Consistency As a Path to Comparability: Benefits and Costs

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Abstract

This paper analyzes the benefits and costs of consistency-based financial statement comparability. Modeling comparability as firms' required propensity to adopt common accounting methods, we show that it creates information spillover among firms through correlated accounting measurements ("spillover informativeness") while reducing firms' own reporting precision ("standalone informativeness"). The model generates two testable predictions. First, firms' fundamental correlation diminishes the information gains via spillover informativeness. Second, fundamental volatility exacerbates the information losses via standalone informativeness. To test these predictions, we use the measure of De Franco, Kothari, and Verdi (2011), which strictly increases with our defined comparability, and examine its effect on implied volatility at annual earnings announcements. In support of the model, comparability's net information benefits decrease when firms' stock returns are highly correlated and/or volatile. These results are robust to using financial crises and industry merger waves as instrumental variables for fundamental correlation and fundamental volatility, respectively. Overall, this paper provides a framework for studying comparability and highlights the offsetting effects of comparability on earnings informativeness.

JEL classification: G01; G14; G18; M40; M41; M48

Key words: Financial Statement Comparability; Earnings Informativeness; Spillover Informativeness; Standalone Informativeness; Implied Volatility; Fundamental Correlation; Fundamental Volatility; Financial Crisis; Recession; Merger Waves

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1 Introduction

Across the globe, accounting regulators, educators, and practitioners repeatedly stress the beneficial role of comparability in financial reporting because it arguably enhances the usefulness of financial statements in facilitating investors' decision making (e.g., Statement of Financial Accounting Concepts (SFAC) No. 8, 2010). But what is comparability? In general, comparability is portrayed as a characteristic of financial reporting that enables like things to look alike and different things to look different (SFAC No. 8, 2010). There is, however, a paradox inherent in this notion of comparability. This paradox is illustrated by Sunder (1997, 2010): On the one hand, applying the criterion of making like things look alike would lead economic transactions to being grouped into a few categories or even a single one because any pair of transactions will likely have something in common. On the other hand, applying the criterion of making different things look different would yield no categorization and no aggregation because in the extreme, a pair of transactions have to be exactly identical in all respects to qualify for the same accounting treatment. As Sunder (2010, p.101) states, the irreconcilable paradox between these two criteria gives rise to "a fundamental difficulty in defining and attaining uniformity and comparability in accounting."

This difficulty explains why standard setters resort to consistency to achieve comparability, with consistency defined as the use of the same accounting methods across time periods and entities. In fact, the Financial Accounting Standards Board (FASB) (and the International Accounting Standards Board (IASB)) holds the view that "Comparability is the goal; consistency helps to achieve that goal" (SFAC No. 8, 2010, p.19). This view is well reflected in the recent development of accounting standard setting. Over the past three decades, multiple efforts have been put forward to bolster comparability by requiring the adoption of common accounting methods and limiting allowable alternatives (e.g., the IASB's push for global adoption of International Financial Reporting Standards (IFRS)).[1] Does the approach of achieving comparability via consistency indeed create information benefits? Might this approach also entail information costs? This paper investigates these questions. We first

[1]For more examples of the practical measures implemented to improve comparability via consistency, see the FASB's summary of a history on comparability in international accounting standards (available at http://www.fasb.org/jsp/FASB/Page/SectionPage&cid=1176156304264) .

build a model in which comparability is defined and its information benefits and costs are articulated, and then proceed to test the empirical implications of the model.

The model is a one-period reporting game with a social planner and two firms. The social planner sets the accounting policy to maximize the informativeness of firms' earnings reports. In setting this policy, the social planner prescribes a common accounting method for both firms but also allows them to use an idiosyncratic method. She then chooses the extent to which the two firms are required to adopt the common method. The social planner's propensity to require firms' adoption of the common method (as opposed to an idiosyncratic method) represents our key theoretical construct of interest, "consistency-based" financial statement comparability (or just comparability for brevity). We model earnings informativeness as the inverse of the conditional variance of firms' economic fundamentals. This objective function captures the level of certainty with which firm value can be estimated and reflects the FASB's view that comparability should serve to make financial statements informative.

Our model illustrates the offsetting effects of comparability on earnings informativeness. When firms adopt common accounting methods, their financial statements become more comparable, which allows one firm's report to be informative about another firm's fundamentals through correlated accounting measurements. For this reason, comparability can indeed increase earnings informativeness. We refer to this effect of comparability as the "spillover informativeness" channel. However, higher comparability also indicates that the firm is restricted to using a common method even in situations where an idiosyncratic method is more informative about the firm's fundamentals. As a result, comparability potentially decreases earnings informativeness by lowering firms' own reporting precision. We refer to this effect of comparability as the "standalone informativeness" channel.

To test for these information effects of comparability, we draw two predictions from the model. The first prediction is that the net information benefits of comparability decrease as the correlation between a firm's fundamentals and the fundamentals of its industry peers increases. Although the information spillover that we focus on is through firms' correlated accounting measurements (which are affected by comparability), firms' reports are also informative about one another's fundamentals through correlated fundamentals themselves. As the correlation between firms' fundamentals increases, financial statement users can rely more on this correlation than the correlation between firms' accounting measurements, reducing the information gains from increasing comparability via the spillover channel.[2]

The second prediction is that the net information benefits of comparability also decrease as the volatility of the firm's fundamentals increases. When a firm's fundamental volatility is high, financial statement users have a very imprecise prior about the firm's value and need to rely more on its individual report to infer fundamentals. This increases the benefits of firms using idiosyncratic accounting methods that are potentially more informative, and thus the costs of comparability via the standalone channel. Evidence in support of these predictions would be consistent with the two separate information effects of comparability that we model.

We begin our empirical analysis by examining the average effect of comparability on firms' earnings informativeness. This sets the baseline for the subsequent cross-sectional analyses, which are more central to our inferences. To capture comparability, we use the De Franco, Kothari, and Verdi (2011, hereafter DKV) measure and prove it to be strictly increasing with firms' required propensity to adopt common accounting methods within our framework.[3] We use the implied volatility of exchange traded options to proxy for the conditional variance of firms' economic fundamentals, which is the inverse of earnings informativeness.

Using a sample of U.S. firms between 1996 and 2013, we find a negative association between the DKV comparability measure (estimated using the past 16 quarters of earnings and stock returns) and implied volatility (measured two days after the annual earnings announcements). This finding is robust to using several variants of the DKV measure and controlling for industry and year fixed effects in addition to a long list of controls. The association is statistically significant but the economic magnitude is modest. A one standard deviation increase in comparability is associated with a 1.35 percentage point decrease in implied

[2] In the extreme, when the correlation between firms' fundamentals is one, perfectly comparable accounting would result in two perfectly correlated accounting reports that produce no incremental information over one another. Since both fundamentals are unknown, less comparable accounting is preferable in such case because it would result in two imperfectly correlated reports, with each report providing incremental information.

[3] DKV measure is an output-based comparability measure that does not rely on firms' actual choices of accounting measurements. In Section 3.1, we discuss the advantages of the DKV measure over the existing input-based comparability measures as well as its limitations.

volatility, which corresponds to 3.45% of the mean implied volatility in our sample. It suggests that comparability, on average, improves the informativeness of firms' annual financial statements for the sample that we examine.

To test the first prediction, we measure the correlation of fundamentals as the correlation coefficient between the firm's daily returns during a fiscal year and the corresponding daily returns of the value-weighted portfolio of the firm's industry. As predicted, the negative association between comparability and implied volatility at annual earnings announcements, which is suggestive of a beneficial effect of comparability on earnings informativeness, is significantly weaker when a firm's fundamental correlation with its industry peers is high. To test the second prediction, we measure the volatility of a firm's fundamentals as the standard deviation of the firm's daily stock returns during a fiscal year. The results are again consistent with the prediction. The beneficial effect of comparability on earnings informativeness dissipates when a firm's fundamental volatility is high.

One concern with using the two proxies defined above to test our model predictions is that they may be correlated with omitted variables (such as investor sophistication) that affect the sensitivity of earnings informativeness to comparability. We adopt an instrumental variables (hereafter, IV) approach in an effort to address this endogeneity concern. First, we use the recent financial crisis as an IV for firms' fundamental correlation. This IV is motivated by prior literature, which shows that firms' stock returns are more correlated with the market during recession periods (e.g., Ang and Chen (2002) and Hong, Tu, and Zhou (2007)). Consistent with this literature, we observe an increase in the within-industry correlation of firms' stock returns during 2008 and 2009. While highly correlated with firms' fundamental correlation, financial crises are unlikely to directly affect the sensitivity of earnings informativeness to comparability. The results instrumenting fundamental correlation with an indicator for crisis periods continue to suggest that the beneficial effect of comparability on earnings informativeness weakens when fundamental correlation is high.[4]

Second, we use the presence of a merger wave in a firm's industry during a year as an IV for the firm's fundamental volatility during that year. Jovanovic and Rousseau (2002, 2008)

[4]This result is robust to including 2001 as an additional recession year, thus covering all recession years during our sample period as defined by the National Bureau of Economic Research (NBER).

analytically show that industry merger waves reflect increases in growth dispersion (i.e., higher fundamental volatility). Further, significant changes in firms' fundamental volatility are often preceded by economic, regulatory, or technological shocks. Harford (2005) finds that these shocks also drive industry merger waves, making these waves suitable candidates to capture exogenous variation in firms' fundamental volatility. We first show that industry merger waves are strong indicators of increases in firms' fundamental volatility, confirming their relevance as an IV. They are, however, unlikely to directly alter the sensitivity of earnings informativeness to comparability. The results from the IV regressions show that fundamental volatility, as instrumented by the industry merger waves, also diminishes the beneficial effect of comparability on earnings informativeness.

In robustness checks, we further assess the relation between earnings informativeness and comparability, as well as the effect of fundamental correlation and fundamental volatility on this relation, using three modifications of the DKV measure. First, we reestimate the measure using operating cash flows rather than stock returns to proxy for firm fundamentals as in Fang, Maffett, and Zhang (2015). The cash flow-based DKV measure alleviates the concern that there may be a mechanical relation between implied volatility and the unmodified DKV measure since both use stock returns as inputs in their calculation. Second, we account for the asymmetric timeliness of earnings by including an indicator variable to denote negative stock returns and the interaction between this indicator and stock returns in the estimation of the measure (e.g., Basu (1997)). Third, we consider the possibility that price might lead earnings by including lagged returns in the estimation of the measure as in DKV. Results using these three modified measures are similar to those previously reported.

This study makes three important contributions to the literature. First, we build a model to define financial statement comparability and analyze its benefits and costs. Comparability is listed among the most desirable characteristics of financial reporting just below "relevance" and "faithful representation." While the latter two are extensively studied in the theoretical literature (e.g., Fischer and Verrecchia (2000), Dye and Sridhar (2004), and Gigler, Kanodia, Sapra, and Venugopalan (2014)), comparability is generally overlooked. We contribute to this literature by deriving a model that closely reflects the approach taken by the FASB and other accounting regulators to accomplish comparability. The information perspective that we take in analyzing its benefits and costs is also consistent with the FASB's defined objective of general purpose financial reporting, which is to provide financial statement users useful information to facilitate their decision making. The model guides our own analysis, and potentially provides a framework for future research on comparability. It is noteworthy that our definition of comparability is distinct from the notion of uniformity that prior theories study (e.g., Dye and Verrecchia (1995), Dye and Sridhar (2008), and Chen, Lewis, Schipper, and Zhang (2017)). Although both concepts concern firms' use of accounting methods, comparability emphasizes the propensity required of firms to adopt common methods while uniformity refers to the rigidity of the range of admissible methods.[5]

Second, our model serves as a bridge linking various measures of comparability used in the growing empirical literature that examines the economic determinants and consequences of comparability. Earlier studies in this literature tend to use input-based comparability measures (e.g., Ashbaugh and Pincus (2001), Young and Guenther (2003), Bradshaw, Bushee, and Miller (2004), Bae, Tan, and Welker (2008), and Bradshaw and Miller (2008)), while more recent studies focus on output-based comparability measures (e.g., DKV, Barth, Landsman, Lang, and Williams (2012), and Fang, Maffett, and Zhang (2015)). An obvious advantage to input-based measures is that they more closely match the theoretical definition of consistency-based comparability. However, as discussed in DKV, researchers face various challenges in constructing input-based measures. Our model helps reconcile input- and output-based measures. In particular, we provide theoretical justification for the popular DKV measure as a reasonable proxy for input-based measures within our framework because it strictly increases with firms' required propensity to adopt common accounting methods.

Finally, as Bertomeu, Beyer, and Taylor (2016) note, the use of a formal model is particularly useful in drawing causal inferences when there are multiple economic forces present and when these forces are not separately observable in the data. Indeed, while comparability

[5] Dye and Verrecchia (1995, p.393) define uniformity as "the ranges of...procedures allowed under GAAP, as well as whether the manager opportunistically exploits any freedom in his reporting choice." To better illustrate the difference between comparability and uniformity, consider a change in the social planner's policy that allows both firms in our model to use an additional idiosyncratic method for reporting while holding constant the propensity required of them to adopt the common method. In this case, the level of uniformity as Dye and Verrecchia (1995) define decreases while the level of comparability as we model remains unchanged.

might manifest in multiple information effects, our model allows us to formally identify one source of its information benefits, i.e., spillover through correlated accounting measurements, which is often intuitively described in prior studies.[6] The model also highlights one information cost of comparability; that is, it potentially impairs firms' own reporting precision.[7] Admittedly, it is difficult to directly document the two information effects of comparability in the data, so we mainly rely on the comparative statics of the model to parse them out. Consistent with the existence of two separate effects, we show that comparability's net information benefits decrease when firms' fundamentals are highly correlated and also when they are more volatile.

These results carry policy implications. True comparability is difficult to obtain, either conceptually or practically. As a result, standard setters mandate the consistent use of accounting methods to accomplish comparability. Our study sends a cautionary note: This approach leads to both information gains and losses. In fact, it can be counterproductive in certain economies (particularly those that feature high fundamental correlation or volatility), and standard setters should carefully weigh the benefits and costs of such regulations.

2 A model of comparability

2.1 Model setup and the definition of comparability

We set up a one-period reporting game that features a social planner (e.g., an accounting regulator) and two firms (indexed by 1 and 2, respectively). The social planner sets a policy that regulates firms' accounting measurements. In accordance with the policy, each firm discloses a public report about its earnings for the period.

[6] Prior studies identify numerous benefits of comparability. They find that comparability improves analyst forecast accuracy and precision (Ashbaugh and Pincus (2001), DKV), increases foreign investment (DeFond, Hu, Hung, and Li (2011)), facilitates transnational information transfer and capital mobility (Young and Guenther (2003), Wang (2014)), promotes efficient acquisition decisions (Chen, Collins, Kravet, and Mergenthaler (2015)), raises liquidity and institutional ownership (Lang and Stice-Lawrence (2015)), lowers borrowing costs (Fang, Li, Xin, and Zhang (2016)), and decreases future stock price crash risk (Kim, Li, Lu, and Yu (2016)).

[7] The FASB's conceptual framework for financial reporting partially recognizes this potential tradeoff. SFAC No. 8 (2010, p.21) writes that "Sometimes, one enhancing qualitative characteristic may have to be diminished to maximize another qualitative characteristic. For example, a temporary reduction in comparability as a result of prospectively applying a new financial reporting standard may be worthwhile to improve relevance or faithful representation in the longer term. Appropriate disclosures may partially compensate for noncomparability."

The report that firm i discloses is $r_i = v_i + \varepsilon_i$, with v_i representing the firm's fundamental earnings and ε_i representing the measurement noise in the firm's reporting system. The fundamental earnings v_1 and v_2 are both drawn from a normal distribution with mean $\bar{v}$ and variance σ_v^2; we assume that they are correlated with coefficient $\rho_v \in [-1, 1]$. The noise term ε_i depends on the accounting measurements used by firm i, which are regulated by the social planner. For simplicity, we assume that there are two available accounting methods for measuring earnings: Method A is prescribed by the social planner and generates a common measurement noise δ for both firms, and method B is firm-specific and generates an idiosyncratic measurement noise η_i. Both δ and η_i are normally distributed, with mean zero and variance σ_δ^2 and σ_η^2, respectively. They are independent of each other as well as v_i. The social planner sets m_i, the portion of earnings that firm i accounts for using method A. The total measurement noise of firm i's earnings report is thus:[8]

$$\varepsilon_i = m_i \delta + (1 - m_i)\eta_i, m_i \in [0, 1]. \tag{1}$$

The variable m_i, which reflects the social planner's propensity to require firms' adoption of the common method (as opposed to an idiosyncratic method), represents our key theoretical construct of interest, consistency-based financial statement comparability.[9]

We assume that, in setting comparability m_i, the social planner seeks a pair of $\{m_1, m_2\}$ that minimize the sum of the two firms' conditional variances of fundamental earnings:

$$\{m_1^*, m_2^*\} = \arg\min_{m_1, m_2} var(v_1 | r_1, r_2, m_1, m_2) + var(v_2 | r_1, r_2, m_1, m_2). \tag{2}$$

[8] A key assumption we make in modelling the process of accounting measurement is that the final accounting report is an aggregate of the measurement that results from all accounting methods. This relates our model to the extensive literature on aggregation (e.g., Arya, Glover, and Mittendorf (2006), Caskey and Hughes (2011), Fan and Zhang (2012), Beyer (2013), and Bertomeu and Marinovic (2016)). Separately, note that we model the total accounting noise as the weighted average of a common component δ and an idiosyncratic component η_i. This structure is similar to the one employed in Dye and Sridhar (2008), which examine a different issue on rigid versus flexible accounting standards.

[9] This definition of comparability is related to, but different from, that in Wang (2015). In her model, comparability is defined as the correlation between firms' measurement errors. Our model further differs from Wang's (2015) in two important aspects. First, we examine a simultaneous reporting model while she examines a model in which firms report sequentially. Second, investors are fully rational in our model; they use all firms' earnings reports in pricing and seek to maximize the expected terminal cash flows. In contrast, Wang (2015) makes two behavioral assumptions that investors use only a firm's own report in pricing and that investors care about short-term prices rather than terminal cash flows.

In the analysis below, the conditional variance $var(v_i|r_1, r_2, m_1, m_2)$ continues to be a function of both r_i and m_i; we use a shorter notation $var(v_i|r_1, r_2)$ for conciseness.

2.2 Discussion of model assumptions

Several of our model assumptions warrant discussion. First, our model assumes that δ and η_i, the measurement noises that result from applying different accounting methods, are independent of each other as well as firm fundamentals v_i. These assumptions are made to simplify our analysis, but the particular trade-off between the information benefits and costs of comparability that we focus on is likely to persist if we relax these assumptions.

Second, while we assume that δ, the noise from applying the common method, is the same for both firms, we verify that our model predictions hold qualitatively even if the measurement noises from this method differ (i.e., $\delta_1 \neq \delta_2$) as long as δ_i are positively correlated. A natural question arises here: How can δ_i be independent of firm fundamentals but yet are positively correlated with each other? To illustrate this possibility, consider a firm that makes toothbrushes and another one that makes mouse pads. Since both firms produce small, generic products, they assume first-in, first-out (FIFO) about the flow of their inventories to estimate cost of goods sold (COGS). This assumption does not necessarily match the actual flow of the specific units being shipped. In periods of inflation, the application of the FIFO method likely underestimates COGS for both firms. As a result, the two firms' use of FIFO as the common method results in a positive correlation between the measurement noises in their estimation of COGS because both noises are affected by the inflation rate, even though the two firms' inflation-adjusted fundamentals may be uncorrelated.

Turning to the social planner's objective function, we assume that she seeks to minimize the aggregate uncertainty of firms' fundamentals conditional on their reports (which is modeled as the sum of the two conditional variances). This objective function reflects our focus on the *information* benefit and cost of comparability, as well as the objective of general purpose financial reporting, which as the FASB defines, is to "provide financial information about the reporting entity that is useful to existing and potential investors, lenders, and other creditors in making decisions about providing resources to the entity." (SFAC No. 8, 2010, p.1).

Our choice of the social planner's objective function can be micro-founded in a number of ways. For example, consider a setting in which a risk-neutral investor chooses an investment decision k_i to maximize his expected payoffs $E\left[k_i v_i - \frac{k_i^2}{2}|r_1, r_2\right]$, after observing the two firms' reports $\{r_1, r_2\}$. In this payoff function, $k_i v_i$ captures his benefits from making k_i units of investment in firm i, and $\frac{k_i^2}{2}$ represents his investment costs. The investment costs could be related to his capital raising in an imperfectly competitive capital market. In such a market, the supply curve of capital is increasing in the cost of capital, which makes the marginal cost of capital increasing in the amount that the investor borrows. As a result, the investment cost is convex. Because the investor cannot observe the realization of firms' fundamental earnings, he benefits from reports with higher informativeness (or lower conditional variance, i.e., $var(v_i|r_1, r_2)$). We can verify that the investor's ex ante investment payoffs reduce into $\frac{\bar{v}^2+\sigma_v^2-var(v_i|r_1,r_2)}{2}$ and strictly decrease with $var(v_i|r_1, r_2)$. Therefore, the social planner maximizes the investor's welfare by minimizing the sum of conditional variances.[10]

Finally, we note that our model abstracts away from an important feature of financial reporting, bias. Introducing a constant bias into firms' reports (as in Stein (1989)) does not alter our inferences below because such bias is unravelled and has no effect on the informativeness of firms' reports. Introducing a random bias (e.g., Fischer and Verrecchia (2000), Dye and Sridhar (2004)) does allow the bias to influence reporting informativeness. While comparability might affect firms' incentives to bias their reports, it is beyond the scope of this study. To the extent that the effect of comparability on bias is at least partly orthogonal to the effects of comparability on informativeness that we model, our inferences remain valid.

2.3 The trade-off between spillover and standalone informativeness

We now turn to analyzing the benefits and costs of the comparability defined in Section 2.1. Since the two firms are symmetric in our model, their levels of comparability as well as their levels of informativeness should be equal in equilibrium, i.e., $m_1^* = m_2^*$ and $var^*(v_1|r_1, r_2) =$

[10] Alternatively, one can assume that the investor is risk-averse with a constant absolute risk aversion (CARA) utility, $E\left[-e^{-\tau k_i v_i}|r_1, r_2\right]$. Since all random variables in our model are normally distributed, the investor's expected payoffs equal $E[v_i|r_1, r_2]\, k_i - \frac{\tau}{2}k_i^2 var(v_i|r_1, r_2)$. We can verify that the investor's ex ante investment payoffs reduce into $\frac{1}{2\tau}\left(\frac{\bar{v}^2+\sigma_v^2}{var(v_i|r_1,r_2)} - 1\right)$ and also strictly decrease with $var(v_i|r_1, r_2)$.

$var^*(v_2|r_1, r_2)$. For this reason, to solve for $\{m_1^*, m_2^*\}$ that maximize the total informativeness of the two firms' reports, it is without loss of generality to first set $m_1 = m_2 = m$ and then choose m to minimize the $var(v_i|r_1, r_2)$ of a single firm's report. Taking the derivative of $var(v_i|r_1, r_2)$ with respect to m gives the first order condition (F.O.C.):

$$\frac{dvar(v_i|r_1, r_2)}{dm} = \frac{\partial var(v_i|r_1, r_2)}{\partial \sigma_{\varepsilon_1 \varepsilon_2}} \frac{\partial \sigma_{\varepsilon_1 \varepsilon_2}}{\partial m} + \frac{\partial var(v_i|r_1, r_2)}{\partial \sigma_{\varepsilon}^2} \frac{\partial \sigma_{\varepsilon}^2}{\partial m} = 0. \tag{3}$$

The F.O.C. depicts two channels through which comparability affects the conditional variance of firms' earnings reports. The first term of the solution to $\frac{dvar(v_i|r_1,r_2)}{dm}$ shows that an increase in m affects $var(v_i|r_1, r_2)$ through $\sigma_{\varepsilon_1 \varepsilon_2}$, the covariance between two firms' measurement noises. The second term shows that such an increase affects $var(v_i|r_1, r_2)$ through σ_{ε}^2, the inverse of the firms' own reporting precision. Again, we label the two effects of comparability on earnings informativeness the spillover informativeness channel and the standalone informativeness channel, respectively.

Interestingly, these two effects of comparability offset each other in equilibrium. To see this, first consider the case in which the correlation coefficient of the firms' measurement noises (denoted as ρ_ε) exceeds ρ_v, the correlation coefficient of firms' fundamentals. With $\rho_\varepsilon > \rho_v$, $var(v_i|r_1, r_2)$ decreases with ρ_ε (i.e., $\frac{\partial var(v_i|r_1,r_2)}{\partial \sigma_{\varepsilon_1 \varepsilon_2}} < 0$) because a higher ρ_ε allows one to better infer v_i through the more correlated noises. Since ρ_ε strictly increases with m (i.e., $\frac{\partial \sigma_{\varepsilon_1 \varepsilon_2}}{\partial m} > 0$), the first term of the solution to $\frac{dvar(v_i|r_1,r_2)}{dm}$ is negative. The first term thus points to a beneficial role of comparability: It potentially enhances the usefulness of financial reporting by making firms' reported earnings more informative about one another's fundamental earnings.

However, increasing comparability is not costless. As we prove in Appendix A, the optimal level of m that minimizes the conditional variance is beyond the level that minimizes individual firms' reporting precision σ_ε^2. As a result, σ_ε^2 increases with m, or $\frac{\partial \sigma_\varepsilon^2}{\partial m} > 0$. Since $var(v_i|r_1, r_2)$ strictly increases with σ_ε^2 (i.e., $\frac{\partial var(v_i|r_1,r_2)}{\partial \sigma_\varepsilon^2} > 0$), the second term of the solution to $\frac{dvar(v_i|r_1,r_2)}{dm}$ is positive.[11] This term thus highlights a potential cost of comparability.

[11] As an alternative way to derive this, note that because the F.O.C. equals zero in equilibrium, the second term must be positive with the first term being negative (when $\rho_\varepsilon > \rho_v$ is met).

Intuitively, this cost arises because a higher m, while increasing the spillover informativeness of firms' earnings reports, limits the use of firm-specific accounting measurements that potentially increase the precision of individual firms' own reports.

The analysis above illustrates the potential information benefits and costs of comparability assuming $\rho_{\varepsilon} > \rho_{v}$. When this assumption is met, increasing comparability improves spillover informativeness at the expense of standalone informativeness. The assumption seems reasonable because it is arguably easier to mandate the use of similar accounting policies and procedures to achieve a high correlation between firms' measurement noises than to alter the correlation between firms' fundamentals directly. Further, ρ_{ε} is positive by construction while ρ_{v} could very well be negative. It is noteworthy that this assumption is not critical for our analysis: If $\rho_{v} > \rho_{\varepsilon}$, the two effects of comparability on earnings informativeness still counteract each other, except that increasing comparability improves standalone informativeness at the expense of spillover informativeness.

An interesting observation from our analysis above is that although the level of comparability chosen by the regulator entails information costs in equilibrium, leaving the choice of comparability to firms themselves does not necessarily result in the socially optimal outcome. To see this, note that the two informativeness channels contain both an informational effect on an individual firm itself and an externality effect on the other firm. First, consider the spillover informativeness channel. When firm 1 increases its usage of the common method to increase $\sigma_{\varepsilon_1 \varepsilon_2}$, this reduces not only its own conditional variance but also the conditional variance of firm 2 (a positive externality). Second, consider the standalone informativeness channel. When firm 1 decreases its own reporting precision, it increases not only its own conditional variance but also the conditional variance of firm 2 (a negative externality). Since firms cannot internalize the externalities that fall upon others, their private choices of comparability that maximize their own reporting informativeness will not coincide with the socially optimal choices made by the social planner.

2.4 The net benefits of comparability and testable predictions

Section 2.3 shows that comparability has two separate effects on earnings informativeness. The first effect arises via the spillover informativeness channel as comparability can facilitate information transfer by enhancing the correlation between firms' accounting measurements. The second effect arises via the standalone informativeness channel as comparability might impair firms' own reporting precision. It is difficult to directly test for either effect, because empirically we observe comparability's net information benefits rather than its information gains and losses via separate channels. Nevertheless, to probe the dynamics of comparability's offsetting effects on informativeness, we draw two predictions from our model by analyzing how the net information benefits of comparability vary with certain model parameters in equilibrium. We again assume $\rho_\varepsilon > \rho_v$, which is likely to be a realistic assumption.

We focus our analysis on two properties of v_i, because they are tightly linked to the real economy and potentially measurable. First, the correlation between v_1 and v_2 negatively affects comparability's net information benefits. That is, $\frac{dvar(v_i|r_1,r_2)}{dm}$ increases with ρ_v. The intuition behind this prediction is as follows: Firms' earnings reports are informative about one another's fundamentals not only through ρ_ε, the correlation between two firms' measurement noises (which we refer to as the spillover informativeness channel), but also through ρ_v, the correlation between their fundamental earnings. When ρ_v is low, the information gains from increasing comparability are high because financial statement users mainly rely on correlated measurement noises to infer firm fundamentals through the spillover informativeness channel. However, as ρ_v increases, this channel becomes less valuable because one can gradually rely more on correlated fundamentals and less on correlated noises to infer firm fundamentals. Second, the variance of v_i also negatively affects comparability's net information benefits. That is, $\frac{dvar(v_i|r_1,r_2)}{dm}$ increases with σ_v^2. To see this, note that although σ_v^2 does not affect the information benefits of comparability from the spillover informativeness channel, it does increase the costs of comparability from the standalone informativeness channel. This is because when σ_v^2 is high, one has a very imprecise prior about v_i and relies heavily on the information he/she can learn from the firm's own earnings report. As discussed earlier, increasing comparability potentially reduces the precision of the firm's own report. Such information losses, if any, are heightened for firms with higher σ_v^2.

The detailed proofs of the two predictions are in Appendix A. In the empirical analyses that follow, we first examine the average effect of comparability on firms' information environment in Section 4.1. Building on the average effect, we then proceed to test the implications of the two predictions in Section 4.2 and Section 4.3. It is worth noting that the analyses reported in these two sections are joint tests of the predictions and the underlying assumption of $\rho_\varepsilon > \rho_v$; in particular, the proofs show that $\rho_\varepsilon > \rho_v$ is a sufficient and necessary condition for $\frac{\partial}{\partial \sigma_v} \frac{dvar(v_i|r_1,r_2)}{dm} > 0$ (the comparative static underlying our second prediction).

3 Variable measurement, data, and sample

This section first provides a brief summary of the existing comparability measures and theoretical justification for the DKV comparability measure in our framework. It then describes the data sources and sampling procedures that we use to construct the main variables used in our analysis. Finally, it reports the descriptive statistics for the main variables. Detailed variable definitions are in Appendix B.

3.1 Measuring comparability

In our model, comparability is defined as m_i, the firm's required propensity to adopt a common accounting method. Indeed, consistent with this notion of comparability, measures used by earlier studies intend to capture the degree of consistency in firms' application of accounting methods. For example, Ashbaugh and Pincus (2001) compare differences in financial reporting across 13 countries based on eight disclosure requirements and four measurement rules relative to the International Accounting Standards (IAS). Young and Guenther (2003) study financial reporting differences across 23 countries based on 15 accounting disclosure requirements. Bae, Tan, and Welker (2008) code the differences in 21 accounting rules for each country-pair among the 49 countries in their sample. Bradshaw, Bushee, and Miller (2004) and Bradshaw and Miller (2008) measure firm-level comparability as non-U.S. firms' compliance with the U.S. GAAP based on 13 accounting method choices.

These input-based comparability measures, however, face significant challenges. As DKV (2011, p. 898) note, "Using these input-based measures can be challenging because researchers must decide which accounting choices to use, how to weight them, how to account for variation in their implementation, etc. In addition, it is often difficult (or costly) to collect data on a broad set of accounting choices for a large sample of firms."[12] Hence, they propose an output-based comparability measure.

The DKV comparability measure builds on the idea that an accounting system serves to map economic events to the financial statements and thus two firms' reporting practices are comparable if their accounting systems produce similar financial statement figures given a set of economic events. In other words, the DKV measure is closest to the notion of comparability such that like things look alike and different things look different. To gauge the economic foundation of this measure, we first assess it within our framework. Fitting the DKV measure into our model, we obtain:

$$r_1 = f_1(v_1) = v_1 + \varepsilon_1, \tag{4}$$

$$r_2 = f_2(v_2) = v_2 + \varepsilon_2. \tag{5}$$

Substituting v_1, the economic fundamentals of firm 1, into equation (5) gives:

$$r_1' = f_2(v_1) = v_1 + \varepsilon_2. \tag{6}$$

Based on the construction of the DKV measure, we can then write it as:

$$COMP = -E(r_1' - r_1)^2 = 2\sigma_{\varepsilon_1\varepsilon_2} - \sigma^2_{\varepsilon_1} - \sigma^2_{\varepsilon_2}. \tag{7}$$

Equation (7) gives a mathematical expression of the DKV comparability measure, which we denote $COMP$.

[12] Out of these listed challenges, quantifying variation in the implementation of accounting choices is particularly difficult because even if a common method is used to account for an economic transaction, it is still difficult to observe the degree of similarity in its application. This issue is heightened in settings where the accounting standards promote highly uniform measurements to begin with, such as the U.S. For this reason, the studies cited above focus on capturing similarity/dissimilarity across international accounting standards.

Our particular interest is in how the DKV measure varies with m_i. Again, note that m_1^* equals m_2^* in a symmetric equilibrium. Denote $m^* = m_1^* = m_2^*$ and substitute it into equation (7), we simplify $COMP$ below as:

$$\begin{aligned} COMP &= -E\left(r_1' - r_1\right)^2 \\ &= 2\left(m^*\right)^2 \sigma_\delta^2 - 2\left[\left(m^*\right)^2 \sigma_\delta^2 + \left(1-m^*\right)^2 \sigma_\eta^2\right] \\ &= -2\left(1-m^*\right)^2 \sigma_\eta^2. \end{aligned} \tag{8}$$

Equation (8) shows that $COMP$ strictly increases with m^* because $m^* \in [0,1]$. This reasoning justifies the use of DKV measure as a proxy for m^* in our empirical tests. The analysis above also makes clear two limitations of the DKV measure. First, it defines "like" things as "identical" things. While this definition allows us to circumvent the inherent paradox in the common notion of comparability (as discussed in the introduction), it is restrictive because a pair of economic transactions are rarely identical to each other. Second, given that we define similarity as equality, equation (8) proves that the DKV measure also fits the notion of consistency-based comparability. However, the measure is not a one-to-one mapping to m^* as it is also affected by the noise that results from applying the idiosyncratic accounting method, σ_η^2.

Empirically, the DKV measure is calculated as the closeness between two firms' reported earnings of one period given one firm's stock returns for the same period. We closely follow DKV to compute the comparability measure. Specifically, for each firm i in year t (and for each firm j within the same two-digit SIC group as firm i in year t),[13] we estimate the rolling-window time-series regressions below:

$$NI_{iq} = \alpha_i + \beta_i RET_{iq} + \varepsilon_{iq}, \tag{9}$$

$$NI_{jq} = \alpha_j + \beta_j RET_{jq} + \varepsilon_{jq}. \tag{10}$$

[13] We follow DKV and limit firms i and j to those whose fiscal years end in March, June, September, or December. We also exclude from the calculation holding firms, American Depository Receipts (ADRs), limited partnerships, and firms with highly similar names. All are defined as in DKV.

The regressions are estimated using each firm's past 16 quarters of data from $q-15$ to q with quarter q being Q4 of year t. As in DKV, NI is a firm's net income before extraordinary items of a quarter scaled by market capitalization at the beginning of the quarter, and RET is the firm's stock return during the quarter. Firm financials are from the Compustat quarterly files and stock returns are from the CRSP monthly files.

The estimated coefficients from equation (9), $\hat{\alpha}_i$ and $\hat{\beta}_i$, can be viewed as a proxy for the accounting function of firm i. Similarly, $\hat{\alpha}_j$ and $\hat{\beta}_j$ estimated from equation (10) proxy for the accounting function of firm j. Applying the accounting functions estimated from equations (9) and (10) to the underlying economic events faced by firm i, we obtain the expected earnings of firm i using each firms' accounting function as follows:

$$E[NI_{iiq}] = \hat{\alpha}_i + \hat{\beta}_i RET_{iq}, \tag{11}$$

$$E[NI_{ijq}] = \hat{\alpha}_j + \hat{\beta}_j RET_{iq}. \tag{12}$$

Based on the expected earnings computed above, we define the DKV comparability measure for each firm i-firm j combination in year t, $COMP_{ijt}$, as the negative of the average absolute difference between $E[NI_{iiq}]$ and $E[NI_{ijq}]$ over the 16-quarters from $q-15$ to q:

$$COMP_{ijt} = -\frac{1}{16}\sum_{q-15}^{q} \left| E[NI_{iiq}] - E[NI_{ijq}] \right|. \tag{13}$$

Finally, we calculate our primary comparability measure for each firm i-year t, $COMP4_{it}$, as the average of the four largest values of $COMP_{ijt}$ within firm i's industry. As in DKV, we also compute two variants of $COMP4_{it}$: $COMP10_{it}$ is the average of the ten largest values of $COMP_{ijt}$ and $COMPmed_{it}$ is the median of the full set of $COMP_{ijt}$. By construction, larger values of these measures indicate greater financial statement comparability. In subsequent analyses, we also calculate three modified DKV measures to address the concern that stock returns might not be the perfect proxy for economic fundamentals.

3.2 Measuring conditional variance

The objective of the social planner in our model can be stated as maximizing information about the firm's economic fundamentals conditional on the earnings reports, or equivalently, minimizing the expected variance of the firm's fundamentals conditional on the earnings reports (i.e., $var(v_i|r_1, r_2)$). To operationalize conditional variance, we extract the implied volatility from equity option prices. Implied volatility has been commonly used as a proxy for conditional variance since the seminal work of Black and Scholes (1973). It fits well with the theoretical construct of conditional variance because option prices reflect market participants' expectations about future changes in stock price conditional on all available information.[14]

Traded equity options generally mature on the third Friday of the contract month. Because firms make their annual earnings announcements at various times during a month, the length of time between each firm's earnings announcement and the maturity of their options will differ across firms. To alleviate concerns about this non-constant maturity, we use the implied volatility from 30-day standardized option prices provided by OptionMetrics. The use of standardized option prices reduces measurement error that might arise due to variation in maturity and the extent to which the options are in-the-money (Dumas, Fleming, and Whaley (1998) and Hentschel (2003)). Specifically, we take the average of 30-day call-implied volatility and the 30-day put-implied volatility, both calculated two days after the annual earnings announcement, to capture the market's uncertainty about firm fundamentals after receiving the earnings reports. We denote the variable $IMPVOL$.

3.3 Measuring fundamental correlation and fundamental volatility

Section 2.4 yields two predictions related to the effect of comparability on the conditional variance of firm fundamentals. The first prediction posits that comparability's net information benefits (or the negative effect of comparability on the conditional variance of firm fundamentals, if any) decrease with the correlation between firms' fundamentals (ρ_v). The

[14] Prior literature generally deems implied volatility a better measure of expected conditional variance than historical volatility because implied volatility presumably subsumes all information contained in historical volatility and is thus potentially more efficient. Indeed, prior literature finds that implied volatility is an efficient and effective predictor of future realized volatility (e.g., Christensen and Prabhala (1998) and Ederington and Guan (2002)).

second prediction follows that comparability's net information benefits decrease with the volatility of firm fundamentals (σ_v^2).

To measure fundamental correlation, ρ_v, we calculate the correlation coefficient between firm i's daily returns during a given fiscal year and the corresponding daily returns of the value-weighted portfolio of the firm's industry. Stock returns are retrieved from the CRSP daily files. As in our comparability measure, we define industry at the two-digit SIC level and use stock returns to proxy for firms' economic fundamentals. We denote the resulting measure RHO. Our proxy for the volatility of firm fundamentals, σ_v^2, is the standard deviation of firm i's daily returns during a fiscal year. We denote this measure $SIGMA$.

Because RHO and $SIGMA$ are calculated from firms' stock returns, it is possible that our cross-sectional tests are subject to endogeneity if stock returns are related to omitted variables that explain the sensitivity of conditional variance to comparability. We adopt an IV approach to address this concern and defer the discussion of this approach to Section 4.3.

3.4 Control variables

We include a vector of control variables that have been shown to be related to implied volatility, our empirical proxy for earnings informativeness. These controls are predominantly taken from Rogers, Skinner, and Van Buskirk (2009). They are the natural logarithm of the book value of total assets ($SIZE$), the ratio of the book value of equity to the market value of equity (BTM), the ratio of total liabilities to total assets (LEV), the average daily turnover over a year measured as trading volume divided by shares outstanding ($TURNOVER$), the natural logarithm of the number of analysts following the firm ($ANALYSTS$), the analyst forecast dispersion measured as the standard deviation of the latest EPS forecast issued by each analyst following the firm ($DISP$), the absolute value of the cumulative return over the three-day period centered on the annual earnings announcement date ($|RET|$), the absolute value of earnings surprise calculated as the difference between the actual earnings per share (EPS) and the latest mean analyst consensus EPS forecast scaled by the stock price two days before the earnings announcement ($|ESURP|$), an indicator variable to denote negative earnings surprise (NEG_ESURP), an indicator variable to denote loss ($LOSS$), and the 30-

day standardized implied volatility of the S&P 500 index (VIX) two days after the earnings announcement. All controls are measured as of the end of a given firm's fiscal year unless otherwise specified.

3.5 Sample selection and descriptive statistics

The sample for the main analysis, spanning from 1996 to 2013, consists of the intersection of firms covered by OptionMetrics, Compustat, CRSP, and I/B/E/S that have data available to calculate the DKV comparability measures, implied volatilities, and controls. Similar to DKV, we conduct our analysis at the firm-year level and focus on examining whether and how comparability affects the informativeness of annual earnings announcements. This empirical choice is made to ensure sufficient time-series variation in comparability measures within firms because they tend to be sticky from quarter to quarter. Our main analysis includes 11,152 annual earnings announcements by 1,836 unique firms.

Table 1 reports the descriptive statistics of the variables used in our main analysis. As shown, the average implied volatility two days after the annual earnings announcements is 0.39 for our sample firms. The average level of comparability is -0.36. The average firm has a book value of assets (in natural logarithm) of 8.03, a book-to-market ratio of 0.49, a leverage ratio of 0.56, a share turnover of 0.01, nine analysts following the firm, and analyst forecast dispersion of 0.04. In our sample, the average firm experiences an absolute cumulative three-day return around the annual earnings announcement of 5%. 15% of the sample firms report a loss and 34% report negative earnings surprise (although the average absolute price-scaled earnings surprise is very small in magnitude). The average implied volatility of the S&P 500 index two days after each earnings announcement is 0.21 during our sample period.

Table 2 presents Pearson (Spearman) correlation coefficients above (below) the diagonal for the variables used in our main analysis. Of particular interest here is the correlation between $COMP4$ and $IMPVOL$, which is negative and significant at the 1% level. This result provides preliminary evidence that comparability, on average, improves the information content of annual earnings announcements in our sample.

4 The information benefits and costs of comparability

4.1 Implied volatility and comparability: average effect

Our first regression examines the average effect of financial statement comparability on implied volatility, which depends on the trade-off between the information gains from the spillover informativeness channel and the information losses from the standalone informativeness channel in our model. Specifically, we conduct the following pooled ordinary least squares (OLS) regression analysis on a panel of firm-years:

$$IMPVOL_{i,t} = \beta_0 + \beta_1 COMP4_{i,t} + \beta_c CONTROL_{i,t} + FE_{s,t} + \varepsilon_{i,t}, \tag{14}$$

where subscript i indexes firm, s indexes industry, and t indexes year. As discussed in Section 3, $IMPVOL$ is firm i's average implied volatility measured two days after the annual earnings announcement of its year t, $COMP4$ is our primary comparability measure for firm i-year t, and $CONTROL$ is the vector of control variables for firm i-year t. $FE_{s,t}$ represents both industry fixed effects, defined at the two-digit SIC level, and year fixed effects. Standard errors are clustered by firm and year.

Column (1) of Table 3 reports the results of estimating equation (14) excluding controls. As shown, the coefficient on $COMP4$ is negative and significant at the 1% level, which suggests that financial statement comparability lowers implied volatility, or increases the information content of annual earnings announcements. In Column (2) of Table 3, we reestimate equation (14) including the controls.[15] The coefficient on $COMP4$ notably decreases in magnitude after the inclusion of controls, but it remains statistically significant at the 1% level. However, the economic significance of the coefficient is modest. A one standard deviation increase in comparability is associated with a 1.35 percentage point decrease in implied volatility, representing 3.45% of the average implied volatility in our sample. The coefficients on the controls are largely consistent with those reported by prior literature. Implied volatility is negatively associated with firm size. Controlling for size, it is positively associated

[15] In building the sample for the analysis in Table 3, we require the firm to be followed by at least two financial analysts to calculate analyst forecast dispersion, $DISP$. The results are qualitatively similar if we drop $DISP$ as a control and conduct the analysis with a larger sample.

with book-to-market ratio, leverage, and share turnover. It is also higher for annual earnings announcements with returns and surprises of greater magnitude, and for those that report negative earnings surprises and losses. As expected, the implied volatilities of our sample firms also tend to co-move with the implied volatility of the S&P 500 index.

In Columns (3) and (4), we rerun equation (14) replacing $COMP4$ with its two variants, $COMP10$ and $COMPmed$. The results are robust to using these alternative comparability measures. The significantly negative coefficient estimates confirm an average positive effect of comparability on earnings informativeness at annual earnings announcements in our sample.

4.2 Implied volatility and comparability: cross-sectional tests

The discussion in Section 2.4 leads to two testable predictions. The first prediction speaks to comparability's potential information gains via the spillover informativeness channel: Such gains are limited when firms' fundamentals are highly correlated, because firms' earnings reports are already informative of one another's fundamentals. The second prediction concerns comparability's potential losses via the standalone informativeness channel: Such losses are more likely for firms with higher fundamental volatility because financial statement users heavily rely on these firms' individual reports for information.

To test the first prediction, we augment equation (14) with RHO, our proxy for the correlation between firms' fundamentals, and its interaction with $COMP4$. The modified specification is as follows:

$$\begin{aligned} IMPVOL_{i,t} \;=\;& \beta_0 + \beta_1 COMP4_{i,t} + \beta_2 RHO_{i,t} + \beta_3 COMP4_{i,t} \times RHO_{i,t} \\ &+ \beta_c CONTROL_{i,t} + FE_{s,t} + \varepsilon_{i,t}, \end{aligned} \quad (15)$$

RHO is calculated as the correlation coefficient between firm i's daily returns during year t and the corresponding daily returns of the value-weighted portfolio of the firm's industry. We predict that $\beta_3 > 0$.

Column (1) of Table 4 presents the results of estimating equation (15). The coefficient on $COMP4$ remains significantly negative, pointing to a beneficial effect of comparability on implied volatility for an average firm in the sample. The coefficient on RHO is positive and significant at the 5% level, which is consistent with prior literature's finding that stock market volatility is high when there is strong comovement among firms' stock returns (our proxy for firms' economic fundamentals) because the risks of individual stocks are less diversifiable (e.g., Karolyi and Stulz (1996)). More importantly, the coefficient on the interaction between $COMP4$ and RHO is positive and significant at the 1% level. This result is consistent with the prediction that higher fundamental correlation reduces comparability's information gains via the spillover informativeness channel which in turn decreases its net information benefits. In terms of economic significance, if a firm's RHO is at the sample mean, one standard deviation increase in $COMP4$ is associated with 1.31 percentage points decrease in $IMPVOL$. If the firm's RHO is one standard deviation above the sample mean, the decrease in $IMPVOL$ associated with a one standard deviation increase in $COMP4$ is then 0.85 percentage points, which is 35% smaller.

We similarly test the second prediction by augmenting equation (14) with $SIGMA$, our proxy for firms' fundamental volatility, and its interaction with $COMP4$. The modified specification is as follows:

$$\begin{aligned} IMPVOL_{i,t} &= \beta_0 + \beta_1 COMP4_{i,t} + \beta_2 SIGMA_{i,t} + \beta_3 COMP4_{i,t} \times SIGMA_{i,t} \\ &\quad + \beta_c CONTROL_{i,t} + FE_{s,t} + \varepsilon_{i,t}, \end{aligned} \quad (16)$$

$SIGMA$ is the standard deviation of the firm i's daily stock returns during year t. Again, the prediction is that $\beta_3 > 0$.

The results of estimating equation (16) are reported in Column (2) of Table 4. As shown, $COMP4$ continues to exhibit a significantly negative coefficient. The coefficient on $SIGMA$ is positive and significant at the 1% level, which is not surprising given that a firm's volatility implied by its options should be positively related to the volatility of its stock returns. Again, as predicted, the coefficient on $COMP4 \times SIGMA$ is positive and significant at the 1% level. This result suggests that higher fundamental volatility increases comparability's information losses via the standalone informativeness channel which also decreases its net information benefits. Based on the coefficients in this column, if a firm's $SIGMA$ is at the sample mean, one standard deviation increase in $COMP4$ is associated with 0.71 percentage points decrease in $IMPVOL$. If the firm's $SIGMA$ is one standard deviation above the sample mean, the decrease in $IMPVOL$ associated with a one standard deviation increase in $COMP4$ is then 0.06 percentage points, representing a drastic decrease of 91%.

In Column (3) of Table 4, we report the results of estimating a specification that includes RHO, $SIGMA$, as well as both of their interactions with $COMP4$. The coefficient estimates on both interaction terms remain significantly positive. This result provides evidence that the two proxies do not subsume each other, but rather capture two separate mechanisms through which comparability's net information benefits might decrease; that is, a high RHO reduces comparability's information gains while a high $SIGMA$ increases its information losses.

4.3 Implied volatility and comparability: an IV approach

In the previous section, we use RHO and $SIGMA$ to proxy for firms' fundamental correlation and fundamental volatility. One concern with these two proxies is that they may be correlated with omitted variables (such as investor sophistication) that can also explain the sensitivity of implied volatility to comparability. In this section, we adopt an IV approach to address this endogeneity concern.

In seeking an IV for RHO, we note the strong evidence documented by prior literature that individual firms' stock returns are more correlated with overall market returns in times of economic downturns than upturns (e.g., Ang and Chen (2002) and Hong, Tu, and Zhou (2007)). Building on this evidence, we use the recent financial crisis as an IV for the correlation between firms' fundamentals, or more specifically, its empirical proxy, RHO. To the extent that the crisis does not affect the sensitivity of implied volatility to comparability (other than through its correlation with RHO), it allows us to mitigate any effects that might confound the interactive effect of RHO and comparability on implied volatility.

We define $RECESS1$, our IV for RHO, as an indicator variable that equals one if a firm's fiscal year overlaps with calendar year 2008 or 2009 and zero otherwise. It thus covers the recent financial crisis period defined by the NBER. Note that the endogenous variable of interest here is the interaction between $COMP4$ and RHO. To instrument for this interaction term, we follow a three-step approach recommended by prior literature (Wooldridge (2003, 2010) and Dikolli, Kulp, and Sedatole (2009)). Wooldridge (2003) proves that this approach generates consistent estimates of coefficients under weaker assumptions than those required by the method proposed in Heckman and Vytlacil (1998).[16]

To implement the approach, we first obtain $\widehat{RHO}$, the predicted values from an OLS regression of RHO on the IV ($RECESS1$) and all controls in equation (14). We then generate our IV for the endogenous interaction term by interacting $COMP4$ with $\widehat{RHO}$. Finally, we run a standard two-stage least squares (2SLS) model using $\widehat{RHO}$ and $COMP4 \times \widehat{RHO}$ as IVs for the two endogenous regressors RHO and $COMP4 \times RHO$, respectively.

Table 5 presents the results of the 2SLS model. Column (1) of Panel A shows the results of the first-stage regression and confirms the relevance of our IV as $RECESS1$ is highly correlated with the potentially endogenous regressor RHO. The underidentification test strongly rejects the null of no correlation between our IV and the endogenous regressor – the Cragg-Donald F-statistic is 233.92, significantly higher than the Stock and Yogo (2005) critical value of 7.03 for a 10% maximal bias of the IV estimators relative to OLS. Column (1) of Panel B presents the second-stage regression results. These results are consistent with those reported in Column (1) of Table 4 and provide additional support for the conclusion that an increase in firms' fundamental correlation, as induced by the recent financial crisis, reduces comparability's net information benefits. Column (2) of Panel A and that of Panel B present the 2SLS results using an alternative definition of recession indicator which further includes 2001 as a recession period per NBER's definition. As shown, the results using this alternative definition of the IV are qualitatively unchanged from those presented in Column (1) of both panels.

We similarly use an IV approach to address the potential endogeneity concern related to $SIGMA$, our proxy for firms' fundamental volatility. Here, we need an IV that is strongly correlated with $SIGMA$, but unlikely to affect the sensitivity of implied volatility to comparability other than through its correlation with $SIGMA$. Jovanovic and Rousseau (2002,

[16] We have also implemented the Heckman and Vytlacil (1998) method and all inferences remain unchanged.

2008) develop models in which increases in the dispersion of q ratios (which map to the fundamental volatility in our model) lead to industry merger waves. Additionally, large shifts in firms' fundamental volatility are mainly driven by economic, regulatory, and technological shocks, which also tend to drive industry merger waves (Harford (2005)). Based on these studies, we define an indicator variable $MAWAVE$ that denotes the existence of a merger wave in a firm's industry during a year as the IV for the firm's $SIGMA$ of that year. We use this IV to capture the exogenous variation in $SIGMA$ brought out by the underlying macro-level shocks to firms' fundamental volatility.

To code this variable, we closely follow the methodology of Harford (2005), which identifies 24-month industry merger wave periods within each industry-decade. Specifically, we first retrieve all merger or tender-offer bids from the Thomson Reuters' SDC platinum database between 1990 and 2014 with the transaction value of at least \$50 million. We then divide the sample years into their respective decades, i.e., 1990s, 2000s, or 2010s, and identify the 24-month period within each industry-decade that has the highest concentration of merger activity as a potential wave. Next, within each industry-decade, we simulate the distribution of a merger bid's occurrence by randomly assigning each bid from that industry-decade to a month within the decade (so the probability of assignment is 1/120th for a month in the decades of 1990s and 2000s, and 1/48th for a month in the decade of 2010s). The simulation is repeated 1000 times for each industry-decade. The periods that involve the highest 24-month concentration from each of these 1000 simulations are identified and used to form an empirical distribution. We then code a potential wave (i.e., the 24-month period with the highest concentration of merger activity within each industry-decade) as an actual wave if the concentration of merger bids during that period exceeds the 95th percentile of the simulated distribution of peak 24-month merger concentration. Finally, we define $MAWAVE$ as one if a firm's fiscal year overlaps with a merger wave in the firm's industry and zero otherwise.

We repeat the three-step 2SLS analysis using $MAWAVE$ as an IV for $SIGMA$. Panel A of Table 6 shows the first-stage regression results. As expected, the IV, $MAWAVE$, is highly correlated with the potentially endogenous regressor $SIGMA$. This result suggests that industry merger waves coincide with significant increases in its member firms' fundamental volatility. The underidentification test also confirms the relevance of the IV – the Cragg-Donald F-statistic is 2177.57, significantly higher than the Stock and Yogo (2005) critical value of 7.03 for a 10% maximal bias of the IV estimators relative to OLS. Panel B presents the second-stage regression results. These results are consistent with those reported in Column (2) of Table 4. They indicate that firms' fundamental volatility, as instrumented by the underlying macro-level shocks that also drive industry merger waves, reduces comparability's net information benefits.

4.4 Additional tests

In this section, we assess the robustness of our previous findings to three alternative definitions of the DKV measure that are also employed in the prior literature. First, following Fang, Maffett, and Zhang (2015), we reestimate the DKV measure replacing stock returns during a given quarter with the firm's operating cash flows in the quarter in the accounting system regressions (equations (9)-(10)) and in the calculation of the expected earnings (equations (11)-(12)). We denote the resulting measure $COMP4\_OCF$. The robustness checks with this measure help evaluate whether our results are sensitive to our use of stock returns to proxy for firm fundamentals. Second, we recalculate the measure including an indicator for negative stock returns and the interaction between this indicator and stock returns in both stages of the estimation, also as in Fang, Maffett, and Zhang (2015). We label this measure $COMP4\_ASYM$, which helps correct the possible bias induced by the asymmetric timeliness of earnings (Basu (1997)). Third, we further define an alternative measure, $COMP4\_PLE$, by including lagged stock returns in both stages of the estimation. As DKV point out, including lagged returns in the estimation of their measure addresses the possibility that price might lead earnings. The results replacing $COMP4$ with these three modified measures in equation (14) are reported in Columns (1)-(3) of Table 7, respectively. They are very similar to those reported in Table 3, and further confirm an average positive effect of financial statement comparability on earnings informativeness.

In Table 8, we repeat the cross-sectional tests using the three alternative comparability measures. For brevity, we only report the specification that includes RHO, $SIGMA$, as well as their interactions with the comparability measure. As shown, the coefficient estimates on both interaction terms remain significantly positive. The sole exception is that the coefficient estimate on $COMP4\_OCF \times RHO$ is marginally insignificant (t-stat=1.64). These results further support our model predictions that comparability's information benefits decrease with fundamental correlation and fundamental volatility. In untabulated analyses, we repeat the IV tests with the three variants of the DKV measure. The results are consistent with those reported in Table 5 and Table 6, and provide additional support that an increase in firms' fundamental correlation (as induced by the recent financial crisis) and an increase in firms' fundamental volatility (as instrumented by the industry merger waves) both weaken the positive effect of comparability on earnings informativeness.

5 Conclusion

Financial statement comparability is often embraced as one of the most desirable qualitative characteristics of external financial reporting. However, operationalizing the common notion of financial statement comparability, which is to make like things look alike and different things look different, is difficult if not impossible. As such, standard setters around the globe have taken the approach of requiring consistency in accounting standards in an effort to achieve comparability. This paper studies the benefits and costs of consistency-based comparability from an information perspective. We first derive a theoretical framework to define the construct and analyze its information effects. This framework fills a void in the literature, as we are unaware of any theory that undertakes a comprehensive analysis of financial statement comparability. Our analysis shows that, in equilibrium, comparability yields information benefits by enhancing spillover informativeness, but at the same time entails information costs by reducing standalone informativeness.

We then empirically investigate comparability's information effects. Using the DKV measure and its several variants, we find a negative association between comparability and implied volatility at annual earnings announcements. This finding is consistent with the interpretation that comparability on average provides net information benefits for the firms in our sample.[17]

[17] We acknowledge two limitations of this interpretation. First, as discussed in Section 3.1, although we prove

More importantly, the beneficial effect of comparability on implied volatility weakens when firms' stock returns tend to co-move with the returns of their industry peers, which supports the existence of the spillover informativeness channel; and when firms' stock returns are more volatile, which supports the existence of the standalone informativeness channel. The results are robust to using financial crises and industry merger waves as IVs for fundamental correlation and fundamental volatility, respectively.

Prior empirical literature identifies various benefits of comparability (e.g., Ashbaugh and Pincus (2001), Young and Guenther (2003), DKV, DeFond et al. (2011), Wang (2014), Chen et al. (2015), Lang and Stice-Lawrence (2015), Fang et al. (2016), and Kim et al. (2016)). Our analysis complements these studies by showing that comparability can improve earnings informativeness via the spillover channel. However, we also show a separate channel through which comparability can decrease earnings informativeness, namely the stand-alone informativeness channel. We provide evidence consistent with the existence of both channels. With standard setters' push for regulations that aim to promote comparability worldwide, and their continued reliance on consistency as the mechanism to achieve comparability, understanding the potential information benefits and costs of this approach is important not only to regulators, but also to firm managers, investors, and academics. In future research, it may be interesting to build on our model to further investigate comparability's information effects or to explore alternative approaches to improve comparability.

that the DKV measure strictly increases with firms' propensity to adopt common accounting measurements within our framework, it operates on a narrow definition of similarity in economic transactions. It also involves measurement error due to its correlation with accounting noise. A more direct, input-based measure of comparability is, however, diffcult to build for numerous reasons that are also discussed in Section 3.1. Second, we lack a valid IV for the DKV measure itself and the endogenous nature of this measure prevents us from making causal claims about the average effect of comparability on implied volatility.

Appendix A: Proofs

Proposition 1 *For σ_v sufficiently large, there exists a unique symmetric equilibrium in which $m_1 = m_2 = m^*$, where m^* solves the following first order condition:*

$$\frac{dvar(v_i|r_1,r_2)}{dm} = \frac{\partial var(v_i|r_1,r_2)}{\partial \sigma_{\varepsilon_1\varepsilon_2}}\frac{\partial \sigma_{\varepsilon_1\varepsilon_2}}{\partial m} + \frac{\partial var(v_i|r_1,r_2)}{\partial \sigma_\varepsilon^2}\frac{\partial \sigma_\varepsilon^2}{\partial m} = 0. \tag{17}$$

Evaluated at $m_1 = m_2 = m^*$, for $\rho_\varepsilon > (<)\, \rho_v$ (with ρ_ε being the correlation coefficient between ε_1 and ε_2 and ρ_v being the correlation coefficient between v_1 and v_2), $\frac{\partial var(v_i|r_1,r_2)}{\partial \sigma_{\varepsilon_1\varepsilon_2}} < (>)\, 0$, $\frac{\partial \sigma_{\varepsilon_1\varepsilon_2}}{\partial m} > 0$, $\frac{\partial var(v_i|r_1,r_2)}{\partial \sigma_\varepsilon^2} > 0$, and $\frac{\partial \sigma_\varepsilon^2}{\partial m} > (<)\, 0$.

Proof. As discussed in Section 2.3, since the two firms are symmetric in our model, we first set $m_1 = m_2 = m$ and then solve for the m that minimizes $var(v_i|r_1,r_2)$, for any $i \in \{1,2\}$. For conciseness, we focus on discussing the minimization of $var(v_1|r_1,r_2)$ (as the minimization of $var(v_2|r_1,r_2)$ is identical), which is given by:

$$\begin{aligned} & var(v_1|r_1,r_2) \\ = \; & \sigma_v^2 - \frac{cov(v_1,r_1)\,var(r_2) - cov(v_1,r_2)\,cov(r_1,r_2)}{var(r_1)\,var(r_2) - [cov(r_1,r_2)]^2} cov(v_1,r_1) \\ & - \frac{cov(v_1,r_2)\,var(r_1) - cov(v_1,r_1)\,cov(r_1,r_2)}{var(r_1)\,var(r_2) - [cov(r_1,r_2)]^2} cov(v_1,r_2), \end{aligned} \tag{18}$$

where

$$cov(v_1,r_1) = var(v_1) = \sigma_v^2, \tag{19}$$

$$cov(v_1,r_2) = cov(v_1,v_2) = \rho_v\sigma_v^2, \tag{20}$$

$$cov(r_1,r_2) = cov(v_1,v_2) + \sigma_{\varepsilon_1\varepsilon_2} = \rho_v\sigma_v^2 + m^2\sigma_\delta^2, \tag{21}$$

$$var(r_1) = var(r_2) = \sigma_v^2 + \sigma_\varepsilon^2 = \sigma_v^2 + m^2\sigma_\delta^2 + (1-m)^2\sigma_\eta^2. \tag{22}$$

The conditional variance can then be simplified into:

$$var(v_1|r_1,r_2) = \sigma_v^2\left[1 - \sigma_v^2\frac{(\sigma_v^2+\sigma_\varepsilon^2)(1+\rho_v^2) - 2\rho_v(\rho_v\sigma_v^2+\sigma_{\varepsilon_1\varepsilon_2})}{(\sigma_v^2+\sigma_\varepsilon^2)^2 - (\rho_v\sigma_v^2+\sigma_{\varepsilon_1\varepsilon_2})^2}\right]. \tag{23}$$

Taking the derivative of $var(v_1|r_1, r_2)$ with respect to m gives:

$$\frac{dvar(v_1|r_1,r_2)}{dm} = \frac{\partial var(v_1|r_1,r_2)}{\partial \sigma_{\varepsilon_1\varepsilon_2}}\frac{\partial \sigma_{\varepsilon_1\varepsilon_2}}{\partial m} + \frac{\partial var(v_1|r_1,r_2)}{\partial \sigma_\varepsilon^2}\frac{\partial \sigma_\varepsilon^2}{\partial m} = 0. \tag{24}$$

At $m = 0$, the first derivative is $-\frac{2\sigma_v^4\sigma_\eta^2\left[\left(\sigma_v^2+\sigma_\eta^2\right)^2+\rho_v^2\left(\sigma_\eta^4-2\sigma_\eta^2\sigma_v^2-2\sigma_v^4\right)+\rho_v^4\sigma_v^4\right]}{\left[\left(\sigma_v^2+\sigma_\eta^2\right)^2-\rho_v^2\sigma_v^4\right]^2} < 0$, while at $m = 1$, the first derivative is $\frac{2\sigma_v^4\sigma_\delta^2\left(1-\rho_v^2\right)^2}{(1-\rho_v)^2\left(\sigma_v^2+2\sigma_\delta^2+\rho_v\sigma_v^2\right)^2} > 0$. Hence, by the intermediate value theorem, an interior equilibrium always exists. In addition, for σ_v sufficiently large, we verify that the first derivative is strictly increasing in m. As a result, the solution to the first order condition is also unique.

We now discuss the signs of the four terms in the first order condition in equilibrium, i.e., evaluated at $m = m^*$, respectively.

The first term $\frac{\partial var(v_1|r_1,r_2)}{\partial \sigma_{\varepsilon_1\varepsilon_2}}$ represents the effect of $\sigma_{\varepsilon_1\varepsilon_2}$ on $var(v_1|r_1, r_2)$ and is given by:

$$\frac{\partial var(v_1|r_1,r_2)}{\partial \sigma_{\varepsilon_1\varepsilon_2}} = -\sigma_v^4\frac{2\sigma_\varepsilon^2\left[\left(\sigma_v^2+\sigma_\varepsilon^2\right)-\rho_v\left(\rho_v\sigma_v^2+\sigma_{\varepsilon_1\varepsilon_2}\right)\right]\left[\frac{\sigma_{\varepsilon_1\varepsilon_2}}{\sigma_\varepsilon^2}-\rho_v\right]}{\left[\left(\sigma_v^2+\sigma_\varepsilon^2\right)^2-\left(\rho_v\sigma_v^2+\sigma_{\varepsilon_1\varepsilon_2}\right)^2\right]^2}. \tag{25}$$

One can verify that at $m = m^*$,

$$\left(\sigma_v^2+\sigma_\varepsilon^2\right)-\rho_v\left(\rho_v\sigma_v^2+\sigma_{\varepsilon_1\varepsilon_2}\right) = \left(1-\rho_v^2\right)\sigma_v^2+\left(1-\rho_v\right)\left(m^*\right)^2\sigma_\delta^2+\left(1-m^*\right)^2\sigma_\eta^2 > 0, \tag{26}$$

and

$$\frac{\sigma_{\varepsilon_1\varepsilon_2}}{\sigma_\varepsilon^2}-\rho_v = \rho_\varepsilon-\rho_v, \tag{27}$$

where ρ_ε is given by:

$$\rho_\varepsilon = \frac{\left(m^*\right)^2\sigma_\delta^2}{\left(m^*\right)^2\sigma_\delta^2+\left(1-m^*\right)^2\sigma_\eta^2} > 0. \tag{28}$$

Therefore, the sign of $\frac{\partial var(v_1|r_1,r_2)}{\partial \sigma_{\varepsilon_1\varepsilon_2}}$ is solely determined by the sign of $\rho_\varepsilon - \rho_v$. The term is thus negative (positive) if $\rho_\varepsilon > (<)\, \rho_v$.

The second term $\frac{\partial \sigma_{\varepsilon_1\varepsilon_2}}{\partial m}$ represents the effect of comparability m on $\sigma_{\varepsilon_1\varepsilon_2}$. Since $\frac{\partial \sigma_{\varepsilon_1\varepsilon_2}}{\partial m} = 2m^*\sigma_\delta^2$, it is strictly positive. Therefore, the product of the first and the second terms,

$\frac{\partial var(v_1|r_1,r_2)}{\partial \sigma_{\varepsilon_1 \varepsilon_2}} \frac{\partial \sigma_{\varepsilon_1 \varepsilon_2}}{\partial m}$, is negative (positive) if and only if $\rho_\varepsilon > (<) \, \rho_v$, which points to a benefit (cost) of comparability in decreasing (increasing) the conditional variance through increasing the covariance of ε_1 and ε_2.

The third term $\frac{\partial var(v_1|r_1,r_2)}{\partial \sigma_\varepsilon^2}$ represents the effect of σ_ε^2 on $var(v_1|r_1, r_2)$ and is given by:

$$\frac{\partial var(v_1|r_1, r_2)}{\partial \sigma_\varepsilon^2} = \sigma_v^4 \frac{\left(1+\rho_v^2\right)\left[\left(\sigma_v^2+\sigma_\varepsilon^2\right)-\left(\rho_v \sigma_v^2+\sigma_{\varepsilon_1 \varepsilon_2}\right)\right]^2+2\left(1-\rho_v\right)^2\left(\rho_v \sigma_v^2+\sigma_{\varepsilon_1 \varepsilon_2}\right)\left(\sigma_v^2+\sigma_\varepsilon^2\right)}{\left[\left(\sigma_v^2+\sigma_\varepsilon^2\right)^2-\left(\rho_v \sigma_v^2+\sigma_{\varepsilon_1 \varepsilon_2}\right)^2\right]^2} > 0. \tag{29}$$

That is, increasing the variance of the measurement noise σ_ε^2 always increases the conditional variance.

The fourth term $\frac{\partial \sigma_\varepsilon^2}{\partial m}$ represents the effect of comparability m on σ_ε^2 and is given by $\frac{\partial \sigma_\varepsilon^2}{\partial m} = 2\left[m^*\left(\sigma_\delta^2+\delta_\eta^2\right)-\sigma_\eta^2\right]$. It is easy to see that this term is positive (negative) for $m^* > (<) \frac{\sigma_\eta^2}{\sigma_\delta^2+\delta_\eta^2}$. Therefore, the product of the third and the fourth terms, $\frac{\partial var(v_1|r_1,r_2)}{\partial \sigma_\varepsilon^2} \frac{\partial \sigma_\varepsilon^2}{\partial m}$, is positive (negative) if and only if $m^* > (<) \, \frac{\sigma_\eta^2}{\sigma_\delta^2+\delta_\eta^2}$, which points to a cost (benefit) of comparability in increasing (decreasing) the conditional variance through increasing (decreasing) the variance σ_ε^2. As we prove above, given $\rho_\varepsilon > (<) \, \rho_v$, the product of the first and the second terms is negative (positive) in the first order condition, this means that the product of the third and the fourth terms must be positive (negative) in equilibrium to make the condition equal zero. In other words, we must have in equilibrium either $\frac{\partial var(v_1|r_1,r_2)}{\partial \sigma_\varepsilon^2} \frac{\partial \sigma_\varepsilon^2}{\partial m} > 0$ and $m^* > \frac{\sigma_\eta^2}{\sigma_\delta^2+\delta_\eta^2}$ when $\rho_\varepsilon > \rho_v$, or $\frac{\partial var(v_1|r_1,r_2)}{\partial \sigma_\varepsilon^2} \frac{\partial \sigma_\varepsilon^2}{\partial m} < 0$ and $m^* < \frac{\sigma_\eta^2}{\sigma_\delta^2+\delta_\eta^2}$ when $\rho_\varepsilon < \rho_v$. ■

Proposition 2 *For $\rho_\varepsilon > \rho_v$, the equilibrium comparability m^* is decreasing in ρ_v and σ_v, i.e., $\frac{\partial m^*}{\partial \rho_v} < 0$ and $\frac{\partial m^*}{\partial \sigma_v} < 0$. Or equivalently, in equilibrium, the marginal effect of comparability with respect to the conditional variance $\frac{dvar(v_i|r_1,r_2)}{dm}$ is increasing in ρ_v and σ_v, i.e., $\frac{\partial}{\partial \rho_v} \frac{dvar(v_i|r_1,r_2)}{dm} > 0$ and $\frac{\partial}{\partial \sigma_v} \frac{dvar(v_i|r_1,r_2)}{dm} > 0$.*

Proof. By the implicit function theorem,

$$\frac{\partial m^*}{\partial t} = -\frac{\frac{\partial}{\partial t} \frac{dvar(v_i|r_1,r_2)}{dm}}{\frac{d^2 var(v_i|r_1,r_2)}{dm^2}}, \tag{30}$$

where $t \in \{\rho_v, \sigma_v\}$. We first derive the sign of $\frac{\partial m^*}{\partial \sigma_v}$. Since m^* minimizes $var(v_i|r_1, r_2)$,

$\frac{d^2 var(v_i|r_1,r_2)}{dm^2} > 0$. We also verify that in the equilibrium of $m = m^*$,

$$\frac{\partial}{\partial \sigma_v} \frac{dvar(v_i|r_1, r_2)}{dm} \propto m^* \left(\sigma_\delta^2 + \delta_\eta^2\right) - \sigma_\eta^2, \tag{31}$$

where "$\propto$" means "having the same sign." Given $\rho_\varepsilon > \rho_v$, from Proposition 1, $m^* > \frac{\sigma_\eta^2}{\sigma_\delta^2 + \delta_\eta^2}$. As a result, $\frac{\partial}{\partial \sigma_v} \frac{dvar(v_i|r_1,r_2)}{dm} > 0$ and $\frac{\partial m^*}{\partial \sigma_v} = -\frac{\frac{\partial}{\partial \sigma_v} \frac{dvar(v_i|r_1,r_2)}{dm}}{\frac{d^2 var(v_i|r_1,r_2)}{dm^2}} < 0$. For $\rho_\varepsilon < \rho_v$, $m^* < \frac{\sigma_\eta^2}{\sigma_\delta^2 + \delta_\eta^2}$, $\frac{\partial}{\partial \sigma_v} \frac{dvar(v_i|r_1,r_2)}{dm} < 0$ and $\frac{\partial m^*}{\partial \sigma_v} > 0$. That is, $\rho_\varepsilon > \rho_v$ is a sufficient and necessary condition for $\frac{\partial}{\partial \sigma_v} \frac{dvar(v_i|r_1,r_2)}{dm} > 0$.

For the sign of $\frac{\partial m^*}{\partial \rho_v}$, it can be verified that $\frac{\partial}{\partial \rho_v} \frac{dvar(v_i|r_1,r_2)}{dm} > 0$ (detailed proofs are omitted for brevity but available upon request). Combined with $\frac{d^2 var(v_i|r_1,r_2)}{dm^2} > 0$, we have $\frac{\partial m^*}{\partial \rho_v} = -\frac{\frac{\partial}{\partial \rho_v} \frac{dvar(v_i|r_1,r_2)}{dm}}{\frac{d^2 var(v_i|r_1,r_2)}{dm^2}} < 0$. ■

Appendix B: Variable Definitions

$COMP4$	The primary measure of financial statement comparability. We closely follow DKV and calculate the measure in four steps. First, we estimate a firm's accounting function in year t by regressing its quarterly earnings on the corresponding stock returns over the past 16 quarters. Second, for each firm i-year t, we calculate the expected earnings of the firm in a quarter based on its own accounting function as well as the accounting functions of other firms j within the same two-digit SIC group of firm i (given firm i's stock return for the quarter). Third, we calculate the absolute differences between the expected earnings for firm i in a quarter for each pair of firm i-j, multiply the differences by negative one, and average them over the past 16 quarters. Fourth, we take the average of the four largest values from step three.
$COMP10$	Similar to $COMP4$, except that we take the average of the ten largest values from step three in step four.
$COMPmed$	Similar to $COMP4$, except that we take the median of the full set of values from step three in step four.
$IMPVOL$	The average of the OptionMetrics 30-day call option-implied volatility and the 30-day put option-implied volatility, both measured two trading days after the annual earnings announcement date of firm i-year t.
RHO	The correlation coefficient between daily stock returns of firm i in year t and the corresponding daily returns of the value-weighted portfolio of the two-digit SIC industry group to which firm i belongs.
$SIGMA$	The standard deviation of daily stock returns of firm i in year t, requiring at least 200 observations.
$SIZE$	The natural logarithm of the book value of total assets, measured for firm i at the end of year t.
BTM	The book value of common equity divided by the market value of common equity, measured for firm i at the end of year t.

Appendix B: Variable Definitions (continued)

LEV	Total liabilities divided by total assets, measured for firm i at the end of year t.
$TURNOVER$	Average daily turnover (calculated as trading volume in shares divided by the number of shares outstanding), measured for firm i over year t.
$ANALYSTS$	The natural logarithm of the number of analysts who issued at least one EPS forecast for firm i-year t.
$DISP$	The standard deviation of the latest EPS forecasts issued by each analyst prior to the annual earnings announcement of firm i-year t.
$\|RET\|$	The absolute value of the cumulative stock return over the three-day period centered on the annual earnings announcement date of firm i-year t.
$\|ESURP\|$	The absolute value of the earnings surprise at the annual earnings announcment of firm i-year t. Earnings surprise is calculated as actual EPS minus the latest mean analyst consensus EPS forecast, scaled by the stock price two days before the earnings announcement date.
NEG_ESURP	An indicator variable that equals one if the earnings surprise at the annual earnings announcement of firm i-year t is negative, and zero otherwise.
$LOSS$	An indicator variable that equals one if firm i's earnings before extraordinary items in year t is negative, and zero otherwise.
VIX	The 30-day implied volatility of the S&P 500 index measured two trading days after the annual earnings announcement date of firm i-year t.
$RECESS1$	An indicator variable that equals one if firm i's year t overlaps with calendar year 2008 or 2009, and zero otherwise.
$RECESS2$	An indicator variable that equals one if firm i's year t overlaps with calendar year 2001, 2008, or 2009, and zero otherwise.
$MAWAVE$	An indicator variable that equals one if firm i's year t overlaps with a merger wave in the firm's two-digit SIC industry group, and zero otherwise. Industry merger waves are identified following the methodology of Harford (2005).

Appendix B: Variable Definitions (continued)

$COMP4\_OCF$	$COMP4\_OCF$ is calculated similarly to $COMP4$, but uses quarterly operating cash flows rather than stock returns to proxy for firms' economic fundamentals in both stages of the estimation.
$COMP4\_ASYM$	$COMP4\_ASYM$ is calculated similarly to $COMP4$, but adjusted for the asymmetric timeliness of earnings by including an indicator variable to denote negative stock returns and an interaction between this indicator and stock returns in both stages of the estimation.
$COMP4\_PLE$	$COMP4\_ASYM$ is calculated similarly to $COMP4$, but includes lagged stock returns in both stages of the estimation.

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Table 1

Descriptive Statistics

This table reports the number of observations (N), mean, standard deviation (SD), 10th percentile (P10), median, and 90th percentile (P90) for the variables used in the main analysis. Detailed variable definitions are reported in Appendix B. All continuous variables are winsorized at the 1st and the 99th percentile. The sample period is between 1996 and 2013.

Variable Name	**N**	**MEAN**	**SD**	**P10**	**MEDIAN**	**P90**
IMPVOL	11,152	0.391	0.180	0.206	0.350	0.634
COMP4	11,152	-0.361	0.587	-0.820	-0.160	-0.050
RHO	11,152	0.591	0.195	0.315	0.609	0.836
SIGMA	11,152	0.025	0.012	0.013	0.023	0.042
SIZE	11,152	8.028	1.650	5.913	7.992	10.237
BTM	11,152	0.492	0.311	0.160	0.430	0.902
LEV	11,152	0.555	0.215	0.245	0.565	0.862
TURNOVER	11,152	0.009	0.007	0.003	0.008	0.018
ANALYSTS	11,152	2.220	0.560	1.386	2.197	2.944
DISP	11,152	0.041	0.066	0.004	0.020	0.094
|RET|	11,152	0.050	0.047	0.006	0.036	0.114
|ESURP|	11,152	0.003	0.007	0.000	0.001	0.007
NEG_ESURP	11,152	0.340	0.474	0	0	1
LOSS	11,152	0.145	0.352	0	0	1
VIX	11,152	0.209	0.082	0.124	0.192	0.311

Table 2
Univariate Correlations

This table presents Pearson (Spearman) correlations above (below) the diagonal among all variables used in the main analysis. Detailed variable definitions are reported in Appendix B. Correlations in bold are significantly different from zero at the 0.05 level or less for two-tailed tests.

	Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1)	IMPVOL		**-0.153**	**-0.223**	**0.761**	**-0.463**	**0.107**	**-0.199**	**0.314**	**-0.193**	**0.080**	**0.335**	**0.271**	**0.088**	**0.357**	**0.452**
(2)	COMP4	**-0.244**		**0.035**	**-0.193**	**0.083**	**-0.146**	**-0.064**	**-0.155**	**0.081**	**-0.105**	**-0.049**	**-0.202**	**-0.032**	**-0.239**	**0.068**
(3)	RHO	**-0.226**	**0.048**		**-0.109**	**0.484**	**0.155**	**0.170**	**0.083**	**0.288**	**0.168**	**-0.118**	-0.012	0.011	**-0.128**	**0.103**
(4)	SIGMA	**0.810**	**-0.291**	**-0.107**		**-0.438**	**0.057**	**-0.232**	**0.471**	**-0.136**	**0.043**	**0.310**	**0.258**	**0.035**	**0.331**	**0.365**
(5)	SIZE	**-0.493**	**0.171**	**0.491**	**-0.395**		**0.145**	**0.540**	**-0.190**	**0.522**	**0.084**	**-0.217**	**-0.122**	-0.016	**-0.241**	0.017
(6)	BTM	**0.048**	**-0.184**	**0.117**	**0.122**	**0.152**		**0.076**	**0.027**	**-0.105**	**0.180**	0.009	**0.253**	**0.094**	**0.114**	**0.113**
(7)	LEV	**-0.225**	-0.007	**0.175**	**-0.207**	**0.536**	**0.061**		**-0.205**	**0.119**	**0.090**	**-0.137**	**0.036**	**0.041**	**-0.058**	**0.038**
(8)	TURNOVER	**0.315**	**-0.194**	**0.057**	**0.497**	**-0.211**	0.012	**-0.223**		**0.078**	**0.157**	**0.216**	**0.199**	-0.004	**0.169**	**0.063**
(9)	ANALYSTS	**-0.193**	**0.098**	**0.288**	**-0.134**	**0.516**	**-0.108**	**0.115**	**0.088**		0.008	**-0.069**	**-0.198**	-0.012	**-0.106**	**0.034**
(10)	DISP	0.003	**-0.207**	**0.097**	**0.099**	**0.148**	**0.239**	**0.125**	**0.196**	**0.101**		0.005	**0.407**	**0.143**	**0.137**	**0.042**
(11)	|RET|	**0.326**	**-0.093**	**-0.128**	**0.304**	**-0.199**	**-0.029**	**-0.129**	**0.206**	**-0.087**	**0.021**		**0.121**	-0.011	**0.112**	**0.140**
(12)	|ESURP|	**0.249**	**-0.309**	**-0.059**	**0.251**	**-0.158**	**0.331**	0.016	**0.137**	**-0.144**	**0.323**	**0.139**		**0.087**	**0.283**	**0.087**
(13)	NEG_ESURP	**0.075**	**-0.027**	0.008	**0.042**	-0.007	**0.090**	**0.042**	0.005	-0.014	**0.133**	-0.012	**0.132**		**0.102**	**0.035**
(14)	LOSS	**0.335**	**-0.312**	**-0.130**	**0.356**	**-0.221**	**0.072**	**-0.052**	**0.171**	**-0.105**	**0.136**	**0.100**	**0.270**	**0.102**		**0.023**
(15)	VIX	**0.434**	**0.080**	**0.134**	**0.375**	**0.020**	**0.058**	**0.050**	-0.013	**0.047**	**-0.034**	**0.103**	0.013	**0.020**	**0.020**	

Table 3

The Average Effect of Comparability on Implied Volatility

This table reports the ordinary least squares (OLS) regression results on the relation between implied volatility (IMPVOL) and financial statement comparability. Comparability is measured using COMP4 in Column (1) and Column (2), COMP10 in Column (3), and COMPmed in Column (4). Column (1) includes only comparability variable and fixed effects and Columns (2)-(4) additionally include controls. Detailed variable definitions are reported in Appendix B. Statistical significance at the 0.10, 0.05, and 0.01 level for two-tailed tests is denoted by *, ** and ***, respectively. All standard errors are clustered by firm and year.

Dependent Variable = IMPVOL	Comparability = COMP4 (1)	COMP4 (2)	COMP10 (3)	COMPmed (4)
Comparability	-0.065***	-0.023***	-0.019***	-0.013***
	(-11.37)	(-6.82)	(-7.56)	(-9.03)
SIZE		-0.044***	-0.044***	-0.043***
		(-16.25)	(-16.34)	(-16.34)
BTM		0.053***	0.052***	0.053***
		(7.46)	(7.33)	(7.63)
LEV		0.029*	0.027*	0.023
		(2.00)	(1.87)	(1.63)
TURNOVER		4.585***	4.509***	4.393***
		(6.11)	(6.02)	(5.85)
ANALYSTS		0.003	0.004	0.003
		(0.91)	(0.93)	(0.87)
DISP		0.041	0.040	0.045
		(0.84)	(0.84)	(0.94)
|RET|		0.413***	0.409***	0.411***
		(6.76)	(6.68)	(6.82)
|ESURP|		1.895***	1.882***	1.811***
		(6.83)	(6.85)	(6.46)
NEG_ESURP		0.012***	0.012***	0.013***
		(4.32)	(4.52)	(4.45)
LOSS		0.079***	0.078***	0.074***
		(10.90)	(10.59)	(9.93)
VIX		0.702***	0.699***	0.703***
		(7.74)	(7.61)	(7.83)
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	11,152	11,152	11,061	11,152
Adj R-squared	0.379	0.641	0.642	0.645

Table 4
The Effect of Comparability on Implied Volatility: Cross-sectional Results

This table reports the OLS regression results on the relation between implied volatility (IMPVOL) and financial statement comparability (COMP4), and how this relation is affected by fundamental correlation (RHO) and fundamental volatility (SIGMA). Detailed variable definitions are reported in Appendix B. Statistical significance at the 0.10, 0.05, and 0.01 level for two-tailed tests is denoted by *, ** and ***, respectively. All standard errors are clustered by firm and year.

Dependent Variable = IMPVOL	(1)	(2)	(3)
COMP4	-0.046***	-0.035***	-0.047***
	(-4.88)	(-3.89)	(-4.07)
RHO	0.028**		0.013
	(2.43)		(1.55)
COMP4 * RHO	0.040***		0.019*
	(2.81)		(1.66)
SIGMA		9.106***	9.101***
		(39.62)	(39.57)
COMP4 * SIGMA		0.918***	0.942***
		(3.19)	(3.26)
Controls	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	11,152	11,152	11,152
Adj R-squared	0.641	0.747	0.747

Table 5

The Effect of Comparability on Implied Volatility:
Instrumenting Fundamental Correlation with Recession Periods

This table reports the two-stage least squares (2SLS) regression results on the relation between implied volatility (IMPVOL) and financial statement comparability (COMP4), and how this relation is affected by fundamental correlation (RHO) instrumented using an indicator to denote recession periods. This indicator is defined as RECESS1 in Column (1) of Panel A and Panel B, and as RECESS2 in Column (2) of the two panels. Panel A reports the first-stage regression results and Panel B reports the second-stage regression results. $\widehat{RHO}$ and $\widehat{COMP4 * RHO}$ are the fitted value of RHO and COMP4 times the fitted value of RHO, respectively, where the fitted value is from the first-stage regressions. Detailed variable definitions are reported in Appendix B. Statistical significance at the 0.10, 0.05, and 0.01 level for two-tailed tests is denoted by *, ** and ***, respectively. All standard errors are clustered by firm and year.

Panel A: First-stage Estimation Results

	RECESS =	
Dependent Variable =	RECESS1	RECESS2
RHO	(1)	(2)
RECESS	0.115***	0.067***
	(0.004)	(0.003)
Controls	Yes	Yes
Observations	11,152	11,152
R-squared	0.456	0.443

Panel B: Second-stage Estimation Results

Dependent Variable = IMPVOL	(1)	(2)
COMP4	-0.060***	-0.064***
	(0.015)	(0.015)
$\widehat{RHO}$	-0.048**	0.002
	(0.022)	(0.023)
$\widehat{COMP4 * RHO}$	0.076***	0.082***
	(0.024)	(0.025)
Controls	Yes	Yes
Observations	11,152	11,152
R-squared	0.555	0.552

Table 6

The Effect of Comparability on Implied Volatility:
Instrumenting Fundamental Volatility with Industry Merger Waves

This table reports the 2SLS regression results on the relation between implied volatility (IMPVOL) and financial statement comparability (COMP4), and how this relation is affected by fundamental volatility (SIGMA) instrumented using an indicator to denote industry merger waves. Panel A reports the first-stage regression results and Panel B reports the second-stage regression results. $\widehat{SIGMA}$ and $\widehat{COMP4*SIGMA}$ are the fitted value of SIGMA and COMP4 times the fitted value of SIGMA, respectively, where the fitted value is from the first-stage regression. Detailed variable definitions are reported in Appendix B. Statistical significance at the 0.10, 0.05, and 0.01 level for two-sided tests is denoted by *, ** and ***, respectively. All standard errors are clustered by firm and year.

Panel A: First-stage Estimation Results

Dependent Variable = SIGMA	(1)
MAWAVE	0.001***
	(0.000)
Controls	Yes
Observations	11,132
R-squared	0.556

Panel B: Second-stage Estimation Results

Dependent Variable = IMPVOL	(1)
COMP4	-0.016**
	(0.006)
$\widehat{SIGMA}$	7.653***
	(0.276)
$\widehat{COMP4*SIGMA}$	0.356*
	(0.208)
Controls	Yes
Observations	11,132
R-squared	0.684

Table 7

The Average Effect of Comparability on Implied Volatility:
Using Alternative Comparability Measures

This table reports the OLS regression results on the relation between implied volatility (IMPVOL) and alternative measures of financial statement comparability. Comparability is measured using COMP4_OCF in Column (1), COMP4_ASYM in Column (2), and COMP4_PLE in Column (3). Detailed variable definitions are reported in Appendix B. Statistical significance at the 0.10, 0.05, and 0.01 level for two-tailed tests is denoted by *, ** and ***, respectively. All standard errors are clustered by firm and year.

		Comparability =	
Dependent Variable =	(1)	(2)	(3)
IMPVOL	COMP4_OCF	COMP4_ASYM	COMP4_PLE
Comparability	-0.018***	-0.018***	-0.019***
	(-4.24)	(-8.16)	(-7.77)
SIZE	-0.044***	-0.044***	-0.044***
	(-16.71)	(-16.87)	(-16.40)
BTM	0.050***	0.052***	0.052***
	(6.89)	(7.21)	(7.31)
LEV	0.028*	0.025	0.027*
	(1.84)	(1.69)	(1.86)
TURNOVER	4.594***	4.391***	4.451***
	(5.99)	(5.48)	(5.88)
ANALYSTS	0.003	0.004	0.004
	(0.67)	(1.04)	(0.96)
DISP	0.045	0.041	0.043
	(0.86)	(0.83)	(0.87)
|RET|	0.394***	0.413***	0.414***
	(7.11)	(6.81)	(6.83)
|ESURP|	1.871***	1.849***	1.848***
	(6.64)	(6.67)	(6.61)
NEG_ESURP	0.014***	0.013***	0.013***
	(4.65)	(4.67)	(4.53)
LOSS	0.081***	0.077***	0.077***
	(11.79)	(10.87)	(10.74)
VIX	0.711***	0.708***	0.702***
	(7.95)	(7.67)	(7.63)
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	10,214	10,984	11,029
Adj R-squared	0.646	0.642	0.642

Table 8

The Effect of Comparability on Implied Volatility:
Cross-sectional Results Using Alternative Comparability Measures

This table reports the OLS regression results on the relations between implied volatility (IMPVOL) and alternative measures of financial statement comparability, and how these relations are affected by fundamental correlation (RHO) and fundamental volatility (SIGMA). Comparability is measured using COMP4_OCF in Column (1), COMP4_ASYM in Column (2), and COMP4_PLE in Column (3). Detailed variable definitions are reported in Appendix B. Statistical significance at the 0.10, 0.05, and 0.01 level for two-tailed tests is denoted by *, ** and ***, respectively. All standard errors are clustered by firm and year.

Dependent Variable = IMPVOL	Comparability = (1) COMP4_OCF	(2) COMP4_ASYM	(3) COMP4_PLE
Comparability	-0.040***	-0.037***	-0.046***
	(-4.11)	(-5.51)	(-5.62)
RHO	0.015*	0.018**	0.017**
	(1.81)	(2.10)	(1.99)
Comparability * RHO	0.018	0.022***	0.021**
	(1.64)	(2.74)	(2.37)
SIGMA	8.951***	9.265***	9.326***
	(39.64)	(40.78)	(40.37)
Comparability * SIGMA	0.786***	0.602***	0.852***
	(3.49)	(4.68)	(4.82)
Controls	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	10,214	10,984	11,029
Adj R-squared	0.747	0.748	0.748