Accounting Measurement of Assets and Earnings and Market Valuation of Firm Assets?[1]

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Accounting Measurement of Assets and Earnings and the Market Valuation of Firm Assets

Abstract

In this paper we evaluate the quality of accounting reports for valuation purpose from a measurement-error based perspective. This perspective views accounting assets and earnings noisy measurements of their underlying economic constructs, economic assets and economic income. We show that the usefulness of accounting report does not depend solely on the absolute amount of errors in either assets or earnings measurement. Instead it depends on how they affect investors' inference about firms' information regarding the rate of return on their decisions. We develop this perspective in a simple analytical framework which generates an empirically implementable measure of accounting quality. Our empirical evidence supports the validity of this measure. The main implication from our analyses is that accounting quality can be high as long as measurement errors satisfy certain time-series properties. We discuss how accrual accounting satisfy these properties.

1 Introduction

In this paper, we evaluate the quality of accounting reports for valuation purposes using a measurement error-based framework.[1] Specifically, we assess the valuation usefulness of accounting measurements of assets and earnings jointly by their ability to enable investors to accurately infer firms' information with regard to the rate of return on firms' decisions. In our framework, a firm's future cash flows is determined by the firm's information about the rate of return on their decisions and firm price is set by investors based on their inference about such information. There is no agency conflict but as long as the market is not strong-form efficient,[2] how accounting measures assets and earnings affects firm price by affecting investors' inference about such information. The framework produces an empirically implementable measure to quantify the quality of accounting reports and generates testable predictions to validate the measure. We implement the empirical implications and find strong supporting evidence that high accounting reporting quality is significantly positively reflected in price.

Our analysis is premised on the observation that measurement errors are inevitable in accounting reports, because of the inherent uncertainty with respect to the underlying economic constructs, and the limitation of accounting principles and management estimates to accurately reflect and measure the these constructs.[3] It is motivated by the debate about how to evaluate and therefore improve the quality of accounting reports for valuation purpose. While many agree that the quality of accounting reports is high when they contain fewer errors in both balance sheet and income statement, different opinions exist on which one takes priority. Standard setters (FASB and IASB) have adopted the balance sheet-based model, emphasizing accurate recognition and measurement of assets under the belief that assets represent firm decisions that generate future income and therefore is conceptually more fundamental and logically prior to income. On the other hand, proponents of the income statement-based approach criticize the balance sheet approach for introducing significant noise in accounting earnings, destroying earnings' valuation usefulness by reducing its forward-looking usefulness, as evidenced by the reduced earnings persistence over time (Dichev (2007)). Under the income

[1] That is, we abstract away from the steward role of accounting. As had long been noted in the literature (e.g., Gjestal (1982)) and recently emphasized in an insightful survey on earnings quality by Dechow, Ge, and Schrand (2010), the quality of information should be evaluated in a specific decision context. In this paper we focus on the role of accounting in communicating firm value, holding firm value constant.

[2] This means firms cannot credibly or feasibly communicate all aspects of their information to investors. Since there is no moral hazard or information asymmetry, allowing credible communication is assuming strong-form market efficiency.

[3] Our framework and analysis do not depend on the source of the inaccuracy, although our framework can be extended to allow richer modeling of managers' reporting decisions, a potential area that can be further explored in future research.

statement-based approach, high quality financial report should enhance earnings persistence, by better matching of expenses to revenues and by separating the impact of financing-type activities from operating type (Dichev (2007)).

Both approaches have intuitive appeals, and their policy implications are not necessarily in conflict with each other. For example, to the extent that expenses are expired assets, better recognition and measurement of expenses appears, at least on surface, equivalent to better measurement of assets. On the other hand, while fair value measurement of balance sheet items and the use of comprehensive incomes as the overall performance metric may make earnings more volatile and reduce its persistence/predictability, if such volatility is indicative of the riskiness of firms' investments, incorporating it into earnings should enhance investors' understanding of business fundamental and improve the valuation usefulness of accounting.

These issues are complex and difficult to analyze and quantify without an analytical model. We make a preliminary attempt in this paper. In our framework accounting reports perform an informational role in that investors use them to *make statistical inference* about key firm fundamentals, and to price firms according to their inference. In the traditional framework used by researchers to evaluate accounting's valuation usefulness (e.g., the residual income model), investors also need to estimate future earnings. However, their estimation is simplified by assuming earnings follow a statistical, time-series AR(1) process, with the coefficient (i.e., earnings persistent parameter) known by investors (Ohlson (1995)). In this framework, measurement errors in accounting assets and earnings do not matter as clearn surplus accounting ensures that such errors cancel out in the long run.

The traditional models (e.g., AR(1) structure) implicitly assume that investors value firms by viewing earnings as the output of a statistical process unaffected by human decision. We relax this assumption and instead assume investors view earnings as generated by firm investment and operation decisions.[4] As long as these decisions have future benefits, earnings would appear to be autocorrelated too in our framework.[5] When the likelihood of future benefits meets certain threshold, as deemed by accounting principles and management estimate, they are recognized and recorded as accounting assets.[6] While accounting assets may be noisy estimates of the assets' true future benefits, they

[4] Zhang (2000) also relaxes this assumption in that a model where positive (negative) earnings inform managers about the productivity of their investment decisions, which in turn affects firms' future decisions. He does not address how measurements of accounting assets and earnings affect investors' inference about managers' information.

[5] We return to this connection later to explain the conceptual difference between the AR(1) coefficient estimate of earnings persistence and the measure we develop in this paper.

[6] The long-term economic benefits are not exclusively generated from the long-term assets by accountants' classi-

nonetheless reflect firms' expectation about the future return of the assets. We assume that investors understand these features and therefore use the dollar amount of accounting assets to predict the dollar amount of future earnings, by applying an expected rate of return on assets, estimated from firms' past history of earnings and assets. While still a simplification of how investors process accounting information,[7] this assumption allows us to explicitly introduce measurement errors in both earnings and assets and to analyze how they affect investors' inference about firms' future profitability and risk.

We develop the measurement error-based framework in two steps. We start with a simple analytical structure to pin down firm value and to make explicit the informational inference role of accounting reporting system for investors' valuation use. The model is highly stylized and is not meant to capture the nuance of decision making within firms or strategic interactions among firms or between firms and investors. Rather, we use it to serve three primary purposes: (1) to delineate clearly the relations among various concepts: firm value, firm operating and investment decisions and the quality of information underlying these decisions, risk and uncertainty, accounting reporting quality, and investors' pricing of the firm; (2) to provide a theoretical structure to derive empirical construct, and specify empirical analyses; and perhaps most importantly, (3) to help interpret empirical results, specifically, to address the question of whether and when one can interpret the association between price and accounting quality measure as evidence of the effect of accounting measurement quality or of real business fundamentals.

In the model, the fundamental value of a firm is determined by the expected NPV of the set of operation and investment decisions the firm implements based on its information/belief about the expected return on these decisions.[8] When decisions are made under uncertainty, firm value can be uniquely pinned down with key parameters characterizing the firm's information: the expected rate of return on decisions and the uncertainty associated with the expectation. These are the "business fundamentals" that investors need to infer to value the firm.[9] Since accounting reports are the only source of credible and quantifiable information about firm decisions, rational investors will rely on

fication. Short-term accounts receviables can have long-term economic benefits if they help retain customers for the long-run.

[7] But perhaps not as much a simplification as it sounds: analyzing the relation between earnings and assets and assessing its over time pattern is essentially analyzing firms' ROA and its persistence, one of the key metrics and tools taught and used in financial statement analysis.

[8] Throughout the paper unless otherwise explicitly stated, we use investment, operating decisions, and decisions interchangably. We abstract from firms' financing decisions.

[9] This is similar to the residual income model where firm value can be fully pin down by the knowledging of four inputs: current book value, earnings, earnings persistence, and the (exogenously assumed) discount rate.

them to infer the fundamentals and price firms accordingly. As long as investors do not have full access to firm information at all times (i.e., no strong-form market efficiency) and cannot fully infer such information from firm decisions (a plausible assumption), the quality of accounting in measuring firm decisions will affect price.

To make concrete the concept of accounting quality, we next assume a perfect information system exists that can provide accurate measurements of firms' productive decisions (i.e., economic assets) and its associated economic income. Under the perfect information system, investors can use an OLS regression to obtain the best unbiased estimate of underlying expected rate of return on firms' investment (i.e., one of the two firm fundamentals). Since the regression R-squared (R^2) is bounded above by 1 and approaches 1 when firms can generate enough reports from the same distribution, it provides a conceptually appropriate measure for the amount of information investors can learn from the (perfect) reporting system reports about firm fundamentals as it exhibits two properties of information: that information is unit-less and can be improved or even made perfect when more observations are available. In reality the number of reports is limited but nonetheless the R^2 measures the maximum amount of information available to investors given sample size. Furthermore, R^2 is increasing in the precision of firm information (the second component of firm fundamentals). This in turn predicts that investors would price firms higher when the regression R^2 from the perfect system is higher, because it suggests firm decisions are more likely made with more precise information which generate higher expected value.

We next introduce measurement errors to the perfect system to analyze whether and how they affect the biasedness of the estimated return on investments as well as the regression R^2. We find that the accounting system can potentially achieve the same quality as the perfect measurement system. The coefficient estimate stays unbiased if there is no measurement error in assets or if errors in earnings are correlated with errors in accounting assets in same way as the true underlying expected return. Also, when assets are measured with error, the regression R^2 provides an unbiased estimate for the true R^2 if accounting earnings and assets have the same signal-to-noise ratio in measuring their respective underlying constructs and if the slope coefficient is unbiased.

Several key institutional features in accrual accounting suggest that it is possible that the above conditions be met, despite the fact that accounting earnings and assets are noisy measures of their counterparts under the perfect system. First is the articulation between balance sheet measurement and income statement measurement in that errors in balance sheet flow into errors in income statements, and vice versa. This feature permits non-zero correlation between error terms. The second feature is the consistency principle in that the magnitude of the noise in income measurement and that in asset (balance sheet) measurement can be made such that signal-noisy ratio in balance sheet and income statement remains the same. The third is the permission of firms' own estimates which in theory can correct errors incurred from restrictive accounting standards.

The framework also allows us to distinguish the conceptual difference between the AR(1) measure of earnings persistence and the R^2 measure. We show that as long as assets have long-term benefits, the resulting earnings will exhibit AR(1) property. However, it measures the *level* of earnings predicted to occur assuming firms perform the same decisions they did in generating past earnings (because past earnings is the only regressor). In contrast, the R^2 measures the *likelihood* of obtaining the expected return on assets, conditional on all firm past decisions that have been deemed by firms as possessing future benefits. In statistical terms, the $AR(1)$ coefficient generates the predicted earnings (assuming firms do not take new decisions), whereas R^2 is related to the accuracy of the prediction when the prediction takes into account all firm decisions.

In summary, we draw three main empirical implications from the analytical framework: (1) the R^2 from regressing economic income on economic assets is a theoretically justifiable measure for the amount of information investors can obtain from a perfect reporting system; (2) the empirical R^2 based on accrual accounting counterparts, at least in theory, can be used as a proxy for the quality of information under a perfect system; and (3) the empirical R^2 contains different information content from the AR(1) coefficient. The first implication is not directly testable, and can only be jointly tested with the second implication. The last implication, however, can be tested on its own, although without the analytical framework, it is not clear how to interpret the results even if empirically they do indeed behave differently.

We test the empirical implications in the second part of our paper. To test the joint hypothesis that the ideal R^2 affects share prices and can be proxied by accounting R^2, we examine whether the accounting R^2 possesses the same empirical properties as those predicted by theory for the ideal R^2. Specifically, (1) the R^2 should vary positively with proxies for general uncertainty (both cross-sectional and over-time) because everything equal firm decision quality should be lower when they operate in more uncertain environment; (2) it should predict the persistence of past profitability: holding the level of past returns constant, those achieved under better decision quality are more *likely* to be repeated in the future; and (3) perhaps the most important one, it should be positively related to share price.

All these predictions are born out strongly in the data, which we discuss later in the paper. The effect of R^2 on investors' pricing of firm assets is significant not only statistically but also economically:

the estimate suggests that an inter-quartile increase of R^2 is associated with a 33% higher marginal pricing (from \$0.31 to \$0.41) for the average firm's noncash assets, whereas a one-standard deviation of R^2 is associated with about 7% change in the average pricing of firm assets. The results are robust to alternative estimation methods (e.g., portfolio approach and Fama-MacBeth), and to inclusion of controls for uncertainty in firms' operation environment and business fundamentals.

Our analytical structure identifies error correlations in accrual accounting as the key for accrual R^2 to be able to proxy for the true R^2. As a pseudo test, we obtain a cash-based R^2 from regressing cash flows from operations on accounting assets. We find that the cash flows-based R^2 positively and significantly affects the market valuation of assets when included on its own, but the significance disappears when the earnings-based R^2 is included. In contrast, the significance and magnitude of the earnings-based R^2 are little changed regardless of whether the cash flows-based R^2 is included. When we partition the sample by the accrual quality measure (Dechow and Dichev (2002)), we find that the cash flows-based R^2 is positive and statistically significant only in the high accrual quality subsample and not in the low accrual quality subsample, whereas the earnings-based R^2 remains significant in both subsamples. These results raise questions about whether the accrual quality measure is measuring the quality of accrual or the quality of cash flows.

Lastly, we examine whether the accounting R^2 captures *empirically* different information content than other existing measures of accounting quality. We include in the main regressions the set of accounting earnings attributes/qualities used in the literature, including the AR(1) coefficient (earnings persistence), accrual quality, earnings smoothness, earnings predictability, value relevance, timeliness, and conservatism. We do not find any of these alternative measures to be statistically related to the marginal value of firm assets, and only earnings predictability and smoothness are positively related to the average value of assets. More importantly, the coefficient estimates for R^2 remain significant with the magnitudes little changed regardless of which alternative measure is included.

We view our main contribution to the literature as a methodological one, in that we develop a measure to quantify the quality of firms' accounting reporting system. We establish the measure's validity both analytically and empirically. The analytical framework identifies conditions under which reporting quality should matter for investors' pricing. It offers guidance to construct a measure of information, to empirically validate the measure, and to interpret the results. In doing so, it helps address the long-standing vexing question of "is it fundamental or is it accounting". It shows that these two are often inherently the same thing, except that without accounting, the "fundamentals" cannot be captured. In addition, it also helps clarify the notion of earnings persistence as embedded in the AR(1) estimate. We view the empirical analyses in the paper as further evidence to support the potential usefulness of the framework and the methodology implied by the framework.

Circling back to the opening paragraphs of the introduction, the ultimate purpose of our analyses is to provide a framework and methodology to help assess the effects of measurement errors in accounting and in doing so help shed light on the debate on how to improve accounting reporting quality. Specifically, our framework suggests that the debate can focus on three key elements in accounting measurement properties: (1) the degree of correlation between balance sheet and income statement; (2) the amount of noise in income statement; and (3) the amount of noise in balance sheet. We show that the R^2 is in theory a summary measure for the overall impact of the above three elements. Our evidence supports its *empirical* importance. Therefore, our analyses set up a starting point for future research to explore the relative impact of each of the three elements, and to assess how different accounting methods and principles affect them.

Ultimately the usefulness of our framework depends on how tenuous its assumptions are. As noted earlier, our analysis are based on three key assumptions: (1) market is not strong-form efficient; (2) the richness and subtlety of the information underlying firm decisions cannot be fully communicated via accounting reports; and (3) there are no agency issues involved. The first two assumptions are quite related: if the second assumption fails, it means strong-form efficiency can be achieved by accounting. The third assumption is the most restrictive and most likely untrue in reality. We do not want to rely on the argument that this assumption is also maintained in most previous valuation studies, as prior studies have documented a large body of evidence suggesting agency issue clearly affects reporting quality. It is unclear to us, however, how and to what extent the validity of the R^2 measure (estimated over 10-years) and its strong association with price is affected by various agency issues. It is important to explore in future work, and we believe our framework and methodology have the potential to help researchers develop theories that can be tested based on accounting data.

2 Information quality, investment quality, and firm value

2.1 Determinant of firm value

Consider a firm i whose operations in a given period τ entails taking a set of actions D_τ to implement the investment opportunity available to the firm. The investment opportunity generates a total net cash flows of C_τ, given by

$$\max_{D_\tau} E\left(C_\tau^{\tau'}|\Omega_\tau^F\right) = E\left(2\widetilde{\theta}_\tau D_\tau - D_\tau^2 + \widetilde{\varepsilon}_\tau|\Omega_\tau^F\right) \tag{1}$$

where $\widetilde{\theta}_\tau$ captures the marginal return for the investment opportunities, $\widetilde{\varepsilon}_\tau$ is the exogenous cash flow shock which we assume to be independent of $\widetilde{\theta}_\tau$ with zero mean and finite variance, and Ω_τ^F represents the firm's information set prior to taking the decision. D_τ represent the set of decisions the firm takes to implement the project, including operation, investment, and financing activities. τ represents the length of the investment opportunity, or equivalently, the length of the firm's product life cycle, which can span multiple calendar years. For simplicity, we assume the total costs of these actions in dollar terms to be D_τ^2, with the total revenue given by $2\widetilde{\theta}_\tau D_\tau$. The superscript $\tau' \geq \tau$ denotes the period when both $\widetilde{\theta}_\tau$ and $\widetilde{\varepsilon}_\tau$ are fully realized. Thus $\tau' > \tau$ represents cases where there exists lags between the cash flow realization period and the decision period.

We assume $\widetilde{\theta}_\tau$ is randomly drawn from a distribution $N\left(\overline{\theta}_\tau, \sigma_{G\tau}^2\right)$ with $\overline{\theta}_\tau$ and $\sigma_{G\tau}^2$ commonly known to both investors and firm managers. $\overline{\theta}_\tau$ represents the average marginal return for a firm's investment opportunities. $\sigma_{G\tau}^2$ represents the firm's growth opportunities in that when $\sigma_{G\tau}^2 = 0$, the firm will not have any chance to obtain opportunities with marginal return higher than $\overline{\theta}_\tau$. On the other hand, when $\sigma_{G\tau}^2$ is large enough, the firm may be given an opportunity with high marginal returns.

We assume that prior to the decision, the firm observes private, noisy information about $\widetilde{\theta}_\tau$, $s_\tau = \widetilde{\theta}_\tau + \widetilde{\delta}_\tau$ with $\delta_\tau \sim N\left(0, \sigma_{\delta\tau}^2\right)$ and independent from $\widetilde{\theta}_\tau$. Thus, the firm's posterior about $\widetilde{\theta}_\tau$ is distributed normal with mean $\theta_{F\tau}$ and variance $\sigma_{F\tau}^2$ given by

$$\theta_{F\tau} = E\left(\widetilde{\theta}_\tau|\Omega_\tau^F\right) = R_\tau^2 s_\tau + \left(1 - R_\tau^2\right)\overline{\theta}_\tau \tag{2}$$

$$\text{and } \sigma_{F\tau}^2 = Var\left(\widetilde{\theta}_\tau|\Omega_\tau^F\right) = \frac{\sigma_{G\tau}^2\sigma_{\delta\tau}^2}{\sigma_{\delta\tau}^2 + \sigma_{G\tau}^2} \equiv \sigma_{G\tau}^2\left(1 - R_\tau^2\right), \tag{3}$$

where

$$R_\tau^2 \equiv \frac{\sigma_{G\tau}^2}{\sigma_{\delta\tau}^2 + \sigma_{G\tau}^2} = \frac{\sigma_{G\tau}^2 - \sigma_{F\tau}^2}{\sigma_{G\tau}^2} \tag{4}$$

measures the amount of uncertainty reduction from the firm's private information. $R_\tau^2 = 0$ means no uncertainty is reduced, which happens when the firm's private information is complete noise (i.e., $\sigma_{\delta\tau}^2 = \infty$). On the other hand, all uncertainty is resolved when $R_\tau^2 = 1$, which takes place when managers know perfectly the return on their decisions (i.e., $\sigma_{\delta\tau}^2 = 0$). Both s_τ and $\sigma_{\delta\tau}^2$ (and hence R_τ^2) are the firm's private information and cannot be directly commuicated to outside investors.

The firm's optimal decision based on its information is $D^*_\tau = E\left(\widetilde{\theta}_\tau|\Omega^F_\tau\right) = \theta_{F\tau}$. Conditional on D^*_τ, the firm's expected cash flows is $\theta^2_{F\tau}$, where the expectation is taken with respect to the random cash flow shock $\widetilde{\varepsilon}_\tau$. Assume similar process is repeated for all future periods $T > \tau$. The firm's expected cash flows from future periods is given by

$$E_t\left(C_T\left(D^*_T\right)\right) = E_t\left(\theta^2_{F,T}\right) = \overline{\theta}^2_T + \sigma^2_{GT} - \sigma^2_{FT} = \overline{\theta}^2_T + \sigma^2_{GT}R^2_T. \tag{5}$$

While highly stylized, (5) identifies three determinants for firm value from an ex ante perspective (i.e., before any action is taken): it is higher when the average expected return on firm investments ($\overline{\theta}_T$) is high, when firms' investment opportunity set (σ^2_{GT}) is large, and when the information quality underlying firms' decision (R^2_T) is high. While $\overline{\theta}_T$ and σ^2_{GT} may be determined by macro-economic conditions and the specific industry the firm operates in, R^2_T is assumed to be a firm-specific characteristics.

When $R^2_T < 1$, we say firm value embeds a discount for decision risk, in that firm make investment decisions under uncertainty (i.e., $\sigma^2_{FT} > 0$). Decision under uncertainty means potential mistake and lower expected payoffs. Better information quality by firms reduces such mistake and leads to higher expected cash flows. This is the classic result from decision usefulness of information (Blackwell (1953)). However, notice that the discount for decision risk is a numerator effect and directly affects the firm's future cash flows. It may or may not affect the discount rate that investors use to discount future cash flows (i.e., the denominator), which is in theory dependent on the correlation between firms' future cash flows and systematic risk factors. This distinction is important as our empirical analysis is designed to detect the numerator effect of the decision risk. We say investors' pricing of the firm will not be correct unless investors can accurately assess the magnitude of the decision risk.[10] In the next subsection, we discuss how accounting information can help investors learn and assess firms' future cash flows.

2.2 Assessing the quality of reporting system

For our purpose, it is useful to separate a firm's expected future cash flows into two components: the first component consists of cash flows incurred but not realized, the expectation of which is $\theta^2_{F,\tau}$, which

[10] We assume the firm decision risk (σ_F) and the discount rate risk (i.e., the risk due to the correlation between firms' future cash flows and systematic risk factors) are not related, although this assumption works against us showing our result. Recent theoretical work by Ai (2010) shows that in a general equilibrium model when production risk is considered (that decision is made under uncertainty), better information quality (i.e., lower σ_F) leads to lower risk premium, which would futher result in higher value.

depends on the firm's private information s_τ and R_τ^2 as in (2). The second component consists of cash flows from actions that firms have yet to undertake, the expectation of which is given by (5). [11]

To accurately assess the first component, investors need to know the firm's private information about s_τ and R_τ^2. We assume that the firm cannot credibly communicate such information directly without relying on verifiable information derived from actions they have taken. The role of accounting reporting is to provide verifiable, quantified measures based on past transactions to enable investors infer the firm's private information accurately. The objective in our paper is to evaluate the ability of the accrual accounting system as observed in practice in performing this role.

Towards this objective, in what follows, we first define a hypothetical, perfect system $\{x_t, K_t|D_\tau\}_{t=1,...,N_\tau}$ as one where for each reporting period $t = 1, ..., N_\tau$ within the decision period τ, the system provides a measurement of the firm's capital stock (K_{t-1}) at the beginning of the period and a measurement of income x_t generated during the period such that investors can estimate $\theta_{F\tau}$ and R_τ^2 by performing an OLS regression of x_t on K_{t-1}, given below

$$x_t = \alpha_0 + \theta K_{t-1} + \upsilon_t. \tag{6}$$

Let $\widehat{\theta}_{xK}$ be the OLS estimate from the above regression, and $\widehat{R}_{xK}^2$ be the regression R-squared. We say that the system is informative if it satisfies the following two conditions:

$$\begin{aligned} (A1) &\quad : \quad E\left(\widehat{\theta}_{xK}\right) = \theta_{F\tau}; \\ (A2) &\quad : \quad E\left(\widehat{R}_{xK}^2\right) = R_\tau^2. \end{aligned}$$

Clearly, a system that satisfies (A1) and (A2) would help investors accurately assess the cash flow consequences of firms' past actions. What is left unspecified is how to design such a system. This is a more complicated matter and lies outside the scope of this paper. As will be clear soon, the purpose of specifying this system is to provide a benchmark to evaluate the observed accounting system.

We now introduce the observed accounting system. Specifically, we assume that x_t is measured with noise by accounting earnings e_t and K_{t-1} is measured with noise by the accounting assets A_{t-1}, per the following structure:

$$e_t = x_t + \varepsilon_{e,t}, \text{ with } E(\varepsilon_{e,t}) = 0 \text{ and } Var(\varepsilon_{e,t}) = \sigma_e^2 \tag{7}$$

$$A_{t-1} = K_{t-1} + \varepsilon_{A,t-1}, \text{ with } E(\varepsilon_{A,t-1}) = 0 \text{ and } Var(\varepsilon_{A,t-1}) = \sigma_A^2 \tag{8}$$

[11] Thus, at any point in time, investors would price a firm based on (a) their perception about the firm's future investment opportunities, as parameterized by $\overline{\theta}_T^2$ and $\sigma_{G,T}^2$, (2) their perception about the firm's ability to implement such opportunities, as parameterized by R_T^2, and (3) their information about the cash flow consequences of the firm's past actions (i.e., D_t), as parameterized by $\theta_{F,t}^2$.

The assumption of zero mean errors is not crucial, as any nonzero known bias will be captured in the intercept estimate. And because we are interested in the information inference role of accounting (not the use of actual accounting dollar amount to compute the dollar amount of firm value), the assumption that the coefficients in front of x_t and K_{t-1} are both 1 is also not crucial. For example, if in reality $e_t = ax_t + \varepsilon_{e,t}$, we can define $e'_t = e_t/a$ as our earnings, and express $e'_t = x_t + \varepsilon_{e,t}/a$.

To capture the fact that measurement errors are not related to any part of the optimal system, we assume $Corr\left(x_t, \varepsilon_{e,t}\right) = 0$ and $Corr\left(K_{t-1}, \varepsilon_{A,t-1}\right) = 0$. We also assume that $Corr\left(K_{t-1}, \varepsilon_{e,t}\right) = Corr\left(x_t, \varepsilon_{A,t-1}\right) = 0$. This is nothing but a restatement of the fact that x_t and K_{t-1} are the measures under the perfect information system: all information about θ should be captured by observing x_t and K_{t-1} alone. We impose no restrictions on the time-series property of $\varepsilon_{e,t}$, $\varepsilon_{A,t-1}$, or their correlation with each other. In fact, as will be shown shortly, the correlation between errors is a key determinant for the value of accrual accounting.

Let $\widehat{\theta}_{e,A}$ be the coefficient estimate and R^2_{eA} as the R-squared from the following regression:

$$e_t = \beta_0 + \theta A_{t-1} + \eta_t.$$

Given that the best estimate should be obtained by regressing x_t and K_{t-1} via (**??**), the above regression is equivalent to estimating

$$x_t = \theta A_{t-1} + \upsilon_t + \varepsilon_{e,t} - \theta\varepsilon_{A,t-1} \tag{9}$$

It is easy to show the following results:

$$\widehat{\theta}_{e,A} = \widehat{\theta}_{x,K} + \left(\widehat{\theta}_{accrual} - \widehat{\theta}_{x,K}\right)\left(1 - R_{A,K}\right) \tag{10}$$

$$R^2_{e,A} = R^2_{xK}\left(\frac{\widehat{\theta}_{e,A}}{\widehat{\theta}_{x,K}}\right)^2 \frac{R_{e,x}}{R_{A,K}} \tag{11}$$

where $\widehat{\theta}_{x,K}$ is the true (best) estimate from having the perfect system. $\widehat{\theta}_{accrual}$ is the slope coefficient estimate from a regression of $\varepsilon_{e,t}$ on $\varepsilon_{A,t-1}$. $R_{AK} = 1 - \frac{Var\left(\varepsilon_{A,t-1}\right)}{Var\left(A_{t-1}\right)}$ is the R-squared from a regression of A_{t-1} on K_{t-1} and $R_{e,x}$ is the R-squared from a hypothetical regression of e_t on x_t. $\widehat{\theta}_{accrual}$, R_{AK}, and $R_{e,x}$ are not directly observable empirically. Nonetheless, they identify how different aspects of accounting measurement errors may affect the information usefulness of accounting reports.

Specifically, (10) shows that the accounting earnings and assets can provide unbiased estimate for the true expected rate of return if either the accruals are done in such a way that mimics a perfect system, i.e., $E\left(\widehat{\theta}_{accrual}\right) = \theta_{F\tau}$, or if variations in accounting assets perfectly capture variations in underlying economic assets (i.e., $R_{A,K} = 1$). The first condition $E\left(\widehat{\theta}_{accrual}\right) = \theta_{F\tau}$ highlights the argument underlying the income statement approach: better matching of expenses (even if it is at the expense of introducing noise into asset measurement or income measurement) can potentially achieve unbiased estimate of the true. On the other hand, the second condition is consistent with the argument underlying FASB's balance sheet approach: if accounting assets can be measured such that they mimic the movements in underlying economic assets, then the accounting system will also provide an unbiased estimate of the true profitability.

(11) shows that unbiasedness in the coefficient estimate alone is neither a sufficient or a necessary condition to enable accounting system to achieve same amount of information uncertainty reduction as that under the perfect system. Conditional on unbiased estimate (i.e., $\widehat{\theta}_{e,A} = \widehat{\theta}_{x,K}$), the accounting $R^2_{e,A}$ can result in the perfect R-squared ($R^2_{x,K}$) only if the signal to noise ratio (as captured by $R_{e,x}$ and R_{AK}) in earnings measurement and in asset measurement is the same.

The above statements are normative in nature. For the rest of analysis, we focus on the positive implications of our analysis so far. Essentially, (11) shows that as long as $\left(\frac{\widehat{\theta}_{e,A}}{\widehat{\theta}_{x,K}}\right)\frac{R_{e,x}}{R_{A,K}} = 1$, $R^2_{e,A}$ is an unbiased estimate for $R^2_{x,K}$. Ex ante, we have no prior about whether $\left(\frac{\widehat{\theta}_{e,A}}{\widehat{\theta}_{x,K}}\right)\frac{R_{e,x}}{R_{A,K}} = 1$ for the average firm in the US over the last several decades. Thus, we take the agnostic view that cross-sectionally, $R^2_{e,A}$ can be viewed as a noisy but unbiased estimate for true $R^2_{x,K}$. That is, $R^2_{e,A}$ quantifies the maximum amount of information communicated via accounting system. Regardless of whether $R^2_{e,A}$ is an unbiased estimate of $R^2_{x,K}$, if investors obtain information from accounting assets and earnings in ways similar to what the OLS regression represents, $R^2_{e,A}$ is still a theoretical proxy for the amount of uncertainty reduction provided by the accounting numbers. Whether it affects pricing is therefore an empirical question that we address in the remaining of the paper. We summarize this in the following hypothesis:

H1: If accounting-based R^2_{eA} is a reasonable proxy for R^2_{xK}, then it would be lower for firms operating in more uncertain environment; it should assist in predicting the persistence of firms' return on assets; and it should be positively correlated with firm price.

3 Empirical measure and properties

3.1 Sample and empirical measure

We test the model's predictions using a large sample of U.S. firms from 1960-2010. We we on the R-squared (R^2) from a firm-specific linear regression of operating earnings on one-year lagged net accounting operating assets over the 10-year period preceding the year of valuation.

both measured in dollar terms, because the dollar amount of accounting assets embeds firms' most up-to-date information about the amount of past investments that are expected to continue to generate future benefits, and the dollar amount of accounting earnings embeds firms' information about the likelihood of benefits being realized. We obtain the estimate for R^2 by estimating the following firm-specific regression:

$$NOPAT_{it} = a_{0i} + a_{1i} \cdot NOA_{it-1} + \epsilon_{it} \tag{12}$$

where $NOPAT_{it}$ is the net operating earnings after tax ($NOPAT$) for firm i during year t, calculated as the after-tax amount of operating earnings (calculated as EBIT*(1-TXT/PI), where EBIT, TXT and PI are variable names used in Compustat)[12] and NOA_{it-1} is the net operating assets for firm i at the beginning of year t, calculated as the sum of shareholders' equity and interest-bearing debt (short-, long-term debt and capital lease obligations), minus cash assets.[13] For each firm-year, we estimate equation (12) over the preceding 10 years of observations for this firm. Since the regression is estimated on the firm-level, and because we are interested in the information conveyed by firm operating and investment decisions as reflected in the dollar amount of assets they recognize in financial reports, we include both $NOPAT_{it}$ and NOA_{it-1} in dollar terms unscaled.[14] Thus, the slope coefficient $\widehat{a_{1i}}$ provides an estimate of a firm's average accounting return on assets in the past 10 years, a standard measure of firm performance that investors use to gauge productivity.

We begin our analysis by estimating equation (12) for all non-financial (SIC code: 6000-6999) and non-utility (SIC code: 4900-4999) firms in Compustat from 1960 to 2010. Equation (12) is estimated for each firm i in year t using data in the preceding ten years (i.e., $t-9$ to t). We require at least five observations in each estimation to obtain a meaningful estimate of R^2. By design, this R^2 is firm-year

[12] According to Compustat manual, EBIT is defined and calculated as sum of Sales - Net (SALE) minus Cost of Goods Sold (COGS) minus Selling, General & Administrative Expense (XSGA) minus Depreciation/Amortization (DP).

[13] The corresponding Compustat variables are SEQ-CHE+DLC+DLTT.

[14] Scaling by any other variables will introduce noise for our purpose. For example, if scaled by the number of shares outstanding, the coefficient will be incorporate both the information from operation decisions and information from changes in shares outstanding (which is a financing decision).

specific and is indexed throughout the paper by subscripts i and t. The final sample for the main analysis of market valuation consists of 85,652 firm-year observations from 1970 to 2010.

3.2 Summary description

Table 1, Panel A provides summary statistics for the estimated R^2 and $\widehat{a_1}$ (i.e., the estimate for return on assets, ROA) for each of the 48 industries in Fama and French (1997). It shows that the R^2 exhibits both significant cross-industry and within-industry variation. The tobacco products industry has the highest average (median) R^2 at 57.0% (64.5%), followed by alcohol (beer and liquor) with an industry average (median) at 55.5% (63.3%). Coal mining has the lowest average (median) R^2 at 24.2% (16.1%), preceded by steel products (average at 28.6% and median at 19.6%). Interestingly, these are also the industries with the respective highest and lowest within-industry standard deviations, with 35.4% for the tobacco industry and 24.2% for the coal industry. Other consumer industries also exhibit high R^2s, including, for example, the retail and restaurant industries. In contrast, industrial product industries such as the shipping and defense industries tend to have low R^2s. To the extent industrial product industries are more cyclical than consumer industries, these patterns are consistent with the interpretation that the amount of information one can learn from past history is affected by business models and operating environments.

Table 1, Panel A also lists the average estimate of ROA for each industry. The precious metals industry has the lowest average ROA at -7%, followed by fabricated products (e.g., metal forging and stamping) at -3.4%. By contrast, the tobacco industry leads with the highest ROA of 16.1%, followed by the soft drink industry at 11.5%. These results show that while ROA and R^2 are correlated (by design), they have different information content. Whereas ROA provides the estimated mean of return on assets, R^2 estimates the amount of uncertainty reduction provided by accounting reports about firms' decision quality.

Table 1, Panel B presents the summary statistics for all the main variables used in the analysis. The sample average R^2 is 37.9% with a standard deviation of 31.6%. To isolate the effect of industry membership, we calculate a firm-specific R-squared (R^2_{Firm}) defined as the difference between R^2_{it} and the median of R^2 for all firms in the same Fama-French 48-industry in that year (denoted as $R^2_{Industry}$). By construction, the average $R^2_{Industry}$ is close to the average R^2 whereas the average R^2_{Firm} is relatively small (the median is close to 0). However, the cross-sectional variations of R^2 are mostly driven by firm-specific R^2_{Firm} and not their industry component: the standard deviation for R^2_{Firm} is more than twice of that for $R^2_{Industry}$ (30.7% vs. 14.1%).

3.3 Correlation with measures of uncertainty

If R^2 measures the amount of uncertainty faced by firms when making decisions, then R^2 should be negatively correlated with measures of decision uncertainty. We examine this property in Table 2 by presenting the correlation between the three R^2 measures and measures of business fundamentals, especially measures of uncertainty. We focus on measures of uncertainty, specifically, firm size (*Size*, measured in logarithm of total assets), profitability (measured ROA, i.e., the estimated $\widehat{a_1}$ coefficient from (12)),[15] earnings persistence ($Persistence$, estimated as the AR(1) coefficient from a firm-specific time-series autoregression of earnings per share in the rolling window of 10 years preceding year t), sales volatility ($Std(Sales)$, defined as the standard deviation of sales scaled by total assets in the rolling window of 10 years preceding year t), ROA volatility ($Std(ROA)$, defined as the standard deviation of the ratio of operating earnings to assets in the rolling window of 10 years preceding year t), the stock return's correlation with the market (*Beta*, estimated as the CAPM beta using monthly returns in the rolling window of 10 years preceding year t) and idiosyncratic return volatility (*Sigma*, defined as the standard deviation of CAPM model residuals).

Panel A of Table 2 presents the univariate correlations. Consistent with the observation that cross-sectional variation in the unadjusted R^2 is mostly driven by firm-specific R^2_{Firm}, the correlation between these two measures is 0.9. In contrast, the Pearson (Spearman) correlation between R^2 and $R^2_{Industry}$ is 0.27 (0.25). All three R^2 measures are positively correlated with measures of firm fundamentals in predicted ways. For example, they are positively correlated with firm size (except $R^2_{industry}$) and ROA, and negatively correlated with various measures of volatility. Lastly, Table 2 shows that both R^2 and R^2_{Firm} are positively significantly related to the measure of average asset value (Q, Tobin's Q, defined as the sum of market value of equity, liquidation value of preferred equity and book value of total liabilities scaled by total assets), consistent with our basic hypothesis. We will formally test and examine this in the next section.

Panel B of Table 2 presents results from a multiple regression of R^2 and R^2_{Firm} on firm fundamentals. We find that the relation between R^2 and these characteristics remain qualitatively the same (in significance level and in sign) as in univariate correlations, with and without including firm-specific fixed effects. However, the explanatory power of the regression is much higher (larger than 40%) with firm-fixed effects than without (at about 8% to 11%), suggesting that a large portion of the variation in R^2 is driven by unobserved firm-specific effects. To the extent that the decision quality is a func-

[15] Results are qualitatively unchanged if we measure ROA with the over time average of $NOPAT/NOA$.

tion of firm-specific factors (internal organization efficiency, governance, culture, etc.) and is fairly stable over time (conditional on changes in fundamentals), this is consistent with the interpretation that *cross-sectional* variations in the R^2 measure (especially R^2_{Firm}) are driven by differences in firms' decision quality (which is reflected in its external accounting reports).

3.4 Predict performance persistence

The analytical framework predicts that R^2 should be able to predict the persistence of firms' current performance. The idea is that decisions made with high information quality is more to result in expected return and less surprise. In other words, higher R^2 means that the past profitability level is more likely to be repeated in the future.

To empirically validate this assumption, we perform a retention rate analysis. Specifically, for each year t, we first independently sort firms into quartiles based on $R^2(R^2_{Firm})$ and their realized return on assets (ROA) ratio. For each R^2 quartile, we then calculate the percentage of firms remaining in the same ROA quartile in years $t+1$, $t+2$ and $t+5$ (i.e., the retention rate). We repeat the same calculation each year and present the average retention rate in Table 3, Panel A. The left panel sorts firms by the R^2 and the right panel sorts by the firm specific R^2_{Firm}. Since the results are qualitatively similar, we discuss those with the R^2 only.

Overall, the results show that conditional on the realized ROA levels, the retention rates are higher among the subsamples with higher R^2. For example, the 1-year retention rate for firms with lowest R^2 staying in the lowest ROA quartile is 56.5%, indicating that on average, among 56.5% of the firms with lowest R^2 and lowest ROA stay in the lowest ROA quartile next year. More importantly, the retention rate increases monotonically as we move down the same ROA column to higher R^2 quartiles. In particular, 83.3% of the firms with the highest R^2 remain in the lowest ROA quartile next year. Similar results are observed for other ROA quartiles, consistent with our hypothesis that past productivity information is more informative about future productivity in firms with high R^2. The 2-year (5-year) retention rates are generally lower than the 1-year retention rate, consistent with the idea that forecast accuracy deteriorates as the forecasting horizon lengthens. Regardless, higher R^2 subsamples on average have higher retention rates across all ROA levels.

Panel B of Table 3 presents the regression result supporting the prediction that R^2 helps predict performance as measured by ROA. Specifically, each year, we perform a cross-sectional regression of ROA_{t+1} on ROA_t with ROA_t interacted with R^2 (and other previously identified proxies for earnings persistence, e.g., the amount of accrual $Abs(Accruals)$ (Sloan (1996), and dividend (Skinner (2008))).

Reported are the Fama-MacBeth estimate of the coefficient. Column (1) shows that while for a firm with $R^2 = 0$, no dividend, and no accruals, the level of persistence is 0.68. This level is significantly higher when R^2 is higher: the coefficient on $R2 * ROA$ is 0.191 (t-stat=5.41). It also shows that the persistence is lower when it contains more accruals and higher for dividend paying firms: the coefficient estimate for $ROA * Abs(Accruals)$ is negative at -0.493 (t-stat=3.76)) and that for $ROA * Dividend$ is 0.183 (t-stat=5.83). We postpone the discussion for Columns (2) to (5) to later section.

4 Effect on market value of assets

The last main prediction from the theory, in our view the most substantial one, is that R^2 should be positively correlated with the market value of firms' assets. We test these predictions using two specifications: the first examines the effect of R^2 on the marginal value of firm assets and the second examines the effect on the average value of firm assets.

4.1 Effect on marginal value of assets

4.1.1 Empirical specification

For the marginal value specification, we estimate the following equation

$$R_{i,t} - R^b_{i,t} = \alpha_t + \beta_0 \Delta NA_{it} + \beta_1 R^2_{it} \cdot \Delta NA_{it} + \lambda_0 \Delta Cash_{it} + \lambda_1 R^2_{it} \cdot \Delta Cash_{it} + Control_{it} + \varepsilon_{it}. \quad (13)$$

where the dependent variable $R_{i,t} - R^b_{i,t}$ is the compounded size and book-to-market adjusted realized returns (Fama and French (1993)) during fiscal year t, ΔNA_{it} ($\Delta Cash_{it}$) is the change in firm i's non-cash (cash) assets during year t, α_t is the year-fixed effect, and $Control_{it}$ is a set of control variables, all scaled by the market value at the beginning of year t. The main hypothesis predicts $\widehat{\beta}_1 > 0$.

As discussed in Faulkender and Wang (2006), equation (13) is specified from an identity that expresses the market valuation of assets as a multiple of the replacement costs of firm assets. It allows the value of assets to depend on the type and nature of assets (e.g., cash vs. noncash assets) by decomposing a firm's assets into different categories, including cash and non-cash assets, liabilities, and book value of equity. Because equation (13) regresses changes in firm values on changes in assets, the coefficient estimates on assets can be interpreted as the marginal value of firm assets. Faulkender and Wang (2006) find that the marginal value of cash is close to \$1 for the average U.S. firm, consistent with the theoretical prediction. For our purpose, we separate cash from noncash assets both to facilitate comparison with the estimates reported in Faulkender and Wang (2006) to gauge how reasonable our results are, and more importantly, to account for the differences between cash and noncash assets in terms of their liquidity, firm-specificity (how unique assets are to firm-specific operations), and accounting measurement attributes.[16]

We include the same set of control variables as those in Faulkender and Wang (2006), including year fixed effects (α_t); ΔE_{it}, the change in earnings before extraordinary items in year t; ΔRD_{it}, the change in research and development expense in year t; ΔInt_{it}, the change in interest expense in year t; ΔDiv_{it}, the change in common dividends paid in year t, and $Leverage_{i,t-1}$, the market leverage at the end of year $t-1$ defined as total debt divided by the sum of total debt and the market value of equity. Faulkender and Wang (2006) include interactive terms of $Cash_{it-1} \cdot \Delta Cash_{it}$ and $Leverage_{it-1} \cdot \Delta Cash_{it}$ to control for the effects of cash balance and leverage on the marginal value of cash. Following the same logic, we include $NA_{it-1} \cdot \Delta NA_{it}$ and $Leverage_{it-1} \cdot \Delta NA_{it}$ where NA_{it-1} is the logarithm of net assets in year t-1. In addition, where R^2_{it}, $Cash_{it-1}$, NA_{it-1} and $Leverage_{it-1}$ are included to ensure that their interactive terms with changes in assets are not capturing the main effects. Expression (14) summarizes these control variables:

$$\begin{aligned} Control_{it} = \{ & \alpha_t, NA_{it-1} \cdot \Delta NA_{it}, Leverage_{it-1} \cdot \Delta NA_{it}, Cash_{it-1} \cdot \Delta Cash_{it}, \\ & Leverage_{it-1} \cdot \Delta Cash_{it}, R^2_{it}, NA_{it-1}, Cash_{it-1}, Leverage_{it-1}, \\ & \Delta E_{it}, \Delta RD_{it}, \Delta Int_{it}, \Delta Div_{it}, NF_{it}\} \end{aligned} \tag{14}$$

To facilitate interpretation, for all interactive control variables, we use the demeaned values when they are interacted with either ΔNA_{it} or $\Delta Cash_{it}$, where the demeaned values are calculated as the difference between the variables and their sample averages. This way, the coefficient estimate $\widehat{\lambda}_0$ is directly interpretable as the market valuation of cash assets for an average firm with all characteristics at sample average values. $\widehat{\beta}_0$ is the estimated marginal value of noncash assets for a hypothetical firm with average characteristics but whose accounting assets and earnings provide no information (i.e., $R^2 = 0$) about its decision quality , whereas $\widehat{\beta}_0 + \widehat{\beta}_1$ estimate the marginal value of noncash assets for a firm with average characteristics whose accounting assets and earnings perfectly reveal its decision quality ($R^2 = 1$). Throughout the paper, all standard errors are two-way clustered by both firm and year (Petersen (2009)).

[16] We follow Faulkender and Wang (2006) and define cash assets as the sum of cash and marketable securities.

4.1.2 Main effects on marginal value of assets

Table 4, Panel A presents the results for estimating equation (13) with control variables specified by (14). Column (1) shows that the coefficient estimate for ΔNA is 0.296, suggesting that an additional dollar of noncash assets is valued at 29.6 cents by equity investors for a firm with $R^2 = 0$. One interpretation for the coefficient is that investors assign only 30% chance that this dollar investment turns out to be a positive NPV project. The coefficient on $R^2 \cdot \Delta NA$ is 0.175 and is statistically significant at less than the 1% level, consistent with the main hypothesis that investors value firm assets higher when accounting measurements of assets and earnings reveal that firm decision quality is high. The economic magnitude is significant: an inter-quartile increase of R^2 of 57.3% (from 8.2% at the twenty-five percentile to 65.5% at the seventy-five percentile value of R^2, see Table 1, Panel B) would increase the marginal value of noncash assets by more than 10 cents (=0.175*57.3%), more than a 25% increase relative to the marginal value of assets for a firm with sample median value of R^2 (at 39 cents, calculated as 0.296*1.31; the sample median for R^2 is 0.31).

Column (1) shows that on average, investors assign a marginal value of 99 cents to each dollar increase in cash.[17] This estimate is similar to that reported in Faulkender and Wang (2006) and is not statistically different from $1 at conventional levels, consistent with the theoretically predicted value of 1. The coefficient estimate on $R^2 * \Delta Cash$ is 0.162, suggesting that information about decision quality has weaker effect on investors' valuation of cash. This is as expected because after all, cash can be directly paid out to investors when needed.

Columns (2) to (4) decompose R^2 into R^2_{Firm} and $R^2_{industry}$ and estimate equation (13) with each of the components on its own as well as together. The idea is to assess whether the positive effect of R^2 on firm value is from industry-specific variations in R^2 (i.e., $R^2_{industry}$) or firm-specific variations (i.e., R^2_{firm}). The results show that the effect is driven by both components. The coefficient estimates for $R^2_{firm} \cdot \Delta NA$ and for $R^2_{industry} \cdot \Delta NA$ are both positive and statistically significant at less than the 1% level, when included on their own and when included together. The economic magnitudes of the estimates are both meaningful. In Column (4), $\widehat{\beta}_1 \left(R^2_{industry}\right) = 0.203$ suggests that everything else equal, a one-standard deviation increase in an industry's average R-squared $R^2_{industry}$ (about 14.1%) would increase the marginal value of assets for this industry by 2.8 cents, about 10% higher than the baseline value of 28.6 cents (i.e., the coefficient estimate for ΔNA_{it}). Similarly, $\widehat{\beta}_1 \left(R^2_{firm}\right) = 0.155$ suggests that a one-standard deviation increase in a firm-specific R^2_{firm} (about 0.307) would increase

[17] It is calculated as 0.927+0.162*0.378 where 0.927 is the coefficient estimate for $\Delta Cash$, 0.162 is the coefficient estimate for $R^2 * \Delta Cash$, and 0.379 is the sample average of the R^2.

the firm's marginal value of assets by 4.8 cents, higher than the effect of $R^2_{industry}$.

The coefficient estimates for the control variables are similar to those reported in Faulkender and Wang (2006). The coefficient on $Cash_{t-1} \cdot \Delta Cash$ is negative, suggesting diminishing marginal value of cash when a firm's cash position improves. The coefficient on $Leverage \cdot \Delta Cash$ is negative, consistent with the idea that as the leverage ratio becomes higher, some value of cash will accrue to debt holders. Similar decreasing marginal returns are also observed for noncash assets, as the coefficient estimates for $NA_{it-1} \cdot \Delta NA_{it}$ and for $Leverage_{i,t-1} \cdot \Delta NA_{it}$ are significantly negative at less than the 1% level.

4.1.3 Controlling for firm fundamentals

To further control for the effect of business fundamentals, Table 4, Panel B adds additional variables and their interactive terms with ΔNA_{it} to the baseline specification. As suggested by equation (**??**), we focus on control variables that capture cross-sectional differences in firm productivity and volatility. As such, we include firm performance as measured by return on assets (ROA), sales volatility ($Std(Sales)$), ROA volatility ($Std(ROA)$), earnings persistence ($Persistence$), CAPM Beta ($Beta$) and idiosyncratic return volatility ($Sigma$) as controls for firm fundamentals.

Panel B shows that throughout all columns, the coefficients on $R^2 \cdot \Delta NA$ remain positive and statistically significant. While the coefficient estimates are on average smaller than those reported in Panel A, the differences are small in magnitude. For example, the coefficient estimate for R^2 in Column (1) of Panel A is 0.175, compared with 0.173 in Column (1) of Panel B.

Panel B shows that the coefficients on $ROA \cdot \Delta NA$ are positive and statistically significant throughout, suggesting that investors assign higher marginal values to assets in firms with higher return on assets. The inclusion of ROA does not affect the significance of $\widehat{\beta}_1$, consistent with the idea that the R^2 captures the amount of information about decision quality, not the outcome of decision itself (i.e., profitability level). The coefficient on $Std(Sales) \cdot \Delta NA$ is negative in all columns, suggesting that assets are valued lower for firms with volatile sales. The volatility in ROA has no significant impact on the marginal value of assets, as the coefficient on $Std(ROA) \cdot \Delta NA$ is insignificant in all models. In summary, we conclude that findings in Table 3 are consistent with the hypothesis that investors value assets higher when firms' accounting measurement of assets and earnings provide more information about firm decision quality, and this relation holds after controlling for business fundamentals.

4.1.4 Robustness to alternative estimation methods

We also assess the sensitivity of the marginal value results to two alternative estimation methods. Due to space constraints, we do not tabulate the results and report the main findings in text.[18] We first re-estimate the specification in Panel B using the Fama-MacBeth (1973) method. The time-series averages of coefficient estimates and t-statistics from the 41 annual regression results (untabulated) are similar in magnitude to those reported in Panel B. For example, the coefficient estimate for $R^2 \cdot \Delta NA$ is 0.186 (t-statistic = 5.84). When we decompose R^2 into R^2_{Firm} and $R^2_{Industry}$, and include both $R^2_{Firm} \cdot \Delta NA$ and $R^2_{Industry} \cdot \Delta NA$ in the regressions, the estimates are 0.137 and 0.377, respectively and both statistically significant at less than the 1% level. The coefficients on other control variables and business fundamental variables are also similar to those reported in Table 3, Panel B.

To guard against the possibility that our results in Table 4 are driven by extreme values of the R^2 measures, we sort firm-year observations by R^2 into four quartiles and re-estimate equation (13) for each quartile without the interaction term between R^2 and ΔNA. The coefficient on ΔNA increases monotonically from the lowest R^2 quartile (0.296) to the highest R^2 quartile (0.444), consistent with the interpretation that the marginal value of firm assets increases as accounting measurements of assets and earnings provide more information about firms' decision quality.

4.2 Effect on average value of assets

We examine the relation between the average value of firm assets and the R^2 by a cross-sectional regression of a measure of Tobin's Q (for the average value for firm assets) on R^2 and control variables. We adopt two estimation specifications. The first estimates the following panel regression:

$$Q_{it} = \alpha_t + \alpha_i + \beta_1 R^2_{it} + \gamma X_{it} + \varepsilon_{it}, \tag{15}$$

where Q_{it} is a measure of Tobin's Q for firm i in year t, defined as the sum of market value of equity, liquidation value of preferred equity and book value of total liabilities scaled by total assets, α_t and α_i are year- and firm-fixed effects, and X_{it} is the vector of control variables.

The results are presented in Panel A of Table 5. Columns (1) to (4) include only the year- and firm-fixed effects as control variables. They show that the coefficient estimates for R^2_{it}, R^2_{firm}, and $R^2_{industry}$ are all positive and statistically significant (at less than the 1% level), consistent with the hypothesis that higher R^2 is associated with higher average value of firm assets. The economic magnitude of the coefficients are meaningful too. Relative to the sample average Tobin's Q (at 1.603, see Table 1, Panel

[18] The tabulated results are available from the authors upon request.

B), a one-standard deviation increase in R^2_{it} (0.316) is associated with a 7% ($= 0.316 \cdot 0.356/1.603$) increase in the average market value of assets. Similar magnitudes are observed for the effects of R^2_{firm} and $R^2_{industry}$. Across all four columns, the adjusted R-squared of the regression is above 57%, suggesting that the fixed effects alone are reasonable controls for the unobserved firm-specific fundamentals.

Columns (5) to (8) of Panel A add the control variables to the regression. The inclusion of these time-varying firm-characteristics in general decreases the magnitudes of the coefficient estimates for R^2s, although changes are relatively small and the estimates for all R^2 measures remain highly statistically significant. For example, the coefficient for R^2 in Column (5) is 0.319 (t-statistic = 13.6), lower than that shown in Column (1) (0.356, t-statistic = 15.3). Including the control variables only marginally increases the adjusted R-squared of the regression. In untabulated results, we follow the specification used in Himmelberg et al. (1999) and add additional control variables including sales (and its squared term), capital expenditures, R&D, and advertising, profit margin, leverage, and PPE level (and its squared term). We find that the coefficient estimates for various R^2_{it} measures remain significantly positive and are on average about the same magnitudes as those shown in Panel A.

In our second specification, we follow the approach in Pastor and Veronesi (2003) by regressing Tobin's Q on R^2_i with each firm's future stock returns and profitability as the main control variables. This specification is based on Vuolteenaho (2000) who derives an approximate linear identity that equates the logarithm of a firm's market to book ratio with an infinite discounted sum of future log returns and log profitability. Pastor and Veronesi (2003) modify the approximate linear identity by adding additional controls for firms' dividend policies and financial leverage. The estimation is done each year cross-sectionally. The over-time averages of the annual regression coefficients are reported, with the t-statistic calculated per the method in Fama and MacBeth (1973).

Because our dependent variable is Tobin's Q (as opposed to market-to-book ratio), we modify the specification in Pastor and Veronesi (2003) and use ROA instead of ROE as the measure of profitability. Results from this specification are reported in Panel B. The coefficient estimates for all three R^2 measures are highly positive and significant at less than the 1% level, consistent with the hypothesis that everything else equal, investors value firm assets higher when the accounting measurements of assets and earnings provide more information about firms' underlying productivity.

5 Additional analyses

5.1 Cash flows versus accounting earnings

A defining feature of accounting measurements of both assets and earnings is the use of accruals. Accruals play an important role in linking changes in net asset values to earnings. The analytical model shows that it is accruals that enable us to use R^2 as a proxy for the true R^2. As such, the R^2 measure obtained from accrual-based assets and earnings should be more informative than a cash flows-based R^2. To examine this conjecture, we obtain a cash flows-based R-squared (R^2_{CFO}) from estimating equation (12) except that we replace the dependent variable with cash from operations in year t.

Column (2) of Table 3 shows that the CFO-based R2 can also help predict ROA persistence. Column (1) of Panel A, Table 6 shows that when included on its own, the coefficient estimate for $R^2_{CFO} \cdot \Delta NA$ is 0.068 and significant at less than the 5% level. However, Column (2) shows that the estimated magnitude decreases to only 0.011 when the original R^2 is included in the regression, and is no longer significant at conventional levels (t-statistic = 0.43). These results suggest that while the mapping between accounting assets and cash provides information about decision quality , its effect is subsumed by the information from the mapping from accounting assets and earnings.

To further assess whether accruals drive the differences in information between cash flows-based R^2 and earnings-based R^2, Columns (3) to (6) repeat the exercise in Columns (1) and (2) on the subsamples partitioned by whether a firm's accrual quality measure (as defined in Dechow and Dichev (2002)) is above or below the sample median. They show that the coefficient estimate for $R^2 \cdot \Delta NA$ remains quantitatively similar in both subsamples. However, the coefficient estimate for $R^2_{CFO} \cdot \Delta NA$ is significant both on its own and in the presence of $R^2 \cdot \Delta NA$ only in the high accrual quality subsample, and is not significant in the low accrual quality subsample. Since the earnings-based R^2 significantly affects firm values regardless of the measure of accrual quality, these results call into question whether the accrual quality measure is a measure for the quality of cash flows or for the quality of accruals.

5.2 Decision quality and losses

One implicit assumption in our theory that decision quality matters is that the expected return on asset is high enough that any discount for decision quality will not make investors abondon the firm. However, in reality, when firms experience persistent losses, higher R^2 clearly does not measure decision quality anymore. As such, the link between asset value and information about decision quality is weakened (e.g., Hayn (1995), Li (2013)). We examine this empirically by estimating equations (13) separately on the subsamples partitioned by the sign of the estimated coefficient from the R-squared regression. To the extent profitable firms are less likely to be abandoned, we expect the positive relation between assets' marginal values and R^2 to be stronger in profitable firms than in loss firms.

Table 6, Panel B shows the results from the marginal value estimation. The coefficient estimate for $R^2 \cdot \Delta NA$ is positive (at 0.204) and significant (t-statistic =5.99) only in the subsample with positive ROA, and is negative at -0.020 and insignificantly different from zero (t-statistic = -0.46) in the subsample with negative ROA. These results are obtained after controlling for business fundamentals, including the level of ROA and volatilities (coefficients for these controls are suppressed for space constraints). The estimation results also indicate that consistent with intuition, the marginal value of assets is higher for the average profitable firms than for the average loss firms. To see that, note that the average R^2 is 0.456 in the positive ROA subsample, higher than that in the negative ROA subsample (at 0.248) (results not tabulated). Therefore, the coefficient estimates for ΔNA (0.316 in Column (1) for the positive ROA subsample and 0.314 in Column (5) for the negative ROA subsample) imply that the marginal value of assets for the average profit firms is 0.409 (=0.316+0.204*0.456) and is only 0.295 (=0.314-0.02*0.248) for the average loss firms.

In untabulated analyses, we also estimate (15) separately on these subsamples and find qualitatively similar results: the coefficient on R^2 is positive and statistically significant at less than the 1% level only in the positive ROA subsample. Overall, we interpret these results as consistent with the idea that the productivity information from accounting measurement of assets and earnings are more likely to be reflected in firm values when assets are less likely to be abandoned.

5.3 Controlling for other earnings quality measures

In this subsection, we examine whether *empirically* the R^2 measure captures different information content than other accounting measures. We focus on the seven earnings attributes examined in Francis et al. (2004): accrual quality, persistence, predictability, earnings smoothness, relevance, timeliness, and conservatism. All earnings quality measures are calculated similar to those in Francis et al. (2004) and are defined such that higher values represent desirable earnings attributes.

Jumping back to Table 3 again, we see that the AQ measure can help predict ROA persistence, but the AR(1) coefficient from the EPS regression does not.

Panel A of Table 7 presents the correlation among various measures. We notice that the R^2 measure is positively related to four accounting-based measures (accrual quality, persistence, predictability, and smoothness) with the Pearson correlation coefficient ranging from 0.17 to 0.22. The correlation between R^2 and the three market-based attributes (relevance, timeliness, and conservatism) is on average weaker. It is positively correlated with relevance at 0.08 and negatively correlated with timeliness (at -0.04). The correlation with conservatism is almost zero (at 0.01).

Table 7, Panel B presents the results from including the seven earnings quality measures (EQs) in the marginal value estimation. Columns (1) to (7) add earnings quality measures one at a time and Column (8) adds all measures in one regression. Throughout all specifications, the coefficient estimates for $R^2 \cdot \Delta NA$ remain statistically significant with little change in magnitudes regardless of which earnings quality measure is included. In contrast, the coefficients on $EQ \cdot \Delta NA$ are either negative or statistically insignificant. Similar results (untabulated) are observed when we estimates the relation between the average value of assets and various measures of accounting information. Specifically, we find that the coefficient estimate for R^2 stays around 0.3 (similar to those reported in Table 4) regardless of which other earnings quality measure is included. In contrast, the coefficient estimates for all other earnings quality measures (except the predictability and the smoothness measures) are either significantly negative or insignificantly different from zero.

Taken together, these results indicate that R^2 captures a unique aspect of information conveyed by accounting measurements of asset and earnings and its effect on asset valuation is not subsumed by other earnings quality measures.

6 Conclusion

In this paper, we develop a framework to show how and why accounting measurements can affect investors' pricing of firm assets, and develop an empirical measure to measure the quality of accounting reports. Our framework suggests that the quality of accounting reports for valuation purposes should be evaluated by the quality of the inference investors can draw about the quality of firms' past decisions that have future cash flow consequences. We posit that accrual accounting enables investors to do so, by providing audited (and presumably credible), periodic (and presumably timely), and quantified measurements about both what decisions firms have taken and what realized outcomes have been in ways consistent with an optimally designed information system. We rely on the theoretical framework to develop an empirically implementable measure to assess accounting quality and provide empirical tests to support its validity.

Our results point to several areas for future research. Our analyses suggest that a significant portion of cross-sectional variations in the R^2 measure may depend on how accounting measurement rules capture firms' fundamentals, especially about the inherent operational uncertainty that firm faces in their decision making. Future research can examine how different accounting rules and measurements affect the amount of such information. For example, it would be interesting to assess whether different rules regarding intangible assets indeed provide differing amount of information for decision quality. Relatedly, to the extent that managerial discretion plays a significant role in financial reports, future research can also explore how earnings management affects the amount of such information from financial reports. It would also be interesting to explore who uses such information in what decisions, as well as how the value of such information varies cross-sectionally by firm characteristics.

Our analyses suggest that accrual accounting is not hard wired to produce useless information (i.e., inferior to cash). Quite to the contrary, it has the potential to produce information as useful and high quality as that achievable under the hypothetical second best benchmark, at least over time. This should bring comfort to cynic of accounting's usefulness. This does not mean accounting cannot be made better. Our analysis provides a framework to think about where to start and how to improve. Specifically, our framework suggests that the debate between balance sheet and income statement approach can focus on three key elements in accounting measurement properties: (1) the degree of correlation between balance sheet and income statement; (2) the amount of noise in income statement; and (3) the amount of noise in balance sheet. We show that the R^2 is in theory a summary measure for the overall impact of the above three elements. Our evidence supports its *empirical* importance. Therefore, our analyses set up a starting point for future research to explore the relative impact of each of the three elements, and to assess how different accounting methods and principles affect them.

7 References (incomplete)

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Table 1: Summary Statistics

This table reports the mean, median, and standard deviation for the R^2 measure and *ROA* for each Fama and French (1997) 48-industry. For each firm-year, we estimate a regression of net operating earnings after tax (*NOPAT*) in year t on net operating assets (*NOA*) in year t-1 using observations for this firm over the 10-year rolling window preceding year t. R^2 is the adjusted R-squared from this regression and *ROA* is the coefficient estimate on *NOPAT*. Industries are sorted in descending order by the average value of R^2.

Panel A: Summary statistics for R^2 by industry

Fama-French Industry	R^2			*ROA*			Average number of firms per year
	Mean	Median	Std Dev	Mean	Median	Std Dev	
Tobacco Products	0.570	0.645	0.354	0.161	0.121	0.267	5
Beer	0.555	0.633	0.343	0.092	0.097	0.138	12
Retails	0.460	0.435	0.339	0.056	0.064	0.203	142
Healthcare	0.458	0.426	0.353	0.059	0.070	0.231	28
Communication	0.454	0.411	0.337	0.058	0.057	0.233	59
Shipping Containers	0.452	0.450	0.322	0.049	0.070	0.148	11
Books	0.451	0.418	0.332	0.055	0.072	0.204	28
Restaurants and Hotels	0.441	0.402	0.351	0.040	0.053	0.178	44
Soda	0.439	0.413	0.315	0.115	0.065	0.271	7
Drugs	0.431	0.388	0.331	0.015	0.074	0.525	91
Food	0.430	0.389	0.332	0.065	0.075	0.179	59
Personal Services	0.428	0.381	0.333	0.057	0.049	0.218	20
Chemicals	0.418	0.387	0.319	0.059	0.066	0.227	59
Medical Equipment	0.418	0.375	0.327	0.058	0.074	0.344	60
Household	0.414	0.375	0.319	0.048	0.061	0.211	59
Transportation	0.385	0.321	0.314	0.045	0.045	0.180	69
Entertainment	0.383	0.325	0.314	0.039	0.043	0.196	28
Wholesale	0.382	0.299	0.325	0.041	0.047	0.166	96
Electrical Products	0.381	0.319	0.310	0.025	0.050	0.227	37
Business Supplies	0.378	0.310	0.311	0.044	0.054	0.167	51
Business Services	0.372	0.304	0.312	0.009	0.036	0.327	172
Rubber and Plastic Products	0.360	0.294	0.304	0.029	0.042	0.223	31
Measuring and Control Equipment	0.358	0.286	0.299	0.006	0.030	0.298	61
Energy	0.355	0.274	0.305	0.046	0.053	0.219	102
Clothes	0.354	0.285	0.299	0.032	0.039	0.215	48
Aircraft	0.352	0.261	0.315	0.046	0.050	0.167	22
Computers	0.349	0.266	0.302	-0.011	0.024	0.333	78
Building Materials	0.346	0.282	0.294	0.031	0.046	0.206	80
Automobiles	0.343	0.248	0.298	0.031	0.042	0.192	51
Construction	0.341	0.248	0.310	0.032	0.035	0.208	25
Agriculture	0.334	0.231	0.305	0.032	0.034	0.237	9
Machinery	0.329	0.254	0.291	0.019	0.032	0.233	109
Miscellaneous	0.328	0.261	0.284	-0.004	0.025	0.248	37
Electrical Equipment	0.326	0.238	0.296	-0.014	0.005	0.286	144
Toys	0.323	0.259	0.279	-0.020	0.006	0.215	22
Defense	0.323	0.238	0.291	0.026	0.021	0.194	6
Precious Metal	0.317	0.232	0.281	-0.070	-0.038	0.246	12
Textiles	0.309	0.233	0.275	0.017	0.028	0.166	26
Nonmetallic Mines	0.306	0.235	0.270	0.053	0.046	0.229	16
Fabricated Products	0.305	0.204	0.295	-0.034	-0.002	0.249	13
Ships	0.291	0.174	0.290	-0.008	0.004	0.265	7
Steel	0.286	0.196	0.271	0.015	0.022	0.194	51
Coal	0.242	0.161	0.242	0.025	0.033	0.319	4

Panel B: Summary statistics for main variables

This table reports the summary statistics for the main variables used in this paper. R_i-$R_{i,t}^b$ is the excess stock return, where $r_{i,t}$ is the annual stock return of firm *i* at year *t* (fiscal year-end) and $R_{i,t}^b$ is stock *i*'s benchmark portfolio return at year *t*, calculated as the return of the 5X5 Fama and French (1993) portfolios formed on size and book-to-market portfolio to which stock *i* belongs at the beginning of fiscal year *t*. R^2 is the adjusted R-squared from a regression of net operating earnings after tax (*NOPAT*) in year *t* on net operating assets (*NOA*) in year *t*-1 using observations for this firm over the 10-year rolling window preceding year *t*. $R^2_{Industry}$ is the median R^2 for each Fama-French 48 industry in each year. R^2_{Firm} is the difference between R^2 and the corresponding $R^2_{Industry}$. *Log*(*Total Assets*) is the logarithm of total assets. *ROA* is the estimated coefficient on *NOPAT* in Equation (1). Δ*NA* is change in net assets where net assets are defined as total assets minus cash holdings. Δ*Cash* is change in *Cash*, defined as the balance of cash and marketable securities from year *t*-1. Δ*E* is change in earnings before extraordinary items plus interest, deferred tax credits, and investment tax credits. NA_{t-1} is the logarithm of net assets in year *t*-1. *Leverage* is the market leverage ratio defined as total debt over the sum of total debt and the market value of equity. ΔInterest is change in interest expense. Δ*Div* is change in common dividends paid. *NF* is the total equity issuance minus repurchases plus debt issuance minus debt redemption. Δ*RD* is change in R&D expenditures. *Tobin's Q* is defined as the sum of market value of equity, liquidation value of preferred equity and book value of total liabilities scaled by total assets.

Variable	N	Mean	Std Dev	P5	P25	Median	P75	P95
R_i-R_b	85,652	0.020	0.505	-0.606	-0.276	-0.051	0.205	0.892
R^2	85,652	0.379	0.316	0.003	0.082	0.309	0.655	0.933
R^2_{Firm}	85,652	0.055	0.307	-0.378	-0.185	0.001	0.289	0.602
$R^2_{Industry}$	85,652	0.325	0.141	0.149	0.225	0.293	0.388	0.607
Log(*Total Assets*)	85,652	5.567	2.014	2.554	4.064	5.387	6.906	9.234
ROA	85,652	0.030	0.260	-0.382	-0.058	0.046	0.136	0.373
Persistence	85,652	0.349	0.417	-0.326	0.077	0.352	0.604	1.050
Std(*Sales*)	85,652	0.228	0.172	0.052	0.112	0.181	0.289	0.575
Std(*ROA*)	85,652	0.060	0.067	0.010	0.021	0.038	0.071	0.190
Beta	85,652	1.143	0.545	0.331	0.781	1.096	1.445	2.100
Sigma	85,652	0.125	0.055	0.059	0.084	0.113	0.153	0.230
ΔNA_t	85,652	0.096	0.408	-0.439	-0.022	0.059	0.196	0.733
$\Delta Cash_t$	85,652	0.017	0.131	-0.155	-0.024	0.003	0.044	0.229
ΔE_t	85,652	0.018	0.179	-0.210	-0.024	0.010	0.048	0.259
NA_{t-1}	85,652	5.305	2.076	2.154	3.780	5.122	6.692	9.066
$Cash_{t-1}$	85,652	0.167	0.212	0.007	0.037	0.094	0.211	0.587
$Leverage_t$	85,652	0.252	0.227	0.000	0.052	0.201	0.402	0.700
ΔRD_t	85,652	0.002	0.016	-0.014	0.000	0.000	0.002	0.024
$\Delta Interest_t$	85,652	0.003	0.026	-0.027	-0.002	0.000	0.006	0.040
ΔDiv_t	85,652	0.001	0.011	-0.008	0.000	0.000	0.002	0.014
NF_t	85,652	0.011	0.081	-0.063	-0.003	0.000	0.006	0.134
Tobin's Q	85,652	1.603	1.132	0.741	0.979	1.249	1.783	3.645

Table 2: Correlation among R^2 and Firm Characteristics

Panel A: Sample correlations

Panel A reports the sample correlation for variables used in the main test. Pearson correlations are presented in the upper-right corner and Spearman correlations are presented in the lower-left corner, respectively. R^2 is the adjusted R-squared from a regression of net operating earnings after tax (*NOPAT*) in year *t* on net operating assets (*NOA*) in year *t*-1 using observations for this firm over the 10-year rolling window preceding year *t*. $R^2_{Industry}$ is the median R^2 for each Fama-French 48-industry in each year and R^2_{Firm} is the difference between R^2 and its corresponding $R^2_{Industry}$. *Tobin's Q* is defined as the sum of market value of equity, liquidation value of preferred equity and book value of total liabilities scaled by total assets. *Log*(*Total Assets*) is the logarithm of total assets. *ROA* is the estimated coefficient on *NOPAT* in Equation (1). *Persistence* is defined as the AR(1) coefficient from the autoregression of earnings per share: $EPS_{i,t}=\rho EPS_{i,t\text{-}1}+\varepsilon$ using earnings data in the 10-year rolling window preceding year *t*. *Std*(*Sales*) is defined as the standard deviation of sales scaled by total assets in the rolling window of 10 years preceding year t. *Std*(*ROA*) is defined as the standard deviation of realized return on assets in the rolling window of 10 years preceding year *t*. *Beta* is estimated using monthly return data in the 10-year rolling window preceding year *t*. *Sigma* is the standard deviation of CAPM model residual in the 10-year rolling window preceding year *t*. Correlations in bold are statistically significant at the 5% level or lower.

Variable	R^2	R^2_{Firm}	$R^2_{Industry}$	*Size*	*ROA*	*Persistence*	*Std*(*Sales*)	*Std*(*ROA*)	*Beta*	*Sigma*	*Tobin's Q*
R^2	1	**0.90**	**0.27**	**0.15**	**0.21**	**0.18**	**-0.08**	**-0.16**	-0.00	**-0.15**	**0.15**
R^2_{Firm}	**0.90**	**1**	**-0.17**	**0.18**	**0.16**	**0.14**	**-0.07**	**-0.09**	-0.00	**-0.11**	**0.17**
$R^2_{Industry}$	**0.25**	**-0.15**	1	**-0.05**	**0.12**	**0.10**	**-0.03**	**-0.17**	-0.00	**-0.10**	**-0.03**
Size	**0.15**	**0.18**	**-0.07**	1	**0.16**	**0.02**	**-0.23**	**-0.26**	**0.01**	**-0.34**	**0.01**
ROA	**0.40**	**0.34**	**0.18**	**0.20**	1	**0.07**	**-0.06**	**-0.24**	**-0.03**	**-0.17**	**0.13**
Persistence	**0.18**	**0.15**	**0.09**	**0.03**	**0.11**	1	**0.01**	**-0.06**	0.00	**-0.08**	**-0.01**
Std(*Sales*)	**-0.11**	**-0.09**	**-0.04**	**-0.29**	**-0.11**	0.00	1	**0.24**	**0.04**	**0.18**	**-0.01**
Std(*ROA*)	**-0.30**	**-0.20**	**-0.25**	**-0.31**	**-0.34**	**-0.10**	**0.35**	1	**0.14**	**0.40**	**0.32**
Beta	**0.01**	0.01	**0.01**	**0.03**	-0.00	**0.01**	**0.05**	**0.10**	1	**0.21**	**0.08**
Sigma	**-0.16**	**-0.13**	**-0.07**	**-0.38**	**-0.21**	**-0.09**	**0.24**	**0.46**	**0.18**	1	**0.14**
Tobin's Q	**0.20**	**0.23**	**-0.06**	**0.16**	**0.24**	**-0.01**	**-0.05**	**0.17**	**0.06**	**0.14**	1

Panel B: Regressions of R^2 and R^2_{Firm} on firm fundamental variables

Panel B reports the results from regressing R^2 and R^2_{Firm} on firm characteristics. All standard errors are two-way clustered by both firm and year. T-statistics are presented underneath the coefficient estimates. ***, **, and * denote significance levels for two-sided tests at 1%, 5%, and 10%, respectively.

	(1)	(2)	(4)	(5)
	R^2	R^2_{Firm}	R^2	R^2_{Firm}
Log(*Total assets*)	0.019***	0.016***	0.063***	0.061***
	(10.88)	(9.72)	(13.05)	(12.34)
ROA	0.180***	0.145***	0.168***	0.143***
	(7.56)	(6.97)	(9.87)	(9.31)
Persistence	0.116***	0.106***	0.087***	0.079***
	(14.04)	(15.48)	(14.36)	(13.85)
Std(*Sales*)	-0.058***	-0.052***	-0.0244	-0.025
	(-3.34)	(-3.14)	(-1.18)	(-1.22)
Std(*ROA*)	-0.109**	-0.116**	-0.601***	-0.512***
	(-2.04)	(-2.38)	(-6.91)	(-6.27)
Beta	0.007***	0.008***	0.004***	0.002*
	(3.05)	(4.49)	(3.35)	(1.77)
Sigma	-0.313***	-0.295***	-0.156***	-0.145***
	(-7.46)	(-7.45)	(-6.97)	(-6.60)
Firm Fixed Effects	No	No	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
N	85,652	85,652	85,652	85,652
adj. R-sq	0.111	0.083	0.436	0.403

Table 3: Retention Analysis

This table reports the retention rate of portfolios formed on *ROA* and R^2 (the left panel), or on *ROA* and R^2_{Firm} (the right panel). Each year, we sort firms into four quartiles based on R^2 (R^2_{Firm}) independently. Reported in each cell is the average percentage of firms in each R^2 (R^2_{Firm}) quartile whose *ROA* in the next one-, two- or five-years ahead retain in the same *ROA* quartile.

	R2				Firm R2			
1-year ahead retention rate								
	Lowest ROA	ROA Q2	ROA Q3	Highest ROA	Lowest ROA	ROA Q2	ROA Q3	Highest ROA
Lowest R2	0.565	0.600	0.383	0.623	0.601	0.602	0.418	0.640
R2 Q2	0.716	0.655	0.530	0.651	0.700	0.637	0.533	0.662
R2 Q3	0.802	0.688	0.654	0.701	0.796	0.664	0.662	0.708
Highest R2	0.833	0.674	0.746	0.758	0.835	0.691	0.736	0.755
2-year ahead retention rate								
	Lowest ROA	ROA Q2	ROA Q3	Highest ROA	Lowest ROA	ROA Q2	ROA Q3	Highest ROA
Lowest R2	0.430	0.417	0.240	0.446	0.456	0.420	0.270	0.451
R2 Q2	0.532	0.487	0.356	0.467	0.518	0.463	0.362	0.477
R2 Q3	0.612	0.520	0.466	0.510	0.606	0.500	0.474	0.524
Highest R2	0.658	0.488	0.582	0.581	0.660	0.521	0.571	0.575
5-year ahead retention rate								
	Lowest ROA	ROA Q2	ROA Q3	Highest ROA	Lowest ROA	ROA Q2	ROA Q3	Highest ROA
Lowest R2	0.241	0.199	0.137	0.204	0.233	0.198	0.152	0.195
R2 Q2	0.245	0.228	0.192	0.194	0.247	0.222	0.186	0.201
R2 Q3	0.267	0.226	0.236	0.229	0.263	0.213	0.251	0.246
Highest R2	0.257	0.202	0.313	0.292	0.263	0.241	0.305	0.286

Panel B: Effect of R^2 on ROA persistence

Panel A reports average coefficients from annual regressions of ROA in year *t*+1 on ROA in year *t* and its interactions with R^2, R^2_{CFO}, *AQ*, and *Persistence*. R^2 and *Persistence* are defined as the same as previously. For each firm-year, we estimate a regression of cash from operations in year *t* on net operating assets in year *t*-1 using observations for this firm over the 10-year rolling window preceding year *t*. The adjusted R-squared is R^2_{CFO}. *AQ* is accruals quality and is defined as the negative of the ten-year rolling-window standard deviation of the residual terms from estimating changes in working capital accruals on lagged, current and future cash flows from operations. Abs(Accruals) is the absolute value of accruals. Dividend is a dummy variable that takes a value of one for firms that issue dividends and zero otherwise. T-statistics are presented underneath the coefficient estimates. ***, **, and * denote significance levels for two-sided tests at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)
			ROA_{t+1}		
ROA_t	0.680***	0.681***	0.804***	0.730***	0.740***
	(21.21)	(22.18)	(32.73)	(25.44)	(22.99)
ROA_t* R^2	0.191***				0.124***
	(5.41)				(3.10)
R^2	-0.00156				-0.00391
	(-0.57)				(-1.53)
ROA_t* R^2_{CFO}		0.185***			0.0770**
		(5.76)			(2.68)
R^2_{CFO}		0.00131			0.00283
		(0.52)			(1.23)
ROA_t*AQ			1.252***		1.017***
			(4.15)		(3.54)
AQ			-0.0106		-0.0264
			(-0.26)		(-0.67)
ROA_t*Persistence				0.0175	0.000941
				(0.79)	(0.04)
Persistence				0.00701***	0.00622***
				(4.87)	(4.62)
ROA_t*Abs(Accruals)	-0.493***	-0.394***	-0.466***	-0.558***	-0.408***
	(-3.76)	(-2.81)	(-3.10)	(-4.27)	(-2.74)
Abs(Accruals)	-0.0737***	-0.0677***	-0.0703***	-0.0697***	-0.0697***
	(-8.21)	(-7.39)	(-7.60)	(-7.77)	(-7.52)
ROA_t*Dividend	0.183***	0.189***	0.186***	0.229***	0.131***
	(5.83)	(5.95)	(7.03)	(6.95)	(5.10)
Dividend	0.00251	0.00216	0.000929	0.000518	0.00318*
	(1.13)	(0.93)	(0.51)	(0.23)	(1.74)
Number of Years	40	40	40	40	40

Table 4: Effect of R^2 on Marginal Value of Assets

Panel A reports results from an OLS regression of annual excess stock returns on R^2 (R^2_{Firm} and $R^2_{Industry}$) plus firm characteristics (Equation (5)). R_i -$R_{i,t}^b$ is the excess stock return, where $R_{i,t}$ is the annual stock return of firm i at year t (fiscal year-end) and $R_{i,t}^b$ is stock i's benchmark portfolio return at year t, calculated as the return of the 5X5 Fama and French (1993) portfolios formed on size and book-to-market portfolio to which stock i belongs at the beginning of fiscal year t. R^2 is the adjusted R-squared from a regression of net operating earnings after tax (*NOPAT*) in year t on net operating assets (*NOA*) in year t-1 using observations for this firm over the 10-year rolling window preceding year t. $R^2_{Industry}$ is the median R^2 for each Fama-French 48-industry in each year and R^2_{Firm} is the difference between R^2 and its corresponding $R^2_{Industry}$. $\Delta Cash$ is change in cash. $Cash_{t-1}$ is the cash balance from last year. ΔE is change in earnings before extraordinary items plus interest and deferred taxes. ΔNA is change in net assets where net assets are defined as total assets minus cash holdings. ΔInterest is change in interest expense. ΔDiv is change in common dividends paid. *Leverage* is the market leverage ratio defined as total debt over the sum of total debt and the market value of equity. *NF* is the total equity issuance minus repurchases plus debt issuance minus debt redemption. ΔRD is change in R&D expenditures. All independent variables except *Leverage* and R^2 (R^2_{Firm} and $R^2_{Industry}$) are deflated by the lagged market value of equity. All standard errors are two-way clustered by both firm and year. T-statistics are presented underneath the coefficient estimates. ***, **, and * denote significance levels for two-sided tests at 1%, 5%, and 10%, respectively.

Panel A: Baseline specification

	(1)	(2)	(3)	(4)
	$R_{i,t}$ - $R_{i,t}^b$			
ΔNA_t	0.296***	0.346***	0.305***	0.286***
	(10.77)	(14.08)	(11.00)	(9.93)
$R^2*\Delta NA_t$	**0.175*** **			
	(6.05)			
$R^2_{Firm}*\Delta NA_t$		**0.137*** **		**0.155*** **
		(6.21)		**(6.39)**
$R^2_{Industry}*\Delta NA_t$			**0.143*** **	**0.203*** **
			(2.59)	**(3.49)**
$\Delta Cash_t$	0.927***	0.970***	1.039***	1.025***
	(15.89)	(15.26)	(11.14)	(11.17)
$R^2*\Delta Cash_t$	0.162			
	(1.60)			
R^2_{Firm} $*\Delta Cash_t$		0.169*		0.142
		(1.89)		(1.45)
$R^2_{Industry}$ $*\Delta Cash_t$			-0.225	-0.170
			(-1.19)	(-0.83)
$NA_{t-1}*\Delta NA_t$	-0.036***	-0.036***	-0.033***	-0.035***
	(-5.40)	(-5.46)	(-5.11)	(-5.43)
$Leverage_t*\Delta NA_t$	-0.587***	-0.589***	-0.606***	-0.592***
	(-9.27)	(-9.37)	(-9.70)	(-9.36)
$Cash_{t-1}*\Delta Cash_t$	-0.314***	-0.318***	-0.336***	-0.327***
	(-5.84)	(-5.81)	(-5.68)	(-5.89)
$Leverage_t*\Delta Cash_t$	-1.345***	-1.341***	-1.334***	-1.335***
	(-10.38)	(-10.58)	(-10.51)	(-10.59)
R^2	-0.004			
	(-0.41)			
R^2_{Firm}		-0.011		-0.007
		(-1.48)		(-0.78)
$R^2_{Industry}$			0.076**	0.070*
			(2.25)	(1.92)
NA_{t-1}	0.014***	0.015***	0.014***	0.014***
	(6.03)	(6.36)	(6.04)	(5.95)
$Cash_{t-1}$	0.268***	0.266***	0.267***	0.269***
	(6.80)	(6.66)	(6.74)	(6.85)
$Leverage_t$	-0.444***	-0.444***	-0.438***	-0.442***
	(-12.48)	(-12.76)	(-12.48)	(-12.24)
ΔE_t	0.634***	0.636***	0.633***	0.633***
	(14.65)	(14.77)	(14.70)	(14.60)
ΔRD_t	0.699***	0.682***	0.709***	0.709***
	(3.14)	(3.07)	(3.20)	(3.16)
ΔInt_t	-1.408***	-1.388***	-1.406***	-1.407***
	(-5.41)	(-5.33)	(-5.35)	(-5.37)
ΔDiv_t	1.787***	1.830***	1.785***	1.773***
	(5.22)	(5.27)	(5.16)	(5.19)
NF_t	0.346***	0.351***	0.354***	0.344***
	(3.03)	(3.11)	(3.15)	(3.03)
Year fixed-effects	Yes	Yes	Yes	Yes
N	85,652	85,652	85,652	85,652
adj. R-sq	0.232	0.231	0.231	0.232

Panel B: Baseline specification with controls for business fundamental

Panel B presents results of Equation (5) after adding in *ROA*, *Std*(*Sales*), Std(*ROA*), *Sigma*, *Beta*, and *Persistence* as firm fundamental controls. *Std*(*Sales*) is defined as the standard deviation of sales scaled by total assets in the 10-year rolling window preceding year *t*. *Std*(*ROA*) is defined as the standard deviation of realized return on assets in the 10-year rolling window preceding year *t*. *Beta* is estimated using monthly return data in the 10-year rolling window preceding year *t*. *Sigma* is the standard deviation of CAPM model residual in the 10-year rolling window preceding year *t*. *Persistence* is defined as the AR(1) coefficient from the autoregression of earnings per share: $EPS_{i,t}=\rho EPS_{i,t-1}+\varepsilon$ using earnings data in the 10-year rolling window preceding year *t*. All standard errors are two-way clustered by both firm and year. T-statistics are presented underneath the coefficient estimates. ***, **, and * denote significance levels for two-sided tests at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)
	$R_{i,t}$ - $R_{i,t}^{b}$			
ΔNA_t	0.301***	0.352***	0.307***	0.285***
	(14.87)	(17.06)	(15.78)	(13.87)
$R^2 * \Delta NA_t$	**0.173*** **			
	(6.64)			
$R^2_{Firm} * \Delta NA_t$		**0.128*** **		**0.150*** **
		(6.85)		**(6.84)**
$R^2_{Industry} * \Delta NA_t$			**0.151** **	**0.220*** **
			(2.40)	**(3.30)**
$ROA * \Delta NA_t$	0.107***	0.119***	0.121***	0.109***
	(4.83)	(5.15)	(5.17)	(4.86)
$Std(Sales) * \Delta NA_t$	-0.085***	-0.087***	-0.091***	-0.087***
	(-2.87)	(-2.88)	(-2.99)	(-2.92)
$Std(ROA) * \Delta NA_t$	0.265	0.206	0.279	0.287
	(1.53)	(1.18)	(1.54)	(1.61)
$Sigma * \Delta NA_t$	0.386*	0.347	0.369	0.401*
	(1.73)	(1.55)	(1.63)	(1.77)
$Beta * \Delta NA_t$	0.017***	0.019***	0.018***	0.017***
	(2.86)	(3.05)	(2.95)	(2.84)
$Persistence * \Delta NA_t$	-0.009	-0.003	0.002	-0.009
	(-0.97)	(-0.34)	(0.23)	(-0.94)
Control variables	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
N	85,652	85,652	85,652	85,652
adj. R-sq	0.267	0.267	0.267	0.267

Table 5: Effect of R^2 on Average Value of Assets

Panel A: Panel specification with firm- and year-fixed effects

This table reports results from an OLS regression of *Tobin's Q* on R^2 (R^2_{Firm} and $R^2_{Industry}$) plus business fundamental variables introduced in Panel B of Table 3. R^2 is the adjusted R-squared from a regression of net operating earnings after tax (*NOPAT*) in year *t* on net operating assets (*NOA*) in year *t*-1 using observations for this firm over the 10-year rolling window preceding year *t*. $R^2_{Industry}$ is the median R^2 for each Fama-French 48-industry each year and R^2_{Firm} is the difference between R^2 and its corresponding $R^2_{Industry}$. Both firm- and year-fixed effects are included. All standard errors are two-way clustered by firm and year. T-statistics are presented underneath the coefficient estimates. ***, **, and * denote significance levels for two-sided tests at the 1%, 5%, and 10% level, respectively**.**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Tobin's Q							
R^2	**0.356***** **(15.31)**				**0.319***** **(13.61)**			
R^2_{Firm}		**0.328***** **(13.79)**		**0.351***** **(14.80)**		**0.295***** **(12.54)**		**0.317***** **(13.37)**
$R^2_{Industry}$			**0.258***** **(3.02)**	**0.425***** **(5.09)**			**0.180**** **(2.24)**	**0.345***** **(4.31)**
ROA					0.597*** (11.57)	0.609*** (11.77)	0.650*** (12.02)	0.597*** (11.52)
Persistence					-0.069*** (-4.39)	-0.065*** (-4.07)	-0.042*** (-2.69)	-0.069*** (-4.37)
Std(Sales)					0.031 (0.50)	0.0311 (0.49)	0.0268 (0.42)	0.0316 (0.50)
Std(ROA)					1.333*** (4.26)	1.287*** (4.13)	1.104*** (3.64)	1.333*** (4.26)
Beta					0.020** (2.24)	0.021** (2.30)	0.021** (2.39)	0.020** (2.23)
Sigma					1.278*** (4.37)	1.269*** (4.33)	1.208*** (4.12)	1.277*** (4.36)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	85,652	85,652	85,652	85,652	85,652	85,652	85,652	85,652
adj. R-sq	0.578	0.577	0.573	0.578	0.593	0.592	0.589	0.593

Panel B: Pastor-Veronesi specification

This table reports results from estimating *Tobin's Q* on R^2 (R^2_{Firm} and $R^2_{Industry}$) and control variables using the Pastor and Veronesi (2003) specification. Age is one minus the reciprocal of one plus the number of years appeared in CRSP database. *Dividend* is a dummy variable that takes 1 if a firm-year pays dividends. *Leverage* is market leverage defined as total debt over the sum of total debt and the market value of equity. *Log*(*Total assets*) is the logarithm of total assets. *VOLP* is the volatility of profitability defined as the standard deviation of return on equity (assets) five years ahead. *ROA* is the current-year return on assets. *ROA*(*i*) is the return on assets in the i^{th} year in the future (up to five years). *Ret*(*i*) is the compounded annual return in the i^{th} year in the future. Regressions are estimated annually and the averages of coefficient estimates from the annual regressions are presented (Fama-MacBeth method). T-statistics are presented underneath the coefficient estimates. ***, **, and * denote significance levels for two-sided tests at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)
	Tobin's Q			
R^2	**0.426*** **			
	(12.58)			
R^2_{Firm}		**0.311*** **		**0.377*** **
		(8.31)		**(11.10)**
$R^2_{Industry}$			**0.826*** **	**0.977*** **
			(7.75)	**(9.18)**
Age	-1.763***	-1.969***	-2.088***	-1.671***
	(-12.68)	(-13.54)	(-13.14)	(-11.90)
Dividend	-0.126***	-0.130***	-0.126***	-0.123***
	(-7.68)	(-7.90)	(-7.90)	(-7.61)
Log(*Total assets*)	0.0355***	0.0417***	0.0460***	0.0335***
	(6.99)	(8.18)	(8.45)	(6.63)
Leverage	-1.214***	-1.226***	-1.250***	-1.203***
	(-6.37)	(-6.39)	(-6.27)	(-6.30)
ROA	0.784**	0.926***	1.016***	0.774**
	(2.65)	(2.93)	(3.34)	(2.66)
ROA(1)	1.522***	1.529***	1.563***	1.532***
	(6.00)	(6.05)	(6.30)	(6.11)
ROA(2)	1.122***	1.147***	1.136***	1.113***
	(4.31)	(4.10)	(4.22)	(4.40)
ROA(3)	0.650***	0.649***	0.624***	0.627***
	(3.77)	(3.58)	(3.46)	(3.68)
ROA(4)	0.968***	0.993***	1.029***	0.982***
	(4.56)	(4.54)	(4.82)	(4.71)
ROA(5)	1.203***	1.235***	1.266***	1.206***
	(5.11)	(5.09)	(5.27)	(5.18)
VOLP	5.365***	5.248***	5.283***	5.413***
	(14.83)	(14.34)	(14.55)	(15.11)
Ret(1)	-0.334***	-0.339***	-0.344***	-0.334***
	(-8.65)	(-8.65)	(-8.96)	(-8.74)
Ret(2)	-0.275***	-0.281***	-0.287***	-0.277***
	(-6.30)	(-6.26)	(-6.59)	(-6.43)
Ret(3)	-0.241***	-0.246***	-0.251***	-0.242***
	(-5.27)	(-5.25)	(-5.52)	(-5.40)
Ret(4)	-0.178***	-0.183***	-0.190***	-0.181***
	(-4.83)	(-4.77)	(-5.06)	(-4.98)
Ret(5)	-0.138***	-0.141***	-0.148***	-0.141***
	(-4.22)	(-4.20)	(-4.37)	(-4.33)
Average adj. R-sq	0.45	0.44	0.44	0.45
Average N	1,370	1,370	1,370	1,370
Number of Years	35	35	35	35

Table 6: Additional Analyses of the Main Hypothesis

Panel A: Sensitivity to cash flows-based R^2

Panel A reports results from an OLS regression of annual excess stock returns on R^2 and R^2_{CFO} plus firm characteristics. R^2 is defined as the same as previously. For each firm-year, we estimate a regression of cash from operations in year *t* on net operating assets in year *t*-1 using observations for this firm over the 10-year rolling window preceding year *t*. The adjusted R-squared is R^2_{CFO}. Column (1) estimates Equation (5) with R^2_{CFO} and column (2) estimates Equation (5) using both R^2 and R^2_{CFO}. Column (3) to (6) estimate Equation (5) on subsamples partitioned accruals quality (*AQ*). *AQ* is defined as the negative of the ten-year rolling-window standard deviation of the residual terms from estimating changes in working capital accruals on lagged, current and future cash flows from operations. Firm-year observations with higher than sample median *AQ* are grouped in the high *AQ* subsample and firm-year observations with l than sample median *AQ* are grouped in the low *AQ* subsample. We include all control variables in Table 3, Panel B. All standard errors are two-way clustered by both firm and year. T-statistics are presented underneath the coefficient estimates. ***, **, and * denote significance levels for two-sided tests at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample		Subsample with high *AQ*		Subsample with low *AQ*	
ΔNA_t	0.333***	0.298***	0.271***	0.236***	0.357***	0.327***
	(15.84)	(13.97)	(15.01)	(11.89)	(9.73)	(8.50)
$R^2*\Delta NA_t$		**0.171*** **		**0.160*** **		**0.174*** **
		(7.10)		**(4.91)**		**(4.20)**
$R^2_{CFO}*\Delta NA_t$	0.068**	0.011	0.136***	0.076**	0.043	-0.005
	(2.25)	(0.43)	(3.26)	(2.06)	(0.88)	(-0.11)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Business fundamental variables	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	85,623	85,623	33,255	33,255	33,256	33,256
adj. R-sq	0.266	0.267	0.240	0.241	0.284	0.285

Panel B: Effect of R^2 in subsamples partitioned by the sign of *ROA*

Panel A reports results from an OLS regression of annual excess stock returns on R^2 (R^2_{Firm} and $R^2_{Industry}$) plus firm characteristics on two subsamples. Columns (1) to (4) estimate Equation (5) on the subsample with estimated *ROA* from Equation (4) equal or greater than zero and Columns (5) to (8) estimate Equation (5) on the subsample with estimated *ROA* from Equation (4) lower than zero, respectively. We include all control variables from Table 3, Panel B as well as year fixed effects in this test. All standard errors are two-way clustered by both firm and year. T-statistics are presented underneath the coefficient estimates. ***, **, and * denote significance levels for two-sided tests at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$R_{i,t}$-$R_{i,t}^b$				$R_{i,t}$-$R_{i,t}^b$			
	Estimated *ROA*>=0				Estimated *ROA*<0			
ΔNA_t	0.316***	0.381***	0.300***	0.268***	0.314***	0.309***	0.341***	0.347***
	(15.82)	(19.54)	(14.58)	(12.62)	(10.29)	(12.10)	(13.07)	(12.33)
$R^2*\Delta NA_t$	**0.204*** **				**-0.020**			
	(5.99)				**(-0.46)**			
$R^2_{Firm}*\Delta NA_t$		**0.130*** **		**0.166*** **		**-0.002**		**-0.037**
		(4.41)		**(5.37)**		**(-0.06)**		**(-0.88)**
$R^2_{Industry}*\Delta NA_t$			**0.294*** **	**0.360*** **			**-0.110**	**-0.141* **
			(4.22)	**(5.09)**			**(-1.59)**	**(-1.86)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	54,200	54,200	54,200	54,200	31,452	31,452	31,452	31,452
adj. R-sq	0.252	0.251	0.252	0.253	0.293	0.293	0.293	0.293

Table 7: Controlling for Alternative Measures of Earnings Quality

Panel A: Correlation among R^2 and earnings quality measures

Panel A reports the sample correlation for R^2 and seven earnings quality measures. Pearson correlations are presented in the upper-right corner and Spearman correlations are presented in the lower-left corner, respectively. *AQ* is accruals quality, defined as the negative of the ten-year rolling-window standard deviation of the residual terms from estimating changes in working capital accruals on lagged, current and future cash flows from operations. *Persistence* is earnings persistence, defined as the AR(1) coefficient from the autoregression of earnings per share: $EPS_{i,t}=\rho EPS_{i,t-1}+\varepsilon$ using earnings data in the 10-year rolling window preceding year *t*. *Predict* is earnings predictability, defined as the negative of standard deviation of the AR(1) process of earnings per share. *Smooth* is earnings smoothness, defined as the negative of the ratio of the standard deviation of net income before extraordinary items (scaled by beginning total assets) to the standard deviation of cash flows from operations (scaled by beginning total assets). *Relevance* is value relevance, defined as the adjusted R-squared from a regression of 15-month returns on the level and change in annual earnings before extraordinary items (scaled by beginning market value of equity). *Timeliness* is earnings timeliness, defined as the adjusted R-squared from a reverse regression of annual earnings (before extraordinary items) on variables capturing positive and negative 15-month returns. *Conservatism* is accounting conservatism, defined as the ratio of the coefficient on bad news (negative returns) to good news (positive returns) in the reverse regression. Correlations in bold are statistically significant at the 5% level or lower.

Variable	R^2	*AQ*	*Persistence*	*Predictability*	*Smooth*	*Relevance*	*Timeliness*	*Conservatism*
R^2		**0.22**	**0.18**	**0.18**	**0.17**	**0.08**	**-0.04**	**0.01**
AQ	**0.28**		**0.12**	**0.08**	**0.28**	**0.05**	**-0.02**	0.00
Persistence	**0.19**	**0.14**		**0.10**	**0.10**	**0.03**	**0.03**	0.00
Predict	**0.18**	**0.11**	**0.11**		**0.31**	**0.15**	**0.02**	-0.00
Smooth	**0.22**	**0.38**	**0.09**	**0.28**		**0.11**	**0.01**	**0.01**
Relevance	**0.08**	**0.04**	**0.04**	**0.16**	**0.13**		**0.35**	**0.01**
Timeliness	**-0.04**	**-0.03**	**0.02**	**0.04**	**0.02**	**0.35**		0.00
Conservatism	**0.02**	**0.01**	**0.01**	0.00	**0.03**	**0.07**	0.01	

Panel B: Marginal asset test controlling for other earnings quality measures

Panel B reports results from an OLS regression of annual excess stock returns on R^2, firm characteristics and earnings quality measures. Columns (1) to (7) add one earnings measure at a time and interact the earnings quality measures with ΔNA. Column (8) adds all seven earnings quality measures together and interact all earnings quality measures with ΔNA. We include all control variables in Table 3, Panel B. All standard errors are two-way clustered by both firm and year. T-statistics are presented underneath the coefficient estimates. ***, **, and * denote significance levels for two-sided tests at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				$R_{i,t}$-$R_{i,t}^{B}$				
ΔNA_t	0.296***	0.301***	0.292***	0.318***	0.289***	0.294***	0.301***	0.255***
	(11.95)	(14.87)	(9.11)	(13.47)	(16.71)	(13.58)	(14.04)	(7.68)
$\boldsymbol{R^2*\Delta NA_t}$	**0.181*** **	**0.173*** **	**0.174*** **	**0.167*** **	**0.165*** **	**0.177*** **	**0.177*** **	**0.187*** **
	(5.59)	**(6.64)**	**(6.37)**	**(6.55)**	**(6.28)**	**(5.78)**	**(5.79)**	**(5.49)**
$AQ*\Delta NA_t$	-0.066							-0.061
	(-0.30)							(-0.28)
$Persistence*\Delta NA_t$		-0.009						-0.000
		(-0.97)						(-0.03)
$Predict*\Delta NA_t$			-0.009					-0.034
			(-0.57)					(-1.58)
$Smooth*\Delta NA_t$				0.019				0.016
				(1.29)				(0.75)
$Relevance*\Delta NA_t$					0.0324			0.050
					(1.20)			(1.25)
$Timeliness*\Delta NA_t$						0.016		-0.003
						(0.82)		(-0.10)
$Conservatism*\Delta NA_t$							0.000	0.000
							(0.21)	(0.45)
Business fundamental variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	66,511	85,652	85,652	85,652	85,497	74,951	74,943	66,200
adj. R-sq	0.264	0.267	0.268	0.267	0.268	0.263	0.263	0.266