable instead of studying market values directly (and *then* addressing challenges related to scale adjustments). The accounting literature implicitly rejected, or at least ignored, Tobin's q as a method of scaling the market value of firms' capital and instead studied other, less problematic approaches.

¹⁰⁹ See Mary E. Barth & Sanjay Kallapur, The Effects of Cross-Sectional Scale Differences on Regression Results in Empirical Accounting Research, 13 Contemporary Accounting Research 527 (1996).

¹¹⁰ See Mary E. Barth & Greg Clinch, Scale Effects in Capital Markets-Based Accounting Research, 36 J. Bus. Fin. & Accounting 253 (2009) (assessing simulations of the effects of firm size in regressions based on market values); James A. Ohlson & Seil Kim, Linear Valuation without OLS: The Theil-Sun Estimation Approach, 20 Rev. Accounting Stud. 395 (2015) (discussing modifications of regressions based on market values to account for scale).

Empirical law and finance scholars have not cited, and apparently did not notice, these developments in the accounting literature. Instead of considering the accounting literature's new empirical techniques, during the two decades after the publication of Kaplan and Zingales's study, law and finance scholars simply have used Simple q . Indeed, the use of Simple q in corporate governance scholarship became *de rigueur* after Paul Gompers, Joy Ishii, and Andrew Metrick's widely-cited article published in 2003, also in the *Quarterly Journal of Economics*, entitled "Corporate Governance and Equity Prices"—an article we discuss more fully in Part III. Notably, Gompers, Ishii, and Metrick's sole source of authority for using Simple q was Kaplan and Zingales's 1997 paper.¹¹¹

Through 2017, articles in which Simple q is the dependent variable have continued to appear in the literature. We conclude this part with a few representative examples. For instance, Sreedhar T. Bharath, Sudarshan Jayaraman, and Venky Nagar begin their definitions discussion with the following straightforward paragraph: "Our measure of firm value is Tobin's Q (Q). We define Q as the ratio of the market value of assets divided by the book value of assets, both computed at the end of each fiscal year."¹¹² Their precise calculation of q tracks the version used in Kaplan and Zingales, based on market and book values of securities, with the exception that their numerator does not include a deduction for balance sheet deferred taxes. Likewise, Martijn Cremers and Allen Ferrell write in a footnote: "We interpret a higher average Q , measured as the ratio of book value of firm assets to market capitalization, as evidence that the firm uses its resources more productively and efficiently, in line with the literature"¹¹³ Fox, Gilson, and Palia call Simple q "the typical measure of a firm's success at creating value."¹¹⁴ In adopting this definition, they include a footnote discussing the potential problems that its use creates; nevertheless, they conclude: "Tobin's Q is still, however, a reasonable way of looking for a historical period of time to see which firms on average did better at creating value and which firms did worse."¹¹⁵ As these statements suggest, many of the most important questions in business law recently have been addressed by studies that rely Simple q .

That brings our story up to date. Today, Simple q has become an accepted dependent variable in empirical law and finance. Notwithstanding some criticism,¹¹⁶ it has become standard practice for scholars to assert, without further explanation, not only that Simple q is an acceptable measure of Tobin's q but also that it is an appropriate measure of firm value.¹¹⁷

¹¹¹ Gompers, Ishii & Metrick, *supra* note 12, at 126.

¹¹² Sreedhar T. Bharath, Sudarshan Jayaraman & Venky Nagar, *Exit as Governance: An Empirical Analysis*, 68 *J. Fin.* 2515, 2524 (2013); see also *id.* at 2545.

¹¹³ Martijn Cremers & Allen Ferrell, *Thirty Years of Shareholder Rights and Firm Value*, 69 *J. Fin.* 1167, 1168 n.2 (2014). Cremers and Ferrell calculate q using the formula set forth in Kaplan and Zingales, *supra* note 62. *Id.* at 1173. One additional data question illustrated by Cremers & Ferrell is whether the market price of a firm's stock is determined as of the end of a firm's fiscal year or the end of the calendar year.

¹¹⁴ See Merritt B. Fox, Ronald J. Gilson & Darius Palia, *Corporate Governance Changes As a Signal: Contextualizing the Performance Link*, working paper (2016). Similar to Bharath et al., *supra* note 112, Fox, Gilson and Palia define Tobin's Q using the same formula as Kaplan and Zingales, *supra* note 62, but omit any deduction in the numerator for deferred taxes.

¹¹⁵ See *id.* at 11 n.25.

¹¹⁶ See, e.g., Ing-Haw Cheng, *Yesterday's Heroes: Compensation and Risk at Financial Firms*, 70 *J. FIN.* 839 (2015) (citing the "substantial empirical debate about whether traditional measures such as market-to-book or Tobin's Q adequately capture growth options").

¹¹⁷ See, e.g., Byoung-Hyoun Hwang & Hugh Hoikwang Kim, *It Pays to Write Well*, 124 *J. Fin. Econ.* 373 (2017) (using Simple q to conclude that easier-to-read disclosure documents are associated with higher firm valuation); T. Clifton Green & Russell Jame, *Company Name Fluency, Investor Recognition, and Firm Value*, 109 *J. Fin. Econ.* 813, 814 (2013) ("firms with more fluent

II. The Case Against Using Q as a Proxy for Firm Value

For some readers, the peculiar intellectual journey of Tobin's q will be reason enough to question its reliability as a proxy for firm value in the empirical finance literature. But we also want to present a more specific case against using q —particularly Simple q —as such a proxy.

First, we focus on the problem of measurement error with respect to Simple q . Although the empirical finance literature frequently ignores the measurement error problems associated with using simple market-to-book estimates for q , many of the problems have been scrutinized in the macroeconomics literature. We explore that scrutiny and offer some new tests and criticisms of our own with respect to why measurement errors are likely to create biased estimates in regressions with Simple q as a dependent variable.

Second, we examine recent advances in the asset pricing literature that raise questions about the very meaning of Simple q . Specifically, the book-to-market ratio (essentially the reciprocal of Simple q) has been a risk factor in leading asset pricing models. As we confirm with new empirical tests, firms that have a high level of Simple q (and therefore a low book-to-market ratio) are likely to experience relatively low future returns, and vice versa. This finding suggests that empirical law and finance scholars should be more careful in reaching conclusions about firms with higher measures of Simple q .

To be clear, our claim here is not that Tobin's q can *never* be an acceptable proxy for firm value, although we remain skeptical about that general proposition. Rather, our goal is to establish why regressions demonstrating a positive relationship between Simple q and various factors bear a heavy burden of persuasion, a burden they have not met.

A. Measurement Error

We begin our critique of q as a proxy for firm value by revisiting Perfect and Wiles. Recall that scholars have cited Perfect and Wiles as justifying the use of Simple q . That reliance on Perfect and Wiles has been based on two generally unstated assumptions: that alternative measures of q would not significantly improve measurement accuracy, and the measurement errors associated with Simple q were not problematic. As we demonstrate, both of these assumptions are incorrect.

1. Evidence that Simple Q Measures Q with Error

As we note above, Perfect and Wiles compared Simple q , labeled q_s , to four other estimates of Tobin's q . They calculated these four other estimates using more detailed techniques, including more accurate estimates of replacement value in order to capture changes in prices, depreciation, and technology, as well as first-in, first-out (FIFO) vs last-in, first out (LIFO) inventory methods.¹¹⁸ For instance, some of these other estimates took advantage of a Securities and

names have significantly higher Tobin's q and market-to-book ratios"); Antoinette Schoar & Luo Zuo, Shaped by Booms and Busts: How the Economy Impacts CEO Careers and Management Styles, 30 Rev. Fin. Stud. 1425 (2017) (using Simple q to assess CEOs); Ran Duchin et al., Spillovers Inside Conglomerates: Incentives and Capital, 30 Rev. Fin. Stud. 1696 (2017) (using Simple q to assess the impact of pay changes within divisions of firms).

¹¹⁸ See Perfect & Wiles, supra note 17, at 326-32.

Exchange Commission requirement, effective from 1976-79, that large firms report annual estimates of the replacement costs of plant, equipment, and inventories, as well as depreciation and cost of goods sold, and a similar requirement, effective from 1980-85, arising from Financial Accounting Standard No. 33.¹¹⁹

Perfect and Wiles found that although the five estimates of q generally were highly correlated,¹²⁰ the simple estimator q_s had a significantly larger mean and median, significantly different values from the other four. For example, they tested how similar the five q estimates were at grouping a sample of 519 firms into two categories: q greater than 1 versus q less than 1. The simple estimate of q_s agreed with the other estimates in only 79.4% to 82.8% of cases. In other words, for roughly one in five firms, the simple estimate of q_s was not even precise enough to correspond with other measures in categorizing a firm's q as above or below 1. Perfect and Wiles concluded: "Thus, although q_s is relatively simple to construct, it does not produce sorting results that are comparable to the other four estimators."¹²¹ To repeat, Perfect and Wiles concluded that a market-to-book estimate of q did not produce comparable results to alternative formulations of q . That is not the ringing endorsement of Simple q that many scholars have assumed.

The literature's citation to the Perfect and Wiles as justifying the use of Simple q is all the more puzzling in light of additional studies documenting that, of all the estimates of Tobin's q , Simple q performs among the worst. In their comprehensive empirical estimation of measurement error in Tobin's q , Timothy Erickson and Toni Whited note that different approaches to calculating q yield nearly 200 different estimates of "Macro q " and 200 different estimates of "Finance q ."¹²² (Recall that macroeconomists have been using a version of q that more closely resembles Brainard and Tobin's original conception, whereas financial economists have adapted q in ways that make it easier to calculate.)

In a series of studies, Erickson and Whited have demonstrated several serious drawbacks to Simple q , including biases that result from measurement errors. Following Hayashi and Inoue, they question whether the basic assumption of perfect substitutability holds for Simple q , which aggregates all of a firm's assets.¹²³

Erickson and Whited do not mince words: they find that "the most common proxy used in the finance literature, the market to book ratio, only explains about forty percent of the variation in average q ."¹²⁴ They conclude that Simple q 's "measurement error problem must therefore stem more from issues such as aggregation and unobservable assets."¹²⁵ Later studies have confirmed Erickson and Whited's findings; for example, in their important paper on estimating q , Ryan

¹¹⁹ See *id.* at 326. Interestingly, firms generally included disclaimers along with these reported estimates, indicating that the managers believed the replacement value data were "of limited value because of the subjective judgments necessarily involved in making these estimates." *Id.* at 326 n.13.

¹²⁰ Pairwise Pearson correlation coefficients for the measures ranged from 0.9045 to 0.9856. Correlations among changes in q were lower, in the range of 0.8503 to 0.9404. *Id.* at 334.

¹²¹ *Id.* at 335.

¹²² Erickson and Whited, *supra* note 72, at 12.

¹²³ Timothy Erickson and Toni M. Whited, Treating Measurement Error in Tobin's q , 25 *The Review of Financial Studies* 1286, 1325 (2012).

¹²⁴ Timothy Erickson and Toni M. Whited, On the Information Content of Different Measures of Q , 22 (August 2001), available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=279315.

¹²⁵ *Id.*

Peters and Luke Taylor similarly find that “market-to-book-assets ratios are especially poor proxies” for true Tobin’s q .¹²⁶

These problems with Simple q are also evidenced by the extent to which the measure generates extreme outliers, both high and low. Although scholars commonly exclude these outliers, even a cursory review of them suggests a number of puzzling findings. For example, in his study of Delaware law and firm value, Robert Daines eliminated the top and bottom 1% of firm-level measurements of a market-to-book estimate of q , claiming that the effect of Delaware corporate law was unlikely to explain high or low q values. But Guhan Subramanian found that the 1% lower and upper ranges in Daines represented Simple q measures of 0.38 and 70.49, respectively, for the relevant periods.¹²⁷ Such levels of q are extreme: it would be interesting to know why a firm with a q of 0.38 had not been liquidated, or why a firm with a q of 70.49 had such a measure, perhaps because it was small or idiosyncratic in some way. Subramanian’s analysis suggests that Simple q has very long tails, particularly in samples that include small firms. (As he notes, Enron’s Simple q at the height of its stock market valuation was 6.8.) Unfortunately, the literature generally does not focus on the analysis or impact of Simple q outliers.

Simple q generates such extreme outliers because of the questionable assumptions with regard to both the numerator and the denominator utilized in estimating Simple q . With respect to the numerator, Simple q requires an estimate of the market value of a firm’s assets. However, Simple q seeks to estimate these values based on the market values for all of a firm’s outstanding securities, and these values are not typically observable aside from a company’s outstanding common stock (assuming it is publicly traded). Market values for a firm’s other securities, such as outstanding debt and preferred stock, are instead estimated from book values, which can diverge from their fair value. As a result, the Simple q numerator is not based on an assessment of individual assets, or even categories of assets, on the left hand side of the balance sheet.

More problematic still is the calculation of the denominator, which is supposed to reflect the replacement value of a firm’s assets. Here, too, Simple q relies on basic accounting measures. In particular, it uses a company’s book value of equity and debt as a proxy for the replacement value of assets. In itself, the use of book values virtually guarantees that the denominator used in Simple q will depart from the replacement cost of assets theorized by Tobin and Brainard. Lewellen and Badrinath demonstrated that various conceptions of q differed significantly by using cases in which asset replacement costs, the original Tobin’s q denominator, were known.¹²⁸ They found that revised q ratios based on actual replacements costs varied from book-value based estimates in the literature by 10% to 20%.¹²⁹ The methodologies Lewellen and Badrinath used require considerable information, attention, and work, and are no longer used. Obviously, it is much easier simply to calculate Simple q based on available Compustat data. Scholars have preferred the easier route. Measurement errors are an inevitable result.

Book values have become especially subject to measurement error given the importance of intangible assets and financial engineering. Even assets as simple as a firm’s property, plant, and

¹²⁶ Taylor and Peters, *supra* note 22.

¹²⁷ Subramanian, *supra* note 13.

¹²⁸ See Lewellen & Badrinath, *supra* note 30.

¹²⁹ *Id.* at 121.

equipment (PPE) are recorded at historical cost less depreciation, which will vary depending on the depreciation schedule adopted by a firm and inevitably will diverge from market values. The value of inventory generally will reflect the lower of historical cost or fair value, and the inventory balance similarly will depend on whether sales of inventory are treated under FIFO or LIFO accounting. More complex assets are not part of book value at all. Unbooked intangible assets are increasingly important to firm value, but are not reflected on balance sheets. Likewise, financial derivatives and unconsolidated subsidiaries can be important to the market value of a firm's securities, but are not included in book value.

Given these measurement problems, Erickson and Whited's finding that market-to-book measures of q perform poorly is not surprising. Simple q inevitably is subject to significant measurement errors due to the problems of aggregation and unobservability.

2. *Simple Q 's Measurement Error Can Produce Biased Estimates*

Perfect and Wiles found that the regression coefficients for the simple version q_s differed significantly from those obtained when using other measures of q .¹³⁰ Although scholars have subsequently cited Perfect and Wiles as support for their use of Simple q insofar that it resembles q_s , Perfect and Wiles warned that q_s could lead to biased estimates: "In summary, the results indicate that using q_s produces regression estimates that often differ from those found using the other four q ratio estimates, while q_B , q_{LR} , q_{PW} , and q_{QH} produce comparable regression estimates."¹³¹ Their message was clear: beware of using Simple q as a dependent variable.

Notwithstanding these warnings, there are some reasons for scholars not to worry. The fact that Simple q is measured with error might pose only a minor inconvenience if classical measurement error assumptions hold. Under the classical errors-in-variables model, errors in the variable of interest are assumed to be independent of the true measure of the variable. To the extent this assumption holds, measurement errors in a dependent variable do not lead to inconsistent estimates of regression coefficients; the only consequence of the presence of measurement errors in the dependent variable is that they inflate the standard errors of these coefficient estimates.¹³² As noted above, this approach to measurement error has led some scholars to view Simple q regressions as conservative because measurement error reduces the risk of Type I error (i.e., false positives).

¹³⁰ See Perfect & Wiles, *supra* note 17, at 336; see also *id.* at 338 ("In summary, the results indicate that using q_s produces regression estimates that often differ from those found using the other four q ratio estimates.").

¹³¹ *Id.* at 338. Perfect and Wiles suggested a more optimistic view of q_s in one paragraph near the end of their article, though they also make it clear that there were limitations associated with this conclusion, which related to an additional estimation of the regression models using changes in q . They cautioned that the similarity of the regression coefficients in such a specification was not surprising given that changes in common stock values should drive the changes in the q estimates, but concluded nevertheless that: "If, however, *changes* in the q estimates are used, then the empirical results do not, in general, reveal significant differences among the estimators. An implication of this result is, of course, that q_s , due to its ease of construction, may be an attractive estimator when changes in a firm's q ratio are of interest." *Id.* at 339.

¹³² To illustrate, assume that we seek to understand whether x predicts y in a standard regression framework. The true measure, y_i^* , is related to the covariate x_i as $y_i^* = x_i\beta + \epsilon_i$. However, the outcome variable is measured with random error v_i . Thus, $y_i = y_i^* + v_i$, where v_i represents random measurement error that is uncorrelated with y_i^* and x_i . Under these conditions, measurement error in the dependent variable does not lead to inconsistent estimates of the regression coefficient β , as can be seen by rewriting the model in y_i : $y_i = x_i\beta + \epsilon_i + v_i$. Because both ϵ_i and v_i are assumed to be independent of x_i , measurement error effects only the standard errors of the regression coefficient estimate, β .

However, the question remains whether the assumptions of the classical errors-in-variables model hold. There are two reasons why they might not: problems with aggregation and problems with omitted variables. We discuss each in turn.

First, the aggregation of assets can result in non-classical measurement error. Consider current assets. Because current assets are generally recorded at fair value (subject to certain exceptions), it would be natural for the market to place a q -ratio on this category of asset that differs from the q -ratio for other categories of assets (for example, property, plant, and equipment are recorded at cost net of depreciation, not at fair value). Moreover, firms are likely to differ systematically in the extent to which their assets are comprised of current assets. Failure to account for the fact that Simple q aggregates current assets and other assets not recorded at fair value might lead to biased estimates of the predictors of Simple q .

We test this question by estimating the extent to which a firm's level of current assets affects its measure of Simple q for all Compustat firms between 1990 and 2010. For each firm in the database, we calculate Simple q as of the end of its fiscal year. For each firm, we also determine the fraction of the firm's total book value of assets that consists of current assets for that fiscal year. In Table 1, we present the results of two regressions in which we regress the natural log of a firm's Simple q on this ratio (*% Current Assets*) for the same year. In Column 1 we conduct the regression controlling for industry- and year-fixed effects (with robust standard errors clustered by firm); in Column 2, we control for firm- and year-fixed effects.

| | (1) | (2) |
|-------------------------|--------------------|--------------------|
| <i>% Current Assets</i> | 0.594*** [0.02] | 0.796*** [0.02] |
| Industry FE | Y | N |
| Firm FE | N | Y |
| Year FE | Y | Y |
| <i>N</i> | 107,050 | 107,050 |

Robust standard errors in brackets
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

As shown in both columns, a firm's level of current assets is positively associated with a firm's Simple q even after controlling for industry- and firm-fixed effects. Moreover, as indicated by the standard errors, the estimates are strikingly precise. Overall, these regression estimates are consistent with the market attributing a higher q -ratio to current assets.

The implications of this finding are troubling to the extent one is interested in understanding the determinants of Simple q . Because Simple q aggregates all assets (including current assets) it will be upwardly biased to the extent a firm has current assets. Moreover, the fact that this finding persists despite industry and firm-fixed effects illustrates how this bias can vary within industries and firms. To the extent this variation is correlated with other firm characteristics, it can create biased estimates of the association of these characteristics with Simple q . Finally, the fact that the bias arises from aggregating assets in the denominator of q rules out the possibility

of simple regression adjustments, such as adding a control for current assets.¹³³ We demonstrate in Part III that this bias in fact matters to results in the literature.

Second, the omission of variables can result in non-classical measurement error. Consider intangible assets. A firm's expenditures to develop knowledge, intellectual property, or software are typically expensed as research and development rather than capitalized on a company's balance sheet. In contrast, when a firm purchases an intangible asset, such as by acquiring another company or a patent, the firm generally capitalizes the asset on the balance sheet at the purchase price, as part of a line entry for "Intangible Assets." To the extent such intangibles are separately identifiable (e.g., particular patents, non-competition agreements, etc.), they are separately recorded as "Other Intangible Assets," with the residual balance of the purchase price being booked to "Goodwill," which can be subsequently written down if these values are deemed "impaired" by management.

In other words, two firms can have radically different book values based on the extent to which they "build" rather than "buy" their intangible assets, as well as the extent to which they reflect a manufacturing firm (where property, plant, and equipment ("PPE") is likely to be large) relative to a service firm (where PPE is likely to be small and intangibles more important). Moreover, these systematic accounting differences among service firms have become more important over time as the U.S. economy has shifted toward service- and technology-based industries, which has made intangible assets such as human capital, innovative products, brands, patents, software, customer relationships, databases, and distribution systems increasingly important. In their 2010 study, Carol Corrado and Charles Hulten estimate that intangible capital makes up 34% of firms' total capital in recent years.¹³⁴

For example, the accounting treatment of goodwill alone, just one intangible asset, can result in perverse conclusions about firm value if one uses Simple q as a proxy for firm value. Consider Time Warner's disastrous acquisition of AOL in 2000. Before the acquisition, Time Warner's book value of assets, or equivalently liabilities plus capital, was low, in the range of \$25 billion, whereas its stock price was near record highs. After the merger, the combined company's book value increased to the range of \$85 billion, because, given the nature of AOL's operations, much of the acquisition price was recorded on Time Warner's balance sheet as goodwill. But during 2000, the company's share price declined precipitously in large part because of the poor performance of the AOL acquisition, and in early 2002, the company took a record \$54 million charge to goodwill associated with the acquisition. However, equity prices did not track these changes in book value, because the markets had largely anticipated this write down.

Here are Time Warner's Simple q measures for the end of each calendar year, the measures that have been used based on the standard approach in the literature:

1999: 16.1

2000: 7.9

¹³³ For a discussion of the problems that can arise from using ratios in regression analyses, see Richard A. Kronmal, Spurious Correlation and the Fallacy of the Ratio Standard Revisited, *J. Royal Statistical Society* 379 (1993).

¹³⁴ Carol A. Corrado and Charles R. Hulten, Measuring Intangible Capital: How Do You Measure a "Technological Revolution"?, *100 American Economic Review* 99, Table 1 (2010).

2001: 0.89
2002: 0.96
2003: 1.10

Note that Simple q for Time Warner was very high during 1999 and 2000, before the AOL acquisition. Then, the combined entities' much lower Simple q measure increased from 0.89 as of December 2001 to 0.96 by the end of December 2002. This change was simply mechanical: the numerator remained the same (given that the equity market already reflected the poor performance of the AOL assets), but the denominator declined.

This example illustrates how Simple q can be skewed upward to the extent it substitutes book value of capital for the replacement cost of intangible assets. Simple q is often biased upward by research and development, brand management, and human capital, which are reflected in the market value of a firm's capital, but not its book value. As Morck, Shleifer and Vishny recognized: "Tobin's Q is high when the firm has valuable intangible assets in addition to physical capital, such as monopoly power [Lindenberg and Ross (1981)], goodwill, a stock of patents, or good managers."¹³⁵

The measurement error arising from the omission of intangibles can lead to biased regression estimates. We test this bias using an empirical estimate of a firm's intangible capital that Peters and Taylor have developed based on the firm's prior expenditures on research and development plus prior selling, general, and administrative expenditures.¹³⁶ With this estimate, Peters and Taylor calculated for all firms in the Compustat database from 1950 through 2015 a modified version of Tobin's q , which they refer to as Total q :

$$q_{it}^{tot} = \frac{V_{it}}{K_{it}^{phy} + K_{it}^{int}}$$

where q_{it}^{tot} is their measure for Total q for each firm i as of the end of fiscal year t , V_{it} is the market value of outstanding equity plus the book value of debt less the firm's current assets in year t , K_{it}^{phy} is the book value of the firm's PPE in year t , and K_{it}^{int} is their estimate for the replacement cost of the firm's intangible capital in year t . They find that Total q performs well in predicting total investment (i.e., investment in both physical and intangible capital).¹³⁷

Importantly, Peters and Taylor's dataset includes their estimate of the replacement value of intangible capital that is *not* reflected on a firm's balance sheet. Using these data, we can estimate the extent to which the omission of intangible property from a firm's reported book value of assets creates bias in a standard market-to-book estimate such as Simple q . As we did in Table 1, we first calculate Simple q for each firm-year observation appearing within Compustat's annual dataset from 1990 through 2010. Merging this data with the Total q dataset, we then create the variable *PERCENT*, which we define as follows:

¹³⁵ Morck, Shleifer and Vishny, *supra* note 15, at 296.

¹³⁶ Peters and Taylor, *supra* note 22, at 256-57.

¹³⁷ *Id.* at 258-62.

$$PERCENT_{it}^{int} = \frac{Unbooked\ Intangibles_{it}}{Total\ Assets_{it} + Unbooked\ Intangibles_{it}}$$

where $Unbooked\ Intangibles_{it}$ is the replacement value of intangible assets that are missing from book value, as estimated by Peters and Taylor for firm i in year t , and $Total\ Assets_{it}$ is the firm's corresponding aggregate book value of assets (i.e., the conventional denominator used in Simple q). $PERCENT_{it}^{int}$ therefore estimates the fraction of assets missing from a firm's reported book value of assets due to under-reporting of intangible assets under U.S. Generally Accepted Accounting Principles.

In Table 2, we present the results of two regressions in which we use the variable *Percent* as a regressor on Simple q . The first column presents the results of a basic cross-sectional regression in which we regress the natural log of Simple q on *Percent*, holding constant fixed effects for the firm's two-digit SIC code and year-fixed effects (with robust standard errors clustered by firm). In the second column, we take advantage of the panel structure of the data and conduct the same regression substituting firm fixed effects for industry fixed effects.

| | (1) | (2) |
|------------------------------------|--------------------|--------------------|
| <i>Percent</i> | 0.707*** [0.03] | 0.084** [0.040] |
| Industry FE | Y | N |
| Firm FE | N | Y |
| Year FE | Y | Y |
| <i>N</i> | 133,745 | 133,745 |
| Robust standard errors in brackets | | |
| *** p<0.01, ** p<0.05, * p<0.1 | | |

As shown in the first column, the absence of intangible capital from reported book values has a strong positive association with Simple q . Put simply, the failure of book value to capture a firm's investment in intangible property results in the systematic upward bias of Simple q for firms that make larger intangible property investments. In other words, Simple q has precisely the type of biased measurement error that has been a concern of macroeconomics scholars, but has been ignored in the empirical corporate finance literature.

To provide a concrete example: In 2010, Microsoft had a Simple q of 3.27 but a Total q of 1.77, largely due to the fact that its book value of \$86 billion did not reflect an estimated \$54 billion of intangible assets. Significantly, the coefficient on *Percent* is strongly significant despite the fact that the regression specification includes controls for firms' 2-digit SIC codes (as well as year fixed effects), indicating strong within-industry variation in how a firm's intangible capital affects Simple q .

The second column further underscores the extent to which using Simple q as an estimate for Tobin's q will produce upwardly biased q values for firms with meaningful amounts of intangible capital. Despite the fact that this alternative specification includes firm- and year-fixed effects, the coefficient on *Percent* remains significant and positive for predicting Simple q . In other words, Simple q varies systematically with a firm's annual level of intangible capital, regardless of any time-invariant characteristics of the firm that might affect Simple q . This result

has intuitive support: markets likely place *some* value on a firm's intangible capital (thus, increasing the numerator used in Simple q) yet Simple q fails to account for the replacement costs of these assets (thus, biasing downward the denominator for Simple q).

In short, scholars who rely on Simple q face a serious problem of measurement error bias. They cannot find solace in the argument that although any measurement error in the outcome variable (e.g., Simple q) might create large standard errors when estimating treatment effects, it does not otherwise create biased estimates of these treatment effects. As noted, that argument assumes that the measurement error itself is uncorrelated with the true outcome variable and the covariates. However, our analysis of both current assets and intangible assets reveals that this assumption fails in (at least) these two contexts, providing concrete examples of the bias lurking in any study using Simple q as a dependent variable.

It is worth noting that Total q attempts to address both of these biases by including an estimate of unbooked intangibles and excluding current assets. Scholars who are interested in examining the effects of various factors on firm value arguably should consider using Total q as a dependent variable, perhaps to test whether results obtained using Simple q continue to hold with Total q . However, Total q raises additional questions. Why should scholars expect that a measure based on capitalized research and development expenditures plus a seemingly arbitrary 30 percent of selling, general, and administrative expenses would resolve concerns about omitted variable bias? Why should current assets play such an important role in any measure of q , particularly when divorced from current liabilities? Total q does not address the difficult questions raised in the literature about aggregating assets.¹³⁸

Even if scholars refine their use of q measures, as with Total q , we remain skeptical that any governance interventions that produce positive associations with q measures are necessarily welfare enhancing for a company's shareholders, particularly over extended time horizons. Even aside from the issue of measurement error, there are other reasons why a firm's high measure of Simple q —or even Total q or the original Tobin's q —should not be a source of celebration for a firm's investors. These reasons go beyond the reliability of Simple q as a proxy for q , and draw from recent advances in the asset pricing literature, where a version of Simple q is a risk factor, not an indication of firm value. In particular, this scholarship highlights how firms with high market-to-book ratios are likely to generate relatively low future returns to shareholders.

B. Q and Equity Returns

Studies examining the relationship between governance and firm value typically do so because they are interested in whether governance generates positive welfare for investors in firms over an extended period of time. In this regard, empirical studies commonly examine whether corporate governance has positive effects on “long-term firm value,” suggesting governance can produce sustainable value for a firm's investors. Here, too, scholars commonly use market-to-book

¹³⁸ To the extent one worries about asset aggregation, this challenge continues to apply to Total q insofar that it estimates the market value of a firm (net of its current assets) relative to the replacement costs of physical and intangible assets.

estimates of q as their measure of long-term firm value.¹³⁹ However, to the extent scholars take this approach, they face an inescapable conundrum: whatever market value a shareholder receives from holding a relatively high q firm is associated with relatively lower returns in the near future.

To demonstrate the robustness of this empirical relationship, we present in Table 3 several empirical analyses of the relationship between shareholder returns and Simple q . In all analyses we use the monthly stock file at CRSP to estimate the cumulative one-year (calendar) return for every security in CRSP between 1980 and 2010 as a function of the security's Simple q as of the end of the previous calendar year.¹⁴⁰ In column 1, for instance, we estimate this relationship using a security's gross cumulative annual return. Our outcome variable of interest is the one-year buy-and-hold return from investing in each security i at the end of each year t . We then conduct two regressions. In the first, we regress this return on the natural log of the security's measure for Simple q as of December 31 of year $t-1$. In the second, we regress this annual return on whether the security's Simple q for year $t-1$ fell within the first, second, third, or fourth quartile of all estimates of Simple q for year $t-1$. In both cases, we also control for year- and firm-fixed effects.

As shown in columns 1 and 2 of Table 3, a security's Simple q is inversely related to the security's subsequent returns in both models. In columns 3 and 4, we conduct the same analysis but rather than using a security's gross annual return, we use as our dependent variable the excess return relative to the CRSP value-weighted index over the same 12-month time period. Specifically, for each security we subtract from its gross cumulative annual return the cumulative annual return of this value-weighted index for the same time period. Finally, in Columns 5 and 6, we use as our dependent variable the security's risk-adjusted cumulative annual return for the same time period. We calculate this last measure using the Fama-French-Carhart four-factor model, in which we estimate factor coefficients for each security i for year t using the security's monthly return data for the 24-month period prior to and including December of year $t-1$. Using monthly returns for year t , we calculate monthly risk-adjusted returns as a security's actual return less the return predicted from the four-factor model, which we use to construct the cumulative risk-adjusted return over year t . Regardless of whether we examine excess returns or risk-adjusted returns, Simple q remains inversely associated with a security's subsequent annual returns.¹⁴¹

¹³⁹ See, e.g., Hyung Cheol Kang et al. Controlling Shareholders' Value, Long-Run Firm Value and Short-Term Performance, 43 *Journal of Corporate Finance* 340 (2017) ("[W]e use Tobin's Q as a proxy for long-run firm value..."); Cremers, Giambona, Sepe, and Wang supra note 5 (using *Simple q* to measure long-term firm value associated with activist campaigns).

¹⁴⁰ For instance, for a firm with a fiscal year ending December 31, 1991, we calculate Simple q as of December 31, 1991 and match it to equity returns from January 1, 1992 through December 31, 1992.

¹⁴¹ The results of Table 3 remain unchanged if we estimate these regressions using the Fama-MacBeth procedure rather than firm- and time-fixed effects. See Eugene F. Fama and James D. MacBeth, Risk, Return and Equilibrium: Empirical Tests, 81 *J. Pol. Econ.* (2006).

Table 3: Returns and Simple q

| | (1) | (2) | (3) | (4) | (5) | (6) |
|------------------------|------------------------|------------------------|------------------------|------------------------|-------------------------|-------------------------|
| | Annual Return | Annual Return | Excess Return | Excess Return | Risk-Adjusted Return | Risk-Adjusted Return |
| Ln(q) | -0.323*** [0.00903] | | -0.323*** [0.00903] | | -0.633*** [0.0137] | |
| Second Quartile of q | | -0.172*** [0.00684] | | -0.172*** [0.00684] | | -0.246*** [0.00756] |
| Third Quartile of q | | -0.290*** [0.00977] | | -0.290*** [0.00977] | | -0.480*** [0.00970] |
| Fourth Quartile of q | | -0.458*** [0.0119] | | -0.458*** [0.0119] | | -0.898*** [0.0141] |
| Firm FE | Y | Y | Y | Y | Y | Y |
| Year FE | Y | Y | Y | Y | Y | Y |
| N | 177,191 | 177,191 | 177,191 | 177,191 | 177,191 | 177,191 |

Robust standard errors in brackets

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

By themselves, these results underscore the need for caution in interpreting the implications of any governance intervention that purports to enhance a firm's measure of Simple q . Indeed, to the extent one seeks to create sustainable shareholder value, a finding that an intervention is associated with an increase in Simple q could be a cause for concern. Moreover, in unreported results, we also show that this inverse relationship between q and returns persists whether we define q using Simple q or Total q .

It is surprising that the inverse association between q and returns has been overlooked in the corporate governance literature in light of the large literature examining this phenomenon in the context of asset pricing. Especially notable in this regard is the work of Eugene Fama and Kenneth French. In their pioneering work in asset pricing, Fama and French sought to explain why the cross-section of average returns of U.S. common stocks appeared to depart from the predictions of the Capital Asset Pricing Model (CAPM).¹⁴² In a series of papers written in the early 1990s, they empirically established a superior model for explaining the expected returns on U.S. common stocks that accounted for the seemingly excessive returns earned by smaller stocks as well as "value" stocks. Notably, Fama and French identified this latter category of stocks as those having a high book-to-market ratio. Given that this ratio is simply the inverse of the market-to-book proxy for Simple q , the Fama-French three-factor model effectively relies on the inverse relation between returns and this proxy for q .

Within asset pricing, a robust debate also exists regarding the reason for this empirical relationship. As is often the case in asset pricing, the debate generally hinges on the extent to which one believes markets are subject to behavioral biases. For instance, in an influential paper Christopher Polk and Paola Sapienza suggest that firms can have high measures of q due to mispricing by equity markets, which encourages managers to overinvest.¹⁴³ Empirically, they advance this argument by constructing a mispricing metric and find that it is positively related to investment. They also find an inverse relation between capital investment and future equity returns. In combination, they argue that this evidence suggests that overpriced (underpriced)

¹⁴² See, e.g., Eugene F. Fama and Kenneth French, Value Premium and The CAPM 51, *J. Fin.* 55 (1996).

¹⁴³ Christopher Polk & Paola Sapienza, The Stock Market and Corporate Investment: A Test of Catering Theory, 22 *Rev. Fin. Stud.* 187 (2009)

firms tend to overinvest (underinvest), which accounts for the inverse association between q and equity returns.

More recently, Lu Zhang has advanced an alternative explanation that endogenizes a firm's investment and its returns.¹⁴⁴ According to this "Investment CAPM" theory, the positive association between q and investment documented by Polk and Sapienza (among others) is entirely consistent with Tobin's original theory, and the relatively low expected returns for high q firms are also what one would expect to see if managers are in fact optimizing as postulated by Tobin. To understand why, the Investment CAPM focuses on the fact that an optimizing firm will invest according to a capital budgeting decision in which managers evaluate the profitability of an investment against the firm's cost of capital. To the extent managers can accurately assess expected returns, the fact that high q firms make capital investments might reflect the fact that the firm has a low cost of capital. Thus, the Investment CAPM asserts that high q is associated with low future equity returns that are known to managers.

Yuhang Xing further explores the possibility that a firm's high q can reflect either a high marginal productivity of capital or a low cost of capital.¹⁴⁵ Surprisingly, Xing finds that portfolios of firms with low investment growth portfolios have significantly higher average returns than portfolios of firms with high investment growth, even after controlling for the marginal productivity of capital. As Xing summarizes, these findings indicate that "higher Q and investment are more likely to result from lower expected returns in the future, rather than from a high marginal product of capital."¹⁴⁶ Xing further notes that the evidence suggests that firm-level capital investment is more likely to be driven by variation in future discount rates than by variation in the future productivity of its capital.

All of these advances in the literature are problematic for scholars who use q as a proxy for long-term firm value. For behaviorists, increases in q reflect market mispricing, which is followed by relatively low returns to equity as the mispricing dissipates and management overinvests. For adherents of the Investment CAPM, increases in q reflect stochastic reductions in a firm's discount rate, not enhanced profitability. In either case, stockholders of high q firms can be expected to earn relatively low future returns. In the behavioral case, a high q does not demonstrate sustainable increases in firm value; to the contrary, it suggests the opposite conclusion. In the Investment CAPM case, q reflects a reduction in a firm's risk premium and therefore lower expected future returns; even in this case, q is a categorically different kind of proxy for firm value (based on risk reduction and relatively lower future returns) than the description in the literature.

We are not advocating any particular interpretation of the inverse relationship between q and future returns. That debate is ongoing in the asset pricing literature, and we will follow it with interest. Instead, our point here is that scholars who sanguinely conclude that a corporate governance change is normatively desirable because it is associated with a higher measure of

¹⁴⁴ Lu Zhang, The Investment CAPM, NBER Working Paper No. 23226, available at <http://www.nber.org/papers/w23226>.

¹⁴⁵ Yuhang Xing, Interpreting the Value Effect Through the Q-Theory: An Empirical Investigation, 21 Rev. Fin. Stud. 1767 (2007).

¹⁴⁶ Id. at 1783.

Simple q should engage with the asset pricing literature's competing interpretations of the meaning of that higher measure.

III. Simple Q 's Failure as a Measure for Corporate Governance: An Illustration

We next ask whether Simple Q 's biased measurement error and inverse relationship to future shareholder returns might affect how we view the sizable number of papers finding a relationship between governance and firm value when using Simple q as a proxy for the latter. In this section, we replicate an especially well-known paper that finds such a relationship in order to test its resilience against the limitations of Simple q . In so doing, our goal is to illustrate the relevance of our critique for corporate governance researchers.

To be clear, our argument is *not* that all associations between governance and firm value and/or shareholder returns should be disregarded simply because those associations rely on an association between governance and Simple q . On the contrary, many of these papers advance innovative theories about the manner in which governance can affect firms and shareholder welfare. Rather, our point here is to demonstrate why those who find a relationship between governance and Simple q should, at a minimum, bear the burden of demonstrating why the governance intervention under study affects firm value despite the limitations of Simple q as a proxy for firm value.

The paper we examine is Lucian Bebchuk, Alma Cohen, and Allen Ferrell's seminal paper, "What Matters in Corporate Governance?"¹⁴⁷ Published in 2008 in the *Review of Financial Studies*, the article has been cited over 550 times according to Web of Science and has been downloaded over 30,000 times on the Social Science Research Network. The index developed in the paper—the Entrenchment Index—is today a standard regressor in corporate governance research with over 150 studies utilizing it.

In general, Bebchuk, Cohen, and Ferrell (BCF) build on prior work by Paul Gompers, Joy Ishii, and Andrew Metrick (GIM)¹⁴⁸ that investigated the extent to which a set of twenty-four governance provisions tracked by the Investor Responsibility Research Center (IRRC) were priced by the market. Using this data, GIM constructed a "Governance Index" to proxy for the level of shareholder rights at 1,500 large firms during the 1990s and investigated returns from investing in "good governance." In particular, they examine returns from an investment strategy that bought firms in the lowest decile of the index (strong shareholder rights) and sold firms in the highest decile of the index (weak shareholder rights). Remarkably, the study reported that returns from such a strategy would have earned abnormal returns of 8.5 percent per year from 1990 through 1999.

In their paper, BCF hypothesize that only a sub-set of these provisions truly matter to investors, with those that "entrench" management being the most significant. Accordingly, they construct an Entrenchment Index—or E-Index—based on six provisions that materially constrain shareholder influence (staggered boards, limits to shareholder bylaw amendments, supermajority

¹⁴⁷ See BCF, *supra* note 12.

¹⁴⁸ Gompers, Ishii & Metrick, *supra* note 12.

requirements for mergers, and supermajority requirements for charter amendments) or interfere with the market for corporate control (poison pills and golden parachutes).

BCF find that increases in the level of the E-Index are monotonically associated with economically significant reductions in firm value as measured by Simple q . Using the same framework as GIM, they also find that pursuing the same long-short investment strategy but focusing on buying firms with the lowest E-Index and shorting firms with the highest E-Index would have produced abnormal monthly returns of 116 basis points per month during the 1990s. In contrast, the other eighteen IRRC provisions not in the entrenchment index are uncorrelated with either Simple q or abnormal returns.

BCF's finding that the results from GIM are driven primarily by the six entrenchment provisions has understandably made "What Matters in Corporate Governance?" a highly influential paper in the corporate governance literature. Moreover, demonstrating the basic point that not all corporate governance provisions are created equal was in many ways the core takeaway of the study.

To the extent BCF sought to advance the more ambitious claim that high entrenchment actually results in lower firm value or abnormal returns, BCF were much more cautious given the largely correlational nature of their analyses. The paper concluded by noting: "We present some evidence that is consistent with the possibility that, in the aggregate, the entrenching provisions bring about or help maintain lower firm valuation. But this evidence does not establish causality and much more work needs to be done."¹⁴⁹

The evidence that BCF found with respect to a possible causal relationship focused primarily on the fact that many of the firms within their sample altered their E-Index over time. Accordingly, by exploiting the panel structure of the data, they examined how variation in the E-index was associated with changes in Simple q , which revealed a negative relationship. Describing this finding as "consistent"¹⁵⁰ with a causal relationship, they tentatively noted: "[T]o the extent that the identified correlation between the provisions in our E index and firm value at least partly reflects a causal relation going from entrenchment to firm value, these provisions are ones that deserve the attention of private and public decision makers seeking to improve corporate governance." Despite this qualified approach, the paper's widely cited findings nevertheless helped usher in a wave of studies examining the relationship between q and various corporate governance characteristics.

We begin our analysis of BCF's findings by replicating their core finding regarding entrenchment and Simple q . All analyses are conducted on the same sample of firms, which we obtain from Lucian Bebchuk's website.¹⁵¹ For each firm, the file lists by year its corresponding E-Index value. We present the results of this replication in the first two columns of Table 4.

As in BCF, Column 1 presents the results of a pooled OLS regression for their sample firms for the 1992-2002 period. In the specification, we regress the industry-adjusted Simple q for firm i

¹⁴⁹ BCF, *supra* note 12, at 823.

¹⁵⁰ *Id.* at 811.

¹⁵¹ The dataset can be downloaded at the following link: <http://www.law.harvard.edu/faculty/bebchuk/data.shtml>

in year t on the firm's E-index score for that year, holding constant a variety of variables. Consistent with BCF, we define a firm's industry-adjusted Simple q as a firm's Simple q minus the median Simple q in the firm's industry in the observation year (using two-digit SIC codes). Due to the existence of outliers, we winsorize this measure at 1%.¹⁵²

In all regressions in Table 4, including the regression in Column 1, we include the same controls used in BCF, which include the assets of the firm (in logs), the age of the firm (in logs), whether the firm is incorporated in Delaware (0/1), the level of insider ownership, return on assets, capital expenditures (scaled by total assets), research and development (R&D) expenditures (scaled by sales), and leverage. In keeping with BCF's approach, we also include as a control a firm's "O Index," which they define as a firm's IRRC provisions (reported by GIM) minus its E-index value. BCF include this latter variable to estimate how well the E-Index predicts firm outcomes relative to the other governance provisions tracked by IRRC. Finally, we include year fixed effects and a dummy variable for missing R&D expenditures, also consistent with BCF.¹⁵³ As with BCF, we use robust standard errors to account for potential heteroskedasticity.

In Column 1, the coefficient on the E-Index is significantly negative, consistent with the findings in BCF. In Column 2, we further confirm the findings of BCF when we regress industry-adjusted Simple q on dummy variables that represent the different levels that the E-Index can take. As noted in BCF, this latter specification avoids the imposition of linearity on the E-Index's relationship with industry-adjusted Simple q . The results in Column 2 track those of BCF closely, with each level of the E-Index having an increasingly negative association with industry-adjusted Simple q . Moreover, across all six levels of the index, the results are significant at the 1% level. Similar to BCF, the coefficient on the O-Index is positive and significant in both columns, though only at the 10% level.

In the third and fourth columns, we re-run each of these specifications using industry-adjusted Total q rather than industry-adjusted Simple q . As with calculating industry-adjusted Simple q , we define a firm's industry-adjusted Total q as a firm's Total q (as reported in the Taylor and Peter's dataset) minus the median Total q in the firm's industry in the observation year (using two-digit SIC codes). As with industry-adjusted Simple q , we winsorize the measure at 1%. As shown in Columns 3 and 4, the results are strikingly similar to those obtained in Columns 1 and 2. The primary exception is that the negative coefficient on E-Index 5-6 is slightly less negative than the coefficient on E-Index 4. The positive coefficient on O-index is also no longer statistically significant at conventional levels.

¹⁵² Our use of winsorized industry-adjusted Simple q departs slightly from BCF in that BCF use as their dependent variable the log of a firm's industry-adjusted Simple q . We use winsorized, non-transformed industry-adjusted Simple q for two reasons. First, industry-adjusted Simple q can yield negative values, and BCF do not describe how they conducted their log transformation given the presence of these negative measures. Second, BCF report obtaining the same results using non-transformed industry-adjusted Simple q .

¹⁵³ BCF appear to use a dummy for missing variables for R&D given the large number of observations for which R&D expenditures are missing. BCF do not specify how they implement this dummy variable substitution; therefore, we do so by substituting the median value of observed R&D values for missing R&D values and dummy code these observations as "missing R&D."

Table 4 – Replication of BCF Using Simple q and Total q : Pooled Regressions

| | (1) | (2) | (3) | (4) |
|---------------------------|-------------------------|-------------------------|------------------------|------------------------|
| E-index | -0.118*** [0.00814] | | -0.225*** [0.0258] | |
| E-Index 1 | | -0.278*** [0.0520] | | -0.362** [0.158] |
| E-Index 2 | | -0.350*** [0.0488] | | -0.597*** [0.148] |
| E-Index 3 | | -0.452*** [0.0485] | | -0.714*** [0.146] |
| E-Index 4 | | -0.555*** [0.0486] | | -1.110*** [0.148] |
| E-Index 5-6 | | -0.687*** [0.0556] | | -1.014*** [0.198] |
| O-index | 0.00908* [0.00508] | 0.00949* [0.00510] | 0.00996 [0.0153] | 0.0103 [0.0154] |
| Log(Assets) | -0.0261*** [0.00869] | -0.0286*** [0.00878] | 0.346*** [0.0327] | 0.344*** [0.0326] |
| Log(Age) | -0.128*** [0.0156] | -0.128*** [0.0156] | -0.777*** [0.0523] | -0.773*** [0.0523] |
| Delaware Incorporation | 0.00599 [0.0214] | 0.00694 [0.0214] | -0.205*** [0.0679] | -0.210*** [0.0680] |
| Insider Ownership | 0.438 [0.337] | 0.377 [0.338] | 5.965*** [1.024] | 5.855*** [1.028] |
| Insider Ownership Squared | -1.125 [0.731] | -1.03 [0.734] | -9.770*** [1.869] | -9.603*** [1.874] |
| ROA | 1.686*** [0.220] | 1.687*** [0.219] | 2.832*** [0.328] | 2.831*** [0.326] |
| CAPX/Assets | 1.637*** [0.203] | 1.653*** [0.203] | -8.941*** [0.633] | -8.946*** [0.634] |
| Leverage | -0.712*** [0.0935] | -0.719*** [0.0936] | -1.475*** [0.271] | -1.483*** [0.272] |
| R&D per Sales | 0.0208*** [0.00632] | 0.0209*** [0.00637] | 0.0291*** [0.00688] | 0.0291*** [0.00697] |
| Year Fixed Effects | Y | Y | Y | Y |
| Firm Fixed Effects | N | N | N | N |
| Number of Observations | 11,336 | 11,336 | 11,336 | 11,336 |
| R-squared | 0.138 | 0.139 | 0.098 | 0.098 |

Robust standard errors in brackets

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Overall, Table 4 suggests that BCF’s original finding that firms with high E-Index values are associated with lower q persists regardless of whether we define q using Simple q or Total q . However, as emphasized by BCF, these cross-sectional regressions do not speak to their more provocative suggestion that changes in a firm’s E-Index can cause changes in firm value. To get at this latter issue, BCF ran an additional set of specifications using firm fixed effects to control for unobserved firm heterogeneity that remains constant over their sample period. By holding constant firm fixed effects, these regressions put them on a firmer footing for examining how changes in the E-Index over time at a firm might affect its industry-adjusted Simple q . As they note, “[t]he fixed effects regressions ... examine the effect on firm value of changes that firms made, during the 1990–2003 period, in the number of entrenching provisions (whether to increase or decrease the number of entrenching provisions).”¹⁵⁴ (We address in Part IV why even this fixed effects specification, which is now common within the Finance q literature, may be the

¹⁵⁴BCF, supra note 12, at 803.

incorrect estimator for examining changes in firm value within a panel dataset such as used in BCF.)

In Table 5, we replicate this approach using both BCF's measure of industry-adjusted Simple q and industry-adjusted Total q as our outcome variables. The first two columns use industry-adjusted Simple q and replicate the results obtained in BCF. Specifically, in Column 1, the coefficient on the E-Index is negative and significant at the 1% level, and the coefficient on the O-Index is now insignificant. Overall, these results are virtually the same as those obtained in BCF.

In Column 2, we further follow BCF in exploring whether higher values of the E-Index are more predictive of declining values of industry-adjusted Simple q , holding constant firm fixed effects. Consistent with BCF, the coefficients grow increasingly negative between E-Index 1 through E-Index 5-6, although only the last three levels of the E-Index achieve the same level of statistical significance as in BCF. Overall, however, one could draw a similar conclusion as BCF in interpreting these findings as suggesting that higher levels of entrenchment cause a decline in industry-adjusted Simple q . Moreover, the absence of any significant coefficient on the O-Index suggests that the mechanism by which corporate governance might affect Simple q would be through the E-Index as opposed to the G-Index.

In contrast, as shown in Columns 3 and 4, the same cannot be said of the relationship between the E-Index and industry-adjusted Total q . In both Columns 3 and 4, the coefficients on the E-Index have lost all statistical significance, and the coefficient on the O-Index is positive and significant at the 1% level. In other words, the main results of BCF do not hold if we simply substitute Total q for Simple q .

Table 5 – Replication of BCF Using Simple q and Total q : Pooled Regressions: Controlling for Firm Fixed Effects

| | (1) | (2) | (3) | (4) |
|---------------------------|------------------------|-----------------------|------------------------|------------------------|
| E-index | -0.0450*** [0.0148] | | -0.0479 [0.0454] | |
| E-Index 1 | | -0.0872* [0.0494] | | -0.136 [0.119] |
| E-Index 2 | | -0.0846 [0.0537] | | -0.0569 [0.132] |
| E-Index 3 | | -0.164*** [0.0589] | | -0.109 [0.151] |
| E-Index 4 | | -0.211*** [0.0647] | | -0.256 [0.183] |
| E-Index 5-6 | | -0.203*** [0.0724] | | -0.255 [0.356] |
| O-index | 0.00604 [0.00439] | 0.00599 [0.00439] | 0.0388*** [0.0115] | 0.0390*** [0.0115] |
| Log(Assets) | -0.319*** [0.0327] | -0.318*** [0.0327] | 0.00333 [0.0998] | 0.005 [0.0997] |
| Log(Age) | -0.177** [0.0694] | -0.178*** [0.0692] | -1.300*** [0.185] | -1.309*** [0.186] |
| Delaware Incorporation | - | - | - | - |
| Insider Ownership | 1.370*** [0.418] | 1.374*** [0.420] | 1.453 [1.200] | 1.463 [1.208] |
| Insider Ownership Squared | -1.409** [0.708] | -1.412** [0.708] | -1.072 [1.706] | -1.076 [1.714] |
| ROA | 1.118*** [0.179] | 1.117*** [0.179] | 2.278*** [0.318] | 2.275*** [0.318] |
| CAPX/Assets | 1.697*** [0.270] | 1.699*** [0.270] | 0.274 [0.536] | 0.275 [0.537] |
| Leverage | -0.407*** [0.138] | -0.409*** [0.138] | 0.061 [0.295] | 0.0536 [0.295] |
| R&D per Sales | 0.00622 [0.00493] | 0.00623 [0.00493] | 0.0121*** [0.00264] | 0.0121*** [0.00266] |
| Year Fixed Effects | Y | Y | Y | Y |
| Firm Fixed Effects | Y | Y | Y | Y |
| Observations | 11,336 | 11,336 | 11,336 | 11,336 |
| R-squared | 0.734 | 0.734 | 0.772 | 0.772 |

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

These results underscore the challenge of relying on Simple q as a proxy for firm value. While the pooled regressions in Table 4 yield largely the same result whether we use Simple q or Total q , the more exacting fixed effects specification is much more sensitive to the version of q . This sensitivity should not be surprising in light of the history of Simple q discussed in Part I. As noted, Perfect and Wiles found that of all the estimates of q , the simplified measure based on a straightforward market-to-book proxy produced estimates that differ from those obtained using other proxies for q . Our replication is consistent with this finding.

These results also are consistent with our examination in Part II.A. of the estimation bias that can arise from using Simple q as an outcome variable. Recall that because of the calculation of Simple q , a firm's level of Simple q is strongly associated with a firm's particular mix of assets on its balance sheet. In Part II.A, we focused on two examples: the extent to which a firm holds assets in the form of current assets and the extent to which a firm "builds" rather than "buys" intangibles (thereby producing more unbooked intangible assets). In each case, higher levels of

each type of asset were associated with higher levels of Simple q . To examine whether these accounting issues can bias the estimated relationship between the E-index and Simple q , we present in Table 6 two sets of regressions using the BCF dataset. In Column 1, we regress a firm's annual level of current assets on a firm's E-index, controlling for its overall book value of assets as well as year and industry fixed effects. In Column 2, we run the same regression but substitute a firm's unbooked intangibles for current assets. Columns 3 and 4 repeat the analyses, but control for year and firm fixed effects.

Table 6 – The E-Index and Current Assets and Unbooked Intangibles

| | (1) | (2) | (3) | (4) |
|------------------------|----------------------|----------------------|---------------------|----------------------|
| | Current Assets | Unbooked Intangibles | Current Assets | Unbooked Intangibles |
| E-Index | -247.3*** [19.00] | -177.9*** [18.58] | -98.55** [43.02] | -94.06*** [33.86] |
| Log(Assets) | 1,177*** [35.45] | 889.0*** [30.73] | 1,161*** [133.4] | 405.5*** [69.97] |
| Year Fixed Effects | Y | Y | Y | Y |
| Industry Fixed Effects | Y | Y | N | N |
| Firm Fixed Effects | N | N | Y | Y |
| Observations | 12,823 | 15,283 | 12,823 | 15,283 |
| R-squared | 0.417 | 0.312 | 0.196 | 0.115 |

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

As indicated by the table, a firm's E-Index was negatively associated with each form of asset, underscoring how the construction of Simple q can cause regression specifications that use it as a dependent variable to violate the assumptions of linear regression. Here, given the strong association between Simple q and current assets as well as unbooked intangibles found in Part II.A, Table 6 suggests that the E-Index in Tables 4 and 5 should be correlated with the error term of the regression models, which would make it an endogenous predictor. The fact that Total q seeks to account for intangible assets and seeks to minimize the effect of current assets on q thus helps explain the difference in results when we substitute Total q for Simple q .¹⁵⁵

Lastly, we conclude our discussion of BCF with an analysis of their finding regarding a negative association between the E-Index and stock returns. As discussed above, one of the more notable findings of BCF is the fact that returns to an investor who pursued a long-short investment strategy aimed at going long low entrenchment firms and shorting high entrenchment firms would have generated significant abnormal monthly returns during the 1990s. Indeed, as they find, "average returns decrease monotonically as one moves to portfolios with higher entrenchment scores."¹⁵⁶

However, the possibility that low entrenchment firms might be associated with both high measures of Simple q and high stockholder returns stands in contrast to our empirical finding in Part II that stockholder returns and Simple q are inversely related. In general, firms that have

¹⁵⁵ More specifically, in unreported results, the estimated association of the E-Index on Simple q similarly loses significance when we modify Simple q by excluding current assets from the numerator and when we define the denominator as a firm's gross property plant and equipment. Both of these approaches are used to calculate Total q .

¹⁵⁶BCF, supra note 12, at 814.

high measures of Simple q have, on average, lower subsequent stockholder returns. The BCF finding would accordingly seem to suggest either something very special about high q firms having low entrenchment scores or something very special about the sample of firms. Or perhaps both.

As it turns out, the result is largely a product of the fact that in examining returns, BCF were seeking to replicate the approach of GIM who were principally interested in whether one could earn abnormal returns from investing in firms with good governance. Accordingly, neither GIM nor BCF argued that governance produced these returns or even that a positive governance intervention was associated with positive returns.¹⁵⁷

This distinction between the returns *from investing* in observed good governance and the returns *from a governance intervention* is subtle but critical, as it is one that is often missed in the

¹⁵⁷ Moreover, the results of both papers are highly sensitive to the evolving theories of risk-based pricing within the asset pricing literature. For instance, BCF (following GIM) calculated abnormal returns for their long-short portfolio in month t ($Diff_t$) using a four-factor Fama-French-Carhart regression model of the following form:

$$Diff_t = a + b_1 * MKTRF_t + b_2 * HML_t + b_3 * SMB_t + b_4 * Momentum_t + e_t$$

where $MKTRF_t$ is the month t value-weighted market return minus the risk-free rate, SMB_t and HML_t are the Fama-French zero-investment benchmark factor mimicking portfolios reflecting, respectively, size and book-to-market stock return effects for time t , and $Momentum_t$ reflects stock return momentum effects for time t . By regressing monthly portfolio returns on these factors, the intercept from the regression (a) is the monthly abnormal return associated with going long firms with low E-index scores and shorting firms with high E-index scores.

In calculating their risk factors, BCF note that they calculate the monthly Momentum factor using the procedure described in Mark Carhart's seminal study on mutual fund return persistence. See Mark M. Carhart, On Persistence in Mutual Fund Performance, 52 Journal of Finance 57, 61 (1997). However, in estimating the monthly momentum factor in his widely-used public dataset of risk factors, Kenneth French constructed an alternative momentum factor ("UMD") that seeks to estimate the same concept but utilizes an additional sort based on size. See Detail for Monthly Momentum Factor, available at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_mom_factor.html. Using this latter factor instead of Carhart's original momentum factor diminishes the magnitude of BCF's abnormal returns. For instance, in the table below, we replicate BCF's abnormal returns during the 1990s for an investment portfolio that is long firms with an E-Index of 0 and short firms with an E-Index of 5 or higher (which is the same strategy used by BCF). As shown in the second half of the table, the result for the equal-weighted portfolio becomes insignificant when we use UMD.

| | Original BCF Finding | | BCF Finding Using UMD | |
|-----|----------------------|----------------|-----------------------|----------------|
| | Equal weighted | value weighted | Equal weighted | value weighted |
| a | .0058299*** | .0122372*** | .0032012 | .008531*** |
| | .002213 | .0029223 | .0022338 | .002894 |

Additionally, as noted previously, this approach is agnostic as to whether a firm ever changes its E-Index, underscoring why this approach cannot speak to the causal effect of entrenchment on returns. Indeed, subdividing the long-short portfolio into a long-short sub-portfolio containing firms that never changed their E-Index during the 1990s and a long-short sub-portfolio containing firms that adjusted their E-index at least once during the 1990s reveals that the result is driven entirely by the former set of firms. The following table presents the estimates for a for these two sub-portfolios.

| | BCF Finding Using UMD: No Change in E-Index | | BCF Finding Using UMD: At Least 1 Change in E-Index | |
|-----|--|----------------|--|----------------|
| | Equal weighted | value weighted | Equal weighted | value weighted |
| a | .0031145 | .0078783** | .0031415 | .0077302 |
| | .0025763 | .0032473 | .0027128 | .0048896 |

literature. As subsequently explored by Bebchuk, Cohen and Wang,¹⁵⁸ an intervention that results in an increase in q —and thus an intervention that delivers immediate returns to existing stockholders—should not necessarily enable subsequent investors to enjoy risk-adjusted excess returns. On the contrary, in efficient markets a governance intervention that is known to enhance managerial performance should be priced by the market such that subsequent investors (having purchased at the higher valuation) will earn ordinary risk-adjusted returns. BCF's and GIM's findings that investing in good governance during the 1990s was a strategy for earning abnormal returns was therefore remarkable because it suggested that a governance intervention might be valued by the market (as evidenced by the rise in q), yet the market's initial assessment was *insufficient* to prevent subsequent investors from earning abnormal returns.

Table 5 calls into question BCF's conclusion that the short-term value of firms systematically changes to reflect the level of board entrenchment. But what about their finding with regard to returns from investing in good governance? That is, might the market have *subsequently* valued a firm's change in entrenchment such that an investor could earn positive returns from investing in low E-index firms?

To test the relationship between a firm's E-index and its subsequent share returns, we calculate the two-year returns¹⁵⁹ an investor would earn from buying shares of each firm in the BCF sample at the time the IRRC publishes new data (July 1993, July 1995, and February 1998). We compare this return to the return from investing in the CRSP value-weighted index during the same periods. We define the difference between the return on stock t during and the corresponding return on the index as the security's excess return.

We next regress these excess returns on the E-index for all firms in the same sample used in Tables 4 and 5, holding constant firm and year fixed effects.¹⁶⁰ We present the results in Column 1 of Table 7. In contrast BCF's findings, the table reveals a positive but insignificant relationship. In Column 2, we run the same analysis except we use dummy variables to stand for the different levels that the E-index can take. With the exception of firms moving to an E-Index of 5, the coefficients are again positive, with some being statistically significant. In Columns 3 and 4 we run the same two analyses, but we calculate excess returns using industry-adjusted excess returns.¹⁶¹ The results are virtually identical to Columns 1 and 2. Finally, in Columns 5 and 6 we move from estimating excess returns to estimating whether a firm delivered risk-adjusted returns. For these analyses, we calculated abnormal returns using the 4-factor Fama-French-Carhart model, using 24 months of monthly returns commencing with the IRRC publication month. In both columns, the overall relationship is insignificant. However, as with excess returns, the estimated treatment effect for moving from an E-index of zero to an E-Index of 2 or 3 is both positive and moderately significant.

¹⁵⁸ Lucian Bebchuk, Alma Cohen, and Charles Wang, Learning and the Disappearing Association between Governance and Returns, 108 *Journal of Financial Economics* 323 (2013).

¹⁵⁹ We impose a twenty-four month holding period to permit estimation of abnormal returns using monthly data; our results for excess returns are quantitatively the same if we use a 12 month holding period.

¹⁶⁰ We cluster errors by firm to account for serial correlation.

¹⁶¹ We calculate industry-adjusted excess returns by (i) reducing a firm's gross two-year return by the median two-year return observed for firms within the same 2-digit SIC code, and (ii) reducing this adjusted return by the return on the CRSP value-weighted index over the same 2-year period.

Table 7 – E-index vs. Investment Returns

| VARIABLES | (1) Excess Return | (2) Excess Return | (3) Industry- Adjusted Returns | (4) Industry- Adjusted Returns | (5) Alpha | (6) Alpha |
|--------------|-------------------------|-------------------------|---|---|-------------------------|------------------------|
| E-Index | 0.00869 [0.0258] | | 0.0111 [0.0257] | | -0.000139 [0.000869] | |
| E-Index 1 | | 0.0762 [0.0718] | | 0.0784 [0.0723] | | 0.00369 [0.00260] |
| E-Index 2 | | 0.184** [0.0830] | | 0.191** [0.0835] | | 0.00525* [0.00305] |
| E-Index 3 | | 0.191* [0.101] | | 0.201** [0.101] | | 0.00598* [0.00339] |
| E-Index 4 | | 0.0209 [0.111] | | 0.0307 [0.112] | | -0.000286 [0.00365] |
| E-Index 5 | | -0.0356 [0.145] | | -0.0281 [0.145] | | -0.00136 [0.00562] |
| E-Index 6 | | 0.149 [0.214] | | 0.164 [0.216] | | -0.00519 [0.00800] |
| Observations | 5,710 | 5,710 | 5,710 | 5,710 | 5,130 | 5,130 |
| R-squared | 0.089 | 0.092 | 0.09 | 0.093 | 0.011 | 0.015 |

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

The results in Table 7 suggest that entrenchment and stockholder returns are not related in a statistically significant way, providing little evidence that the market subsequently rewarded firms as they moved to lower levels of the E-Index. For similar reasons, these results also indicate that an investor could not earn abnormal returns from investing in firms that were shown to have reduced their E-Index on an IRRC publication date. In light of our analysis of the E-Index and q , the results should be unsurprising: Just as modifying a firm's E-Index revealed no evidence of a meaningful, systematic change in its market valuation in the short term, neither did it result in such a change over the long-term.

IV. Alternatives to Using Simple Q as a Proxy for Firm Value

Finally, we consider alternatives to Simple q . As we suggested in our replication of BCF, one possibility is to stay within a q -framework but use a superior estimate of Tobin's q .¹⁶² In Part III, we examined this approach using Total q . However, Total q suffers from many of same problems that plague Simple q . Among other things, Total q substitutes noisy and seemingly arbitrary variables for the replacement cost of assets in the denominator. For example, the rationale for capitalizing 30% of selling, general, and administrative expenses is questionable. Like Simple q , Total q also aggregates in the denominator all of a firm's assets (tangible and intangible). Most fundamentally, as we noted in the Introduction, even if Total q or some other measure might be a better estimate than Simple q , any attempt to measure firm value using a version of Tobin's q raises the central question: why scale firm value using an estimate of the replacement cost of assets?¹⁶³

¹⁶² As noted at TAN 133, the fact that the bias arises from aggregating assets in the denominator of q rules out the possibility of simple regression adjustments, such as adding a control for current assets.

¹⁶³ Other potential substitutes for an approach based on Tobin's q rely on measures of operating efficiency. See Dybvig & Warachka, supra note 19, at 4-5.

Another alternative is stockholder returns. Changes in share prices directly measure how a corporate structure or regulatory intervention affects the welfare of a firm's investors. However, identifying causal effects on stockholder returns requires more robust regression specifications than corporate governance scholars historically have used. Because most studies use a pooled regression of returns on the governance attribute of interest, it is not possible to discern whether an identified effect is the result of the governance attribute or some other firm-specific characteristic.¹⁶⁴ As BCF cautioned, a finding of correlation between governance and returns is thus subject to different possible interpretations. Moreover, studies that focus on shareholder returns do not account for returns to non-stockholder financial claimants, particularly debtholders, which are an important part of firm value.

Our recommended alternative to Simple q is straightforward: scholars examining the question of “*what affects firm value?*” should estimate firm value directly using the sum of the market values of equity and debt where available and estimates (e.g., book values of debt) where market values are unavailable. Researchers can then apply the standard regression framework to examine the predictors of firm value. The primary difference in our recommended approach is that these analyses would discard any attempt to scale the outcome variable of interest by a noisy estimate for the replacement cost of assets.¹⁶⁵ In other words, we recommend abandoning the denominator of Tobin's q .

We find this approach attractive for several reasons. First, it directly estimates the variable of interest for scholars interested in understanding how corporate governance, regulatory policy, and other economic phenomenon affect firm value. Second, while the resulting estimate of firm value will often be measured with error for the reasons discussed in Part II.A, our analysis of Simple q also illustrated that the primary source of non-classical measurement error arose from errors in estimating the denominator of q . We can think of no *a priori* reason to believe that our proposed estimate of firm value suffers from a similar form of non-classical measurement error. Third, as noted above, the accounting literature has long utilized a direct approach to estimating the correlates of the market value of equity, and has developed methods to address various statistical challenges that using direct market values can pose.¹⁶⁶

Finally, our approach should force scholars to be more disciplined in interrogating the regression specifications used to test particular theories about the correlates of firm value. Perhaps because the determinants of q are under-theorized, there is a tendency within the Finance q literature to adopt regression specifications that have been used in the past without any clear explanation for

¹⁶⁴ As was done in both GIM and BCF, studies that have supplemented their analysis of Simple q with an analysis of stockholder returns have typically done so by constructing a hypothetical long-short portfolio in which an investor invests in firms having a governance attribute of interest and shorts firms lacking the attribute. As noted in Part III, these approaches are therefore unable to untangle whether the governance attribute of interest caused observed returns or whether the returns are the product of other unobserved firm characteristics that might determine both governance and stockholder returns.

¹⁶⁵ To be sure, using unadjusted firm values raises the possibility that estimating the relationship between firm value and corporate governance will demonstrate heteroskedasticity. The reason is that the market values of large firms can display different associations with corporate policy interventions than those of smaller firms. Indeed, within the accounting literature, it was this concern that originally led scholars to deflate market values by a firm's book value of equity. See Barth et al., *supra* note 32 (“deflation simultaneously cures coefficient bias and heteroscedasticity.”). However, more recent scholarship in accounting has shown that this challenge can be addressed by controlling for firm size (e.g., using a firm's book value of assets) in value regressions and using robust standard errors to account for potential heteroskedasticity. *Id.*

¹⁶⁶ See *id.*

their underlying rationale. A notable example is the frequent practice of regressing the natural logarithm of Simple q on a set of regressors while controlling for the natural logarithm of total assets.¹⁶⁷ Ostensibly, this approach seeks to account for the positive skew in both Simple q and total assets. Yet, as a matter of simple mathematics, the resulting regression is no longer a regression of the logarithm of Simple q at all, but rather a regression of the logarithm of *firm value* on the regressors of interest.¹⁶⁸ In effect, the regression specification has become similar to what we view as a potential alternative to q (accidentally, it would seem, because the specification retains Simple q as the dependent variable).

However, we only say “similar” above because we suspect that the direct use of firm value (as opposed to Tobin’s q) will prompt additional questions. For instance, corporate governance scholars increasingly use panel data with a firm fixed effects estimator (FE) to make claims about the causal effects of corporate governance on Simple q , such as changes in the level of the E-index, the adoption of a staggered board, and hedge fund activism.¹⁶⁹ These scholars might find such claims less persuasive when the dependent variable is transparently the direct change in firm value.

For instance, proper causal inference of the FE estimator generally assumes non-stationary data (i.e., data that does not follow a trend with stochastic/random properties). However, both the efficient capital markets hypothesis and casual observation suggest that the time series of firm value violates this assumption: a firm’s value over time follows trends and exhibits a “random walk.” Failure to account for this form of serial correlation can lead to spurious findings using the FE estimator, unless standard errors are adjusted appropriately such as by clustering on individual firms. While a number of papers that use the FE estimator make this adjustment, many prominent papers within the Finance q literature do not.¹⁷⁰

Additionally, focusing on a direct measure of firm value prompts the question of whether the FE estimator is the most appropriate method for measuring changes in firm value when markets are even moderately efficient. In general, the FE estimator seeks to identify the average change in an outcome variable (e.g., Simple q) for a given change in a variable of interest (e.g., levels of the

¹⁶⁷ See, e.g., Robert Daines, Shelley Xin Li, and Charles Wang, Can Staggered Boards Improve Value? Evidence from the Massachusetts Natural Experiment (Sep. 9, 2016), Stanford Law and Economics Olin Working Paper No. 498 (Tables 2, 3, 5 and 6); Bebchuk, Cohen, and Wang, supra note 158 (Table 8); Brian Roundtree, James Weston, and George Allayannis, Do Investors Value Smooth Performance, *Journal of Financial Economics* 90, 237 (2008) (Table 6).

¹⁶⁸ The log of a ratio is equal to the log of the numerator minus the log of the denominator. Thus, where q is defined as “firm value/book value”, the regression:

$$\log(q_i) = \alpha_0 + \beta X_i + \gamma \log(\text{Book Value})_i + \varepsilon_i$$

will yield the same coefficient β for X_i as the following:

$$\log(\text{Firm Value}_i) = \alpha_0 + \beta X_i + \delta \log(\text{Book Value})_i + \varepsilon_i$$

The only difference will be that the coefficient δ will equal $\gamma + 1$.

¹⁶⁹ See, e.g., BCF, supra note 12 (using firm fixed effects to examine effect on Simple q of changes in the E-index); Cremers, Litov & Sepe, supra note 7 (using firm fixed effects to examine effect on Simple q of staggered boards); Amihud, Schmid & Davidoff Solomon, supra note 7 (same); Catan & Klausner, supra note 7 (same); Cremers, et al., supra note 5 (using firm fixed effects to examine effect on firm value from hedge fund activism).

¹⁷⁰ Bebchuk, Cohen and Ferrell, for instance, use robust standard errors to account for heteroscedasticity but do not cluster errors by firm.

E-Index) during the time period after the change, holding constant all fixed, time-invariant characteristics of individual firms. For instance, BCF utilized the FE estimator to identify the average change in Simple q in the years following a firm's change in its E-Index. Yet, to the extent markets are efficient in pricing governance, it seems plausible that these effects would appear in the immediate period following a change in governance. Moreover, estimating the average change in firm value in the post-intervention period raises the additional challenge of controlling for any firm-specific confounding factors that could also affect firm value during this timeframe.

In light of the above challenges to FE estimation, a superior approach may be first differences (FD) estimation—a regression framework that, like FE estimation, controls for time-invariant characteristics of individual firms, but focuses on estimating changes in the period immediately following a governance intervention.¹⁷¹ FD estimation also rests on a weaker set of empirical assumptions. In particular, the FE estimator relies on the assumption of strict exogeneity, which requires that the error in estimating firm value is uncorrelated with all past and future values of firm value. In contrast, the FD estimator relies on an assumption of weak exogeneity that does not require the absence of correlation between all future values of firm value.¹⁷²

To be sure, FD estimation is not perfect. There is evidence suggesting markets may be delayed in pricing governance.¹⁷³ Nor are we suggesting that scholars discard the use of the FE estimator. Rather, our point is to emphasize that there are sound reasons for supplementing an FE estimation with an FD estimation in firm value regressions using panel data. Ideally, the two approaches will produce consistent results, adding confidence to the empirical conclusion. However, to the extent the two approaches yield different results, the use of both methods provides important information for the researcher, who should accordingly investigate whether the discrepancy arises from market mispricing, model misspecification, or is otherwise explicable. Not surprisingly, purely as a matter of statistical practice, leading authorities in analyzing panel data recommend producing both FE and FD estimates to determine if they differ before drawing conclusions.¹⁷⁴

We close by presenting revised results of BCF, using our recommended approach of substituting firm value in place of Simple q . In so doing, we also examine the consequence of accounting for serial correlation of firm value and comparing FE and FD specifications. For simplicity, we define firm value as the numerator of Simple q , and given positive skew in its distribution, we utilize a log transformation. We further trim the dataset to exclude any firms that experience a year-over-year increase in firm value in excess of 300% (approximately the 99th percentile of the distribution of year-over-year changes) on the assumption that such firms likely engaged in M&A transactions that could confound estimates.

¹⁷¹ See Wooldridge, *supra* note 28, at 279-91 (describing first difference estimation).

¹⁷² See A. Colin Cameron and Pravin K. Trivedi *Microeconometrics: Methods and Applications* 758 (2005).

¹⁷³ See, e.g., Bebchuk, Cohen, and Wang, *supra* note 158.

¹⁷⁴ Jeffrey Wooldridge, "Econometrics: Panel Data Methods" in *Complex Systems in Finance and Econometrics* 219 (Robert A. Meyers ed.) (2009) ("It is good practice to compute both FE and FD estimates to see if they differ in substantive ways.")

Table 8 presents the results. In Column 1, we run the same specification used by BCF (and reflected above in Table 5) except that we substitute the natural log of firm value for industry-adjusted Simple q . As in Table 5, results reflect robust standard errors to account for potential heteroskedasticity. Similar to BCF, Column 1 reveals a statistically significant negative relationship between firm value and a firm's level of the E-Index. In Column 2, we run the same specification but cluster standard errors by firm to account for serial correlation in firm value. As expected, this adjustment has the effect of increasing the standard errors, diminishing the statistical significance of the relationship between the E-Index and firm value. Column 2 thus highlights the importance of accounting for serial correlation in estimating the predictors of firm value.

Column 3 presents the coefficients on the same regression used in Column 2 except all variables have been first-differenced, permitting an FD estimation. Notably, the coefficient for the E-Index loses all statistical significance and flips from being negative to positive. The coefficient on the O-index also becomes statistically significant. Column 3 highlights the benefits of utilizing both an FE and FD analysis. In particular, by exposing conflicting results, a researcher will be prompted to investigate whether the difference in results reflects differences in how the market responded to governance or whether the regression models are problematic. At minimum, Column 3 raises questions about the interpretation of the original findings of BCF.

In Column 4, we re-run the regression used to replicate BCF's findings in Column 1 of Table 5, using an FD estimator rather than an FE estimator. In contrast to the strongly significant coefficient estimate on the E-Index of -0.045, the result in Column 4 declines to just -0.007 and is statistically insignificant.

Table 8 – Replication of BCF: Fixed Effects vs. First Differences Estimation

| | (1) | (2) | (3) | (4) |
|---------------------------|------------------------------|------------------------------|------------------------------|-----------------------------------|
| <i>Outcome:</i> | <i>Numerator of Simple q</i> | <i>Numerator of Simple q</i> | <i>Numerator of Simple q</i> | <i>Industry-Adjusted Simple Q</i> |
| E-Index | -0.0169*** [0.00555] | -0.0169** [0.00772] | 0.00185 [0.00687] | -0.00741 [0.0168] |
| O-index | 0.00189 [0.00148] | 0.00189 [0.00190] | 0.00410** [0.00161] | 0.00956* [0.00495] |
| Log(Assets) | 0.895*** [0.0112] | 0.895*** [0.0176] | 0.770*** [0.0207] | -0.536*** [0.0690] |
| Log(Age) | -0.0978*** [0.0255] | -0.0978** [0.0388] | -0.153*** [0.0503] | -0.444*** [0.109] |
| Insider Ownership | 0.320** [0.139] | 0.32 [0.202] | -0.0126 [0.143] | 0.967* [0.547] |
| Insider Ownership Squared | -0.387 [0.252] | -0.387 [0.408] | 0.0354 [0.215] | -1.036 [0.649] |
| ROA | 0.470*** [0.0881] | 0.470*** [0.0959] | 0.106* [0.0564] | 0.422*** [0.157] |
| CAPX/Assets | 0.965*** [0.0986] | 0.965*** [0.126] | 0.0252 [0.0862] | -0.0758 [0.323] |
| Leverage | -0.254*** [0.0471] | -0.254*** [0.0659] | -0.296*** [0.0584] | -0.518*** [0.182] |
| R&D per Sales | 0.00154* [0.000809] | 0.00154*** [0.000592] | -0.000469 [0.000467] | 0.0138* [0.00817] |
| Year Fixed Effects | Y | Y | Y | Y |
| Firm Fixed Effects | Y | Y | N | N |
| Firm First Differences | N | N | Y | Y |
| Observations | 10,433 | 10,433 | 8,938 | 9,440 |
| R-squared | 0.982 | 0.712 | 0.376 | 0.068 |

Robust standard errors in brackets (clustered by firm in Columns 2, 3 and 4)

*** p<0.01, ** p<0.05, *p<0.1

CONCLUSION

Despite their common use, market-to-book proxies for Tobin's q , such as the widely-used Simple q , are unreliable measures of firm value. Because Simple q is a ratio based on a firm's book value of assets, regressions seeking to determine the predictors of Simple q are likely to produce biased estimates due to both omitted assets (e.g., intangibles) and firm-specific details that can systematically alter Simple q (e.g., the level of current assets, depreciation, etc.). Scholars should view with suspicion any assertions that firm characteristics affect firm value because they affect Simple q .

Given the importance of understanding how governance can affect firm value, we hope to inspire a broader conversation about the challenge of measuring firm value to inform future work. We have suggested both alternative measures of Tobin's q and alternative approaches to regression analysis based on advances in the accounting literature. Meanwhile, until scholars find a more reliable approach to assessing the relationship between governance and firm value, they should stop misusing Tobin's q .