# Degree of Operating Leverage, Earnings Properties, Reporting Incentives, and the Usefulness of Earnings

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**Abstract**

We investigate how firm cost structure influences the information environment by studying the relation between the degree of operating leverage, earnings properties, and the usefulness of earnings to shareholders. We predict and find that earnings volatility increases in the degree of operating leverage. We also predict and find that the incentive to engage in aggressive revenue recognition to meet earnings thresholds increases in the degree of operating leverage. We document that the usefulness of earnings to shareholders decreases through the effect of the degree of operating leverage on the volatility of earnings and on the incentive of engaging in aggressive revenue recognition to meet earnings targets. Our results inform how firm cost structure, in particular the substitution of fixed costs for variable costs, influences a firm's information environment and reporting incentives, and the usefulness of earnings to shareholders.

*Keywords:* Degree of Operating Leverage, Earnings Properties, Earnings Usefulness

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## 1. Introduction

A long stream of literature investigates the determinants of earnings properties and the decision usefulness of earnings. These studies find that firm characteristics influence how the accounting system captures economic performance, shapes financial reporting incentives, and influences the usefulness of earnings to market participants (Schipper and Vincent, 2003, Dechow et al., 2010). By investigating firm cost structure, we shed additional light on the relation between firm characteristics, earnings properties, and the decision usefulness of earnings. We focus on the degree of operating leverage, the proportion of total costs that are fixed, which captures the extent to which the firm has invested in fixed costs that reduce variable costs (Horngren et al., 2002).

One difficulty when measuring cost structure is that generally accepted accounting principles do not require firms to distinguish fixed and variable costs in the financial statements. To address this challenge, we consider two proxies for the degree of operating leverage that are based on managerial accounting practice and prior literature (Horngren et al., 2002a and Lev, 1974). We test the validity of these proxies through simulation and find that both measures capture the underlying construct of interest well.

We first examine the relation between the degree of operating leverage and earnings properties. Because the sensitivity of earnings to sales is higher for firms with a higher degree of operating leverage, we predict that earnings volatility is increasing in the degree of operating leverage. Measuring earnings volatility as the rolling standard deviation of quarterly earnings over the prior 5 and 10-years as in Lev (1983) and Dichev and Tang (2009), we find that earnings volatility is increasing in the degree of operating leverage, consistent with our prediction.

Next, we investigate whether there is a relation between the degree of operating leverage and aggressive revenue recognition to meet an earnings target. As the degree of operating leverage increases fewer incremental sales are necessary to meet an earnings target because the sensitivity of earnings to sales is higher for firms with a higher degree of operating leverage. Therefore, to the extent that the cost of aggressive revenue recognition increases in the degree of operating leverage, we predict that firms' use of aggressive revenue recognition to meet an earnings target increases with the degree of operating leverage. We identify zero-earnings, analyst forecasts, and last year's EPS as important earnings thresholds (Burgstahler and Dichev, 1997a, Degeorge et al., 1999, Roychowdhury, 2006), and measure aggressive revenue recognition using discretionary revenues measured as in Stubben (2010). Using these proxies, we find support for our prediction that the incentive to engage in aggressive revenue recognition to meet an earnings target increases with the degree of operating leverage.

We then predict and test whether the decision usefulness of earnings is related to the degree of operating leverage through the predicted relations between the degree of operating leverage and earnings properties. First, because more volatile earnings are a noisier and less accurate signal of underlying performance (Dechow and Dichev, 2002), reduce the predictability of earnings (Dichev and Tang, 2009), and magnify the information uncertainty investors face when interpreting earnings news (Easley and O'Hara, 2004), we predict that the usefulness of earnings to shareholders is decreasing in the degree of operating leverage through the relation with the volatility of earnings. Second, to the extent that market participants recognize that managers of firms with a higher degree of operating leverage have stronger incentives to engage in aggressive revenue recognition to meet earnings targets, we expect market participants to be more skeptical of high degree of operating leverage firms just meeting or barely beating earnings targets (Stein, 1989) and therefore to discount the information content of earnings of these firms to a larger extent. Thus, we predict that the decision usefulness of earnings is declining in the degree of operating leverage through the relation with aggressive revenue recognition.

We define earnings usefulness as the informative content and value relevance of earnings. We follow Collins and Kothari (1989) and measure the informativeness of earnings as the extent to which investors revise their beliefs upon earnings announcements based on the cumulative abnormal return around earnings announcements. We also follow Collins and Kothari (1989) and measure value relevance as the extent to which earnings capture and reflect the information revealed during the fiscal year based on the abnormal stock return compounded over the fiscal year. Using these proxies, we find that shareholders react less to earnings announcements as the degree of operating leverage increases. We also find that the association between earnings and abnormal stock returns cumulated over the fiscal year decreases with the degree of operating leverage.

Finally, we try to shed light on whether and how the relation between the degree of operating leverage and earnings properties drives the documented relation between the degree of operating leverage and the usefulness of earnings to shareholders in two ways. We estimate effect of the degree of operating leverage on earnings usefulness mediated by the relation between operating leverage and earnings properties using a recursive structural equation model (i.e., a path analysis) (e.g. Bhattacharya et al., 2011, Core et al., 2015, Mayew et al., 2014). We find that the usefulness of earnings declines through the relation with earnings volatility and aggressive revenue recognition. Second, we expect shareholders to be more skeptical about the underlying economic performance of firms that barely miss an earnings target because these firms had a strong incentive to engage in aggressive revenue recognition to meet the earnings target, but were unable to meet the target (Shin, 1994). Consistent with market participants understanding the incentives and opportunity to recognize revenue to meet an earnings target, we find a significantly more negative market reaction to missing an earnings target for firms with a high degree of operating leverage.

We contribute to the literature by shedding light on how firm cost structure relates to earnings properties and how this influences the information environment, reporting incentives, and the usefulness of earnings to shareholders. Overall our findings suggest that firm cost structure is related to earnings properties and that those relations affect the decision usefulness of earnings. We bring the forces underlying cost structure, earnings properties and reporting incentives together and show that market participants understand the cross section of forces and react more negatively to missing an earnings target when the degree of operating leverage and the opportunity to aggressively recognize revenue to meet the target is greater. We also provide a methodological contribution by validating through simulation that two proxies for the degree of operating leverage capture the underlying construct of interest. We provide evidence that cost structure is one of the economic determinants of earnings usefulness (Dechow et al., 2010). In doing so, we broaden the understanding of the channels that relate firm fundamentals to earnings properties and how that relation influences the usefulness of earnings to market participants (Collins and Kothari, 1989, Dhaliwal et al., 1991, Hayn, 1995, Core and Schrand, 1999).

## 2. Theoretical framework and empirical predictions

We study how firm cost structure influences earnings properties and the decision usefulness of earnings to shareholders. We assume that firms establish a cost structure that is in the best interest of shareholders and conjecture that earnings properties are a consequence of the resulting cost structure. We focus on the degree of operating leverage, which captures the extent to which a firm's operating costs are fixed, where fixed costs do not change with the level of output while variable costs are directly proportional to the level of output.

### *2.1. Prior evidence on the degree of operating leverage and earnings*

Prior research on the degree of operating leverage has largely focused on the relation between the degree of operating leverage and risk (Lev, 1974, Gahlon and Gentry, 1982, Mandelker and Rhee, 1984, Carlson, Fisher, and Giammarino, 2004, Novy-Marx, 2011, Aboody, Levi, and Weiss, 2017) or on the leverage-tradeoff hypothesis (Van Home, 1980, Mandelker and Rhee, 1984, Dugan, Minyard, and Shriver, 1994, Kahl, Lunn, and Nilsson, 2013).

The few studies on the relation between the degree of operating leverage and earnings properties or the degree of operating leverage and the usefulness of earnings reach mixed conclusions. Lev (1983) studies how the volatility and persistence of earnings co-vary with the degree of operating leverage, and finds that while earnings volatility does not vary with the degree of operating leverage, the persistence of earnings decreases with the degree of operating leverage. In contrast, Aboody et al. (2017) finds that firms that reduce option compensation following the adoption of FAS 123R decrease their operating leverage and experience lower earnings volatility, which suggests a positive relation between the degree of operating leverage and earnings volatility. Similarly, there are two studies of the relation between the degree of operating leverage and the usefulness of earnings. Biddle and Seow (1991) find that the earnings response coefficient decreases in the operating leverage, while Ahmed (1994) observes the opposite when including controls for systematic risk. In addition to the conflicting inferences, these studies do not provide evidence on the channel that generates the link between the degree of operating leverage and the usefulness of earnings.

Overall, the prior literature on the degree of operating leverage, earnings properties and the usefulness of earnings provides mixed results. We reconcile these results with two proxies for the degree of operating leverage, confirm the proxies with simulation, consider the incentives to recognize revenue to meet an earnings target, and test the channel through which the degree of operating leverage affects the usefulness of earnings.

*2.2. The degree of operating leverage and earnings properties*

In this section we describe how firm cost structure is expected to influence earnings properties.

Consider earnings defined as follows:

$$NI = Q(P - VC) - FC, \tag{1}$$

The quantity sold, Q, varies with demand as a random variable that is normally distributed, with $E[Q] = q$, $Var[Q] = \sigma^2$, and is independent from all other random variables. Assume that price, $P$, and the total fixed costs, $FC$, are constant. The variable cost per unit, $VC$, is normally distributed with $E[VC] = \mu$ and $Var[VC] = \eta^2$. The contribution margin is then defined as $(P - VC)$, where $E[(P - VC)] = P - \mu = \lambda$, and $Var[(P - VC)] = \eta^2$.[1]

[1]We assume that the firm has set price optimally, to maximize NI in expectation with the distribution of $q$ known to the firm.

The variance of net income, $NI$, is given by

$$Var(NI) = \lambda^2\sigma^2 + q^2\eta^2 + \sigma^2\eta^2 \tag{2}$$

It follows from Equation 2 that the sensitivity of the variance in net income to the expected variable cost is as follows:

$$\frac{\partial Var(NI)}{\partial \mu} = -2\lambda\sigma^2 \tag{3}$$

Therefore, the variance in net income is decreasing in the variable cost, $\frac{\partial Var(NI)}{\partial \mu} < 0$.[2] Finally, defining the degree of operating leverage as the ratio of fixed to total costs, $\frac{FC}{FC+(Q*VC)}$, the degree of operating leverage is decreasing in *VC*, which leads to the following hypothesis:

*H1: Earnings volatility is increasing in the degree of operating leverage.*

To the extent that investments in fixed costs reduce the variable cost per unit where, for example, a firm invests in a technology that increases production efficiency and reduces variable costs, then the earnings volatility increases. However, we recognize the endogenous nature of the degree of operating leverage and managerial discretion over earnings. First, if demand uncertainty leads firms to prefer technologies with low fixed and high variable costs (Kallapur and Eldenburg, 2005), then firms with higher operating leverage are more likely to operate in environments subject to smaller economic shocks, reducing their earnings volatility (Dichev and Tang, 2009). Second, if managers have a preference for smoother earnings streams (Graham et al., 2005), firms with a high degree of operating leverage may use accounting discretion to produce less volatile earnings streams. Both of these other forces suggest an opposite relation between the degree of operating leverage and earnings volatility than we predict.

The cost structure of a firm may also influence how managers respond to incentives to meet earnings benchmarks. Consider an earnings target, $NI^* = Q' \cdot (P - VC) - FC$,

[2] If VC is know, $\eta^2 = 0$, yields the same conclusion.

that is greater than the realized economic performance $\hat{NI} = \hat{Q} \cdot (P - VC) - FC$, where $Q' > \hat{Q}$. The incremental sales $(Q' - \hat{Q})$ necessary to achieve the desired performance target, $NI^*$, decreases in the contribution margin, $(P - VC)$. To the extent that the cost of sales manipulation, $c$, is increasing in $(Q' - \hat{Q})$, the cost to meet an earnings target is decreasing in $(P - VC)$.[3,4]

Let us define the manager's utility as $U(NI) = s(NI) - c$, where $0 < s < 1$. $s$ when $NI \geq NI^*$ is greater than $s$ when $NI < NI^*$ because of the well-known benefits associated with meeting or beating a performance target (Bartov et al., 2002, Kasznik and McNichols, 2002). Then, the manager will maximize their utility such that she will manipulate sales, $(Q' - \hat{Q})$, when $U(NI^*) > U(\hat{NI})$. Because the cost of manipulating sales is increasing in the incremental sales required to meet an earnings target, $(Q' - \hat{Q})$, and $(Q' - \hat{Q})$ declines with the degree of operating leverage, then the probability that a manager manipulates revenue to meet an earnings target is increasing in the degree of operating leverage.[5] This leads to our second hypothesis:

> *H2: Aggressive revenue recognition to meet an earnings target is increasing in the degree of operating leverage.*

### *2.3. The degree of operating leverage and the usefulness of earnings*

To the extent that firm cost structure affects earnings properties and aggressive revenue recognition, we also expect a relation between cost structure and the usefulness of earnings

[3]There are at least two reasons why the cost of sales manipulation increases in the quantity manipulated. First, auditors set materiality thresholds before performing their auditing activities (International Standards on Auditing 320, paragraph 10). Small amounts of sales manipulation are less likely to meet the materiality threshold and result in further investigation by the auditor. Second, as long as sales manipulation involves sub-optimal business choices, large amounts of sales manipulation will result in worse future performance and hurt the firm value in the long term.

[4]The literature on "sticky costs", the tendency to retain costs in the presence of a negative demand shock, predicts and finds that resource adjustments to meet earnings targets diminish the degree of cost stickiness, and that managers reduce costs more aggressively in the presence of incentives to meet earnings targets (Dierynck et al., 2012, Kama and Weiss, 2013).

[5]Aggressive revenue recognition can be accomplished through channel staffing, bill and hold sales, relaxed credit requirements, or revenue recognized with an aggressive or incorrect application of GAAP.

to shareholders through two channels. First, we expect the degree of operating leverage to influence the usefulness of earnings through the relation with earnings volatility. Dechow and Dichev (2002) find that more volatile earnings are a noisier and a less accurate signal of underlying performance. Dichev and Tang (2009) conjecture and show that earnings volatility reduces earnings predictability, which means that expectations of future earnings have a higher degree of uncertainty. Finally, Easley and O'Hara (2004) suggest that noise in earnings increases non-diversifiable information uncertainty that investors face when interpreting earnings news. Therefore, to the extent that the degree of operating leverage is associated with more volatile earnings as predicted in our first hypothesis and that more volatile earnings entail higher information uncertainty for shareholders, then the earnings of firms with a higher degree of operating leverage are less useful as a signal of economic performance to shareholders. This leads to the following hypothesis:

> H3: *The usefulness of earnings to shareholders is decreasing in the degree of operating leverage through the effect on earnings volatility.*

Second, we expect the degree of operating leverage to influence the usefulness of earnings through the relation with aggressive revenue recognition. Stein (1989) predicts that investors discount the signal from meeting earnings targets when there are strong incentives to meet the earnings target. Empirical evidence shows that managers respond to incentives from performance thresholds by managing earnings (Bizjak et al., 2015) and that market participants anticipate this response and are more skeptical when reacting to earnings (Coles et al., 2006). It follows that, to the extent that firms with a higher degree of operating leverage have stronger incentives to aggressively recognize revenue to meet earnings targets as predicted in our second hypothesis and that market participants recognize this incentive, then market participants will discount earnings that just meet earnings target reported by firms with a higher degree of operating leverage more relative to those reported by firms with a lower degree of operating leverage.[6] This leads to the following hypotheses:

H4: *The usefulness of earnings to shareholders is decreasing in the degree of operating leverage through the effect on the incentive to engage in aggressive revenue recognition to meet an earnings target.*

## 3. Measurement of the degree of operating leverage

One difficulty when measuring cost structure is that generally accepted accounting principles do not require firms to distinguish fixed and variable costs in the financial statements. SFAS 225-10-S99 requires firms to prepare the Income Statement using a functional form, where costs are aggregated by function (e.g. administrative, manufacturing, selling) rather than by their nature (variable versus fixed). Because this classification does not enable the reader to distinguish fixed and variable costs the degree of operating leverage cannot be measured directly. To address this challenge, we measure two proxies that distinguish fixed and variable costs based on prior literature and managerial accounting practice (Lev, 1974, Horngren et al., 2002b). Both proxies extend from the following cost function:

$$TOC = \alpha + \beta\, REV \tag{4}$$

where:

TOC = Total operating costs = $FC + VC \times Q$, where Q, FC, and VC are defined as in Section 2;[7]

REV = Total revenues = $(P \times Q)$, where P and Q are defined as in Section 2;

$\alpha$ = Fixed costs;

$\beta$ = Variable costs per REV.[8]

[6] Note that we test H3 by examining aggressive revenue recognition around the zero earnings, analyst forecasts, and last year's EPS thresholds. However, executive contracts often include several earnings targets such as earnings growth that may also influence aggressive revenue recognition.

[7] We define total operating costs as the sum of cost of goods sold, depreciation and amortization, and selling, general and administrative expenses

[8] It is not possible to observe $Q$. We assume that changes in revenue reflect changes in quantities sold. Changes in revenue that extend from changes in $P$ introduce noise into our proxies.

The two proxies are *DOL_H-L*, calculated using the High-Low activity approach suggested by Horngren et al. (2002b), and *DOL_Lev,* calculated using the "Level" regression approach suggested in Lev (1974).[9] The two proxies are selected in an attempt to balance the trade-off between measuring the degree of operating leverage in a timely manner and using a long enough time series to reduce measurement error in the proxy.

### *3.1. DOL_H-L: High-Low Activity*

The High-Low activity approach estimates fixed and variable costs using the two quarters within the same year that report the highest and lowest revenues. From these quarters we estimate variable costs per revenue dollar ($\hat{VC}/REV$) as:

$$\frac{\hat{VC}}{REV} = \frac{\Delta TOC}{\Delta REV}, \tag{5}$$

where $TOC$ is the total cost, $REV$ is revenue, $VC$ is variable cost, and $\Delta$ indicates the difference between the two quarters. We use the resulting value to estimate fixed costs ($\hat{FC}$):

$$\hat{FC}_t = TOC_t - \left(\frac{\hat{VC}}{REV} * REV_t\right) \tag{6}$$

Finally, we calculate the degree of operating leverage *DOL_H-L* as follows:

$$DOL = \frac{\hat{FC}_t}{TOC_t} \tag{7}$$

This measure is advantageous because it can be estimated each year, capturing annual changes in the cost structure in a timely way. However, only focusing on two quarters may result in less precise estimates of the cost structure.

[9]We measure the degree of operating leverage with a third proxy (DOLCH) based on Kahl et al. (2013). We do not report this proxy because the simulation shows this proxy to be noisy.

### *3.2. DOL_Lev: The "Level" Regression*

The second proxy is based on the approach in Lev (1974) and uses the following rolling time-series regression over 12 quarters:

$$TOC_q = \alpha + \beta \; REV_q + \epsilon \qquad (8)$$

The model reflects the assumed cost structure described in Equation (1), where the coefficient $\alpha$ is an estimate of the fixed costs ($\hat{FC}$). We then calculate the degree of operating leverage $DOL\_Lev$ as the ratio of fixed costs over total operating costs as in Equation (4). $DOL\_Lev$ is a more stable measure of the degree of operating leverage because of the longer time-series required to estimate fixed costs. However, the measure is slower to capture structural changes in the cost structure of the firm.

### *3.3. Construct validity-simulations*

We use a simulation approach to validate that the two proxies capture the underlying construct of interest. The simulation process was designed to maximizing external validity (e.g., Labro, 2015). There are two key features of the simulation. First, the distribution of the parameters in the simulation reflects the distribution of the associated variables in the Compustat universe. Second, we simulate random shocks that may reduce the accuracy of the proxies including: step cost functions, which violate the linear assumption in Equation (1); and vertical integration and outsourcing, which affect the cost structure of the firm but may not be captured by the proxies in a timely manner.

We then test whether the proxies capture the underlying construct of interest by measuring the correlation, the distribution of the difference, and the standard deviation of the difference between the estimated and simulated degree operating leverage. We find that both proxies are highly correlated with the simulated degree of operating leverage ($p$-value $< 0.01$*)*. We also find that the mean difference between the proxy and the simulated degree of operating leverage is less than 5%. Finally, we find that the standard deviation of the difference between the estimated and simulated degree operating leverage is 14%. This evidence indicates that we construct valid proxies for the degree of operating leverage. Appendix A provides further details of the simulation.

## 4. Tests of degree of operating leverage and earnings properties

In the tests that follow we use all industrial firms from the intersection of the Compustat Merged Fundamental Annual File and CRSP databases over the period 1988-2014.[10] Descriptive statistics (Table 1, Panel A) and correlations (Table 1, Panel B) are consistent with those reported by studies over similar sample periods. Table 1, Panel C presents the distribution of the proxies for degree of operating leverage by industry. As expected, Pharmaceutical, Computers, and Instruments exhibit the highest degree of operating leverage, while Food, Wholesale, and Retail exhibit the lowest degree of operating leverage.

### *4.1. Earnings volatility*

Our first hypothesis is that earnings volatility is increasing in the degree of operating leverage. To test this hypothesis we estimate the following empirical model of volatility:

$$Volatility_{i,t} = \alpha + \beta DOL_{i,t} + \sum \delta X_{i,t} + \epsilon_{i,t} \tag{9}$$

We measure earnings volatility as the rolling standard deviation of seasonal changes in quarterly earnings calculated over the previous 20 quarters (5 years) *(Volatility1)* and as the rolling standard deviation of annual earnings changes calculated over the previous 10 years *(Volatility2)*.[11] We include other economic determinants of earnings volatility based on prior literature such as the absolute value of accruals *(|Accruals|)* to control for differences in volatility between accruals and cash flows (Sloan, 1996); an indicator variable equal to 1 if the firm distributes dividends during the year, 0 otherwise *(Div)* to control for the

[10] The sample period begins after 1988 because our measures require data from the cash flow statement, which was not reported prior to that year (Hribar and Collins, 2002). We drop observations with negative estimated fixed costs or estimated fixed costs that larger than total operating costs when measuring *DOL_Lev*. All other continuous variables are winsorized at the 1% level.

[11] We also use a measure of earnings volatility that accounts for the relation between earnings persistence and volatility, as described in Dichev and Tang (2009). Results are fully robust to the use of this specification.

lower volatility of earnings of dividend-paying firms (Skinner and Soltes, 2011); the ratio of intangible assets over total assets *(Intang)* to control for the noise in earnings introduced by the reporting for intangible assets documented by Lev (2003); leverage *(Leverage)*, calculated as short and long term debt over total assets, to control for the volatility in earnings induced by the fix nature of interest expenses; he market-to-book ratio *(MTB)* and the logarithm of total assets *(Size)* to control for the different volatility in performance of stable and growing firms; earnings persistence *(Persistence)*, calculated from an auto-regressive model of seasonal changes estimated over 20 trailing quarters (5 years) following Lev (1983) and Kormendi and Lipe (1987); and for the absolute value of special items *(|Special Items|)* to control for the lower persistence of non-recurring items (Fairfield, Sweeney, and Yohn, 1996). Finally, we include industry fixed effects to control for barriers to entry (Lev, 1983) and any other industry-specific factor influencing earnings volatility, and year fixed effects.

H1 predicts a positive association between earnings volatility and the degree of operating leverage ($\beta > 0$). Table 2 reports the parameter estimates of Equation 9 and shows, consistent with our conjecture, that the coefficient on the degree of operating leverage is positive and significant ($p$-value $< 0.01$) in all specifications, regardless of the measure of volatility or the measure of the degree of operating leverage. The parameter estimates suggest that a one standard deviation increase in *DOL_H-L* increases the volatility of earnings as measured by *Volatility1* by 0.007, which represents a 14.7% increase over the sample mean of *Volatility1*. Similarly, one standard deviation increase in *DOL_H-L* is associated with a 0.011 increase in *Volatility2*, which represents approximately an 11.7% increase over the sample mean of *Volatility2*. We find similar economic significance when considering *DOL_Lev*. The coefficient on the control variables are broadly consistent with those found in prior studies.

Overall, the evidence reported in Table 2 supports our first hypothesis that earnings volatility is positively related to the degree of operating leverage.[12]

[12]We recognize that firms may choose the degree of operating leverage recognizing the relation between the degree of operating leverage and earnings volatility. However, we posit that the degree of operating leverage is relatively static over time such that firms are not altering the degree of operating leverage to

*4.2. Incentive to engage in aggressive revenue recognition*

Our second hypothesis is that the incentive to engage in aggressive revenue recognition to meet an earnings target is increasing in the degree of operating leverage. To test this hypothesis we use these measures to estimate the following empirical model:

$$\begin{aligned} Discretionary\,Rev_{i,t} &= \alpha + \beta_1 SUSP_{i,t} + \beta_2 DOL_{i,t} + \\ &+ \beta_3 SUSP_{i,t} * DOL_{i,t} + \sum \delta X_{i,t} + \\ &+ \sum \zeta SUSP_{i,t} * X_{i,t} + \epsilon_{i,t} \end{aligned} \tag{10}$$

We follow Stubben (2010) and measure discretionary revenues as the residual from a regression of account receivables on revenues to capture aggressive revenue recognition ($Discretionary\,Rev$).[13] We identify firms that meet or just beat the zero-earnings threshold, analysts' forecast, or last year's EPS as suspected of taking actions to avoid missing an earnings threshold (Burgstahler and Dichev, 1997b, Degeorge et al., 1999, Roychowdhury, 2006). Accordingly, we define $SUSP$ as an indicator variable equal to 1 when earnings per share meet or just beat (by less than \$0.01) the earnings threshold, 0 if earnings per share are just below the earnings threshold (by less than \$0.01). We control for other known determinants of reporting earnings just around the zero earnings-threshold. Specifically, we include the absolute value of accruals and absolute special items to control for the possibility that the firm manipulate accruals or special items to meet/beat the earnings threshold. We include earnings persistence and earnings volatility to control for the possibility that firms with more stable earnings beat the zero earnings threshold more frequently. We follow previous research (e.g., Doyle et al., 2013, Roychowdhury, 2006) and control for differences in firm characteristics by including leverage, market to book, and size in the model. Each control variable is also interacted with $SUSP$ to account for the possibility that the relation between

manage earnings volatility in any given year. As evidence of this, we test for the static nature of the degree of operating leverage and find that our measures of DOL are highly persistence over time: the correlation between *DOL_H-L (DOL_Lev)* in year *t* and year *t-1* is 0.45 (0.73), while the correlation between *DOL_H-L (DOL_Lev)* in year *t* and year *t-5* is 0.33 (0.46).

[13] We store the residuals from the following regressions: $\triangle AR = \alpha + \beta \triangle REV + \varepsilon$, where $AR$ represents account receivables while $REV$ represents revenues.

the control variable and discretionary revenues changes when earnings per share meet or just beat (by less than $0.01) the earnings threshold. Finally, the models include industry and year fixed effects to control for any remaining industry time-invariant or time-varying differences.

We predict that aggressive revenue recognition to meet an earnings target is increasing in the degree of operating leverage, a positive coefficient on the interaction of SUSP and the degree of operating leverage ($\beta_3 > 0$). Table 3, Panel A reports the results from estimating Equation 10. Consistent with our hypothesis, we find a positive and significant coefficient on the interaction between the degree of operating leverage and *SUSP.* The coefficient is also either statistically different from zero at the 5% or 10% level ($p$-value = 0.089 in Column 1, $p$-value = 0.067 in Column 2, $p$-value = 0.061 in Column 3, $p$-value = 0.095 in Column 5, $p$-value = 0.044 in Column 6) or marginally insignificant ($p$-value = 0.136 in Column 4). These results support the hypothesis that aggressive revenue recognition to meet an earnings target is increasing in the degree of operating leverage.

Our prediction on the relation between the degree of operating leverage and aggressive revenue recognition applies only to firms with an incentive to meet an earnings target. Thus, we do not make a prediction about the main relation between the degree of operating leverage and discretionary revenues ($\beta_2$). Nevertheless, we observe that the coefficient is in all cases negative and statistically significant, suggesting that firms with a high degree of operating leverage report lower discretionary revenues than firms with a low degree of operating leverage. This coefficient could reflect high degree of operating leverage firms manipulating revenues to achieve a smoother revenue stream (Graham et al., 2005). The sign and significance of the coefficients on the control variables are generally consistent with those found studies relying on similar analyses (e.g., Doyle et al., 2013).

We predict that firms with a high degree of operating leverage have a stronger incentive to use discretion over revenue recognition to meet or beat an earnings target. Firms also have discretion over other accounting items. Nevertheless, our prediction is specific to aggressive revenue recognition and does not extend to alternative manipulation instruments. To consider whether our findings about the degree of operating leverage and aggressive revenue recognition extend to alternative forms of earnings management, we estimate Equation 10 replacing aggressive revenue recognition with abnormal discretionary accruals as dependent variable. We find in Table 4, Panel B, that the degree of operating leverage is not related to the extent that managers use discretionary accruals to meet an earnings target. The results of this placebo test support our prediction that firms with a high degree of operating leverage have a stronger incentive to aggressively recognize revenue to meet an earnings target, but do not have a stronger incentive to engage in the manipulation of other accruals to meet earnings targets. The combination of results is consistent with our prediction that the incentive stems from the difference in the incremental sales required to meet an earnings target induced by different levels of the degree of operating leverage.

We also control for differences in the business cycle that may relate to the degree of operating leverage by using an alternative specification for discretionary revenues. Specifically, we calculate discretionary revenues as the error term in a regression of account receivables on sales, where sales are split into sales from the first three quarters and sales from the last quarter (Stubben, 2010). Untabulated results suggest that considering this additional factor does not influence our finding that the use of aggressive revenue recognition to meet an earnings target is increasing in the degree of operating leverage. Finally, we also consider the possibility that the relation between the degree of operating leverage and revenue manipulation is non-linear by replacing the degree of operating leverage with an indicator variable equal to 1 when the degree of operating leverage is larger than the sample mean for the year, 0 otherwise. In untabulated results, we continue to find evidence that aggressive revenue recognition to meet an earnings target is increasing in the degree of operating leverage.

Overall, we find evidence in support of the hypothesis that the incentive to engage in aggressive revenue recognition to meet an earnings target is increasing in the degree of operating leverage. The result is robust to the use of alternative earnings thresholds, and specific to aggressive revenue recognition.

Together, the results in this section support our hypotheses that earnings volatility and the use of aggressive revenue recognition to meet earnings targets increase in the degree of operating leverage.

## 5. Tests of the degree of operating leverage and the useful of earnings

In this section, we test the relation between the degree of operating leverage and the usefulness of earnings to shareholders. Consistent with Statement of Financial Accounting Concepts No. 2, we define the usefulness of earnings as the informativeness (i.e. predictive value) and value relevance (i.e. confirmatory value).

### *5.1. Degree of operating leverage and earnings usefulness*

We first assess the unmediated relation between the degree of operating leverage and the usefulness of earnings. We test this relation with the following empirical model:

$$\begin{aligned} Abnormal\ Return_{i,t} &= \alpha + \beta_1 UE_{i,t} + \beta_2 DOL_{i,t} + \beta_3 UE_{i,t} * DOL_{i,t} + \\ &+ \sum \delta X_{i,t} + \sum \zeta UE_{i,t} * X_{i,t} + \epsilon_{i,t} \end{aligned} \tag{11}$$

*Abnormal Return* measures the informativeness and value relevance of earnings. We define earnings informativeness as the extent to which investors revise their beliefs when earnings are released (Collins and Kothari, 1989), as proxied by the market reaction to earnings surprises. We measure investor belief revision from earnings as the abnormal stock returns cumulated over the three days around the earnings announcement date ($CAR$). We define value relevance as the extent to which earnings capture and reflect the events and information about the firm occurred during the fiscal year (Collins and Kothari, 1989). We measure value relevant events during the fiscal year as abnormal stock returns compounded over the fiscal year ($BHAR$), calculated as buy and hold abnormal returns compounded over the 12 month period ending 3 months after the fiscal year end with an expected return model based on size, book to market, and momentum, adjusted for delisting as in Beaver, McNichols, and Price (2007). Unexpected earnings ($UE$) is the difference between reported earnings per share and the most recent IBES consensus forecast available before the earnings announcement.

We include controls for other known economic determinants of earnings response coefficients. Kormendi and Lipe (1987), Collins and Kothari (1989), and Easton and Zmijewski (1989) suggest that the earnings response coefficient varies cross-sectionally with firm risk and earnings properties. We include measures of systematic and idiosyncratic risk using stock beta *(Beta)* and stock return volatility *(Ret_ Vol)*, to control for the relation between the degree of operating leverage and risk (e.g., Lev, 1974). We further control for risk by including *Loss*, an indicator variable equal to 1 if the firm incurs a loss during the year, 0 otherwise. We also include the other determinants of earnings properties from Equation 9 *(|Accruals|, Div, Intang, Leverage, MTB, Persistence, Size, |Special Items|)* to isolate the effect of the degree of operating leverage from these other determinants. We interact all these variables with *UE* to capture. Finally, we include industry and year fixed effects to control for any remaining industry time-invariant or time-varying differences.

Hypotheses 3 and 4 predicts that the usefulness of earnings to shareholders is decreasing in the degree of operating leverage, which suggests that the informativeness and usefulness of earnings decreases in the degree of operating leverage. In our tests, this predicts a negative coefficient on the interaction of unexpected earnings and the degree of operating leverage, $\beta_3$. Table 5 reports the parameter estimates from Equation 11 and $BHAR$ in as dependent variable.Columns (1) to (3) report the results where $CAR$ is dependent variable. Consistent with the information content of earnings decreasing in the degree of operating leverage, we find a negative and statistically significant coefficient on the interaction of unexpected earnings and the degree of operating leverage ($p$-value $< 0.01$). The coefficient suggests that a one standard deviation increase in *DOL_ H-L* corresponds to a decrease in the earnings response coefficient of about 7%. We also observe a significantly negative coefficient on the main effect of the degree of operating leverage, which suggests that abnormal returns decline with the degree of operating leverage within the sub-sample of firms that meet the earnings target.

Columns (4) to (6) report the results where *BHAR* is the dependent variable, which tests for the relation between the degree of operating leverage and the value relevance if earnings. We continue to find a negative and significant coefficient on the interaction term of unexpected earnings and the degree of operating leverage ($p$-value $< 0.05$ and $p$-value $< 0.01$ for *DOL_ H-L* and *DOL_ Lev*, respectively). This result is consistent with our prediction that the value relevance of earnings is decreasing in the degree of operating leverage. An analysis of the economic magnitude suggests that a one standard deviation increase in *DOL_ H-L* translates into a decrease in the earnings response coefficient of about 4%.

Together, the results reported in Table 5 provide evidence that shareholders react less strongly to earnings surprises announced by firms with a higher degree of operating leverage. This is consistent with our prediction that the usefulness of earnings is decreasing in the degree of operating leverage.

### *5.2. Degree of operating leverage, earnings usefulness, and earnings properties*

In this section, we shed light on whether and how the relation between the degree of operating leverage and earnings properties drives the relation between the degree of operating leverage and the usefulness of earnings documented in the previous section. First, we estimate the the effects of earnings volatility and the incentive to aggressively recognize revenue to meet an earnings target on the usefulness of earnings in a recursive structural equation model (i.e., a path analysis) similar to Bhattacharya et al. (2011), Core et al. (2015), and Mayew et al. (2014).[14] We then test whether shareholders recognize the stronger incentive to engage in aggressive revenue recognition to meet an earnings target for higher degree of operating leverage firms and react more negatively to firms with a high degree of operating leverage that just miss an earnings target.

[14]This is also known as seemingly unrelated regressions (Hayashi, 2000, p. 279).

*5.2.1. Seemingly Unrelated Regression of the Usefulness of Earnings*

We study whether and how the relation between the degree of operating leverage and earnings properties drives the documented relation between the degree of operating leverage and the usefulness of earnings to market participants using a recursive structural equation model. The path analysis estimates the impact of the degree of operating leverage on earnings volatility, the incentive to engage in aggressive revenue recognition, and the earnings response coefficient simultaneously, accounting for the correlation in the respective error terms (Abernethy et al., 2015, Preacher and Hayes, 2008, Schoenfeld, 2017). Specifically, we estimate the following linear equations simultaneously:

$$VOL_{i,t} = \alpha_2 + \gamma DOL_{i,t} + \sum \delta X_{i,t} + \epsilon_{1,i,t} \tag{12}$$

$$SUSP_{i,t} = \alpha_3 + \zeta DOL_{i,t} + \sum \delta X_{i,t} + \epsilon_{3i,t} \tag{13}$$

$$\begin{aligned} ERC_{i,t} &= \alpha_4 + \beta_1 DOL_{i,t} + \beta_2 VOL_{i,t} + \\ &+ \beta_3 SUSP_{i,t} + \beta_4 BETA_{i,t} + \epsilon_{4i,t} \end{aligned} \tag{14}$$

Equations 12 and 13 model earnings volatility *(Volatility)* and the incentive to engage in aggressive revenue recognition *(SUSP)* as a function of the degree of operating leverage and the set of economic determinants described in Equations 9 and 11.[15] Equation 14 models *ERC,* calculated as the coefficient resulting from estimating a rolling regression of *CAR* (*BHAR*) on unexpected earnings over the previous 10 years, as a function of its structural components: earnings volatility, the incentive to engage in aggressive revenue recognition, risk, and the degree of operating leverage.[16] The effect of the degree of operating leverage through the channels of earnings volatility and the incentive to engage in aggressive revenue

[15] Our goal is to study how the market reaction to unexpected earnings changes as a function of the use of discretionary revenues to meet an earnings target. The difficulty in measuring the joint effect of discretionary revenues and meeting an earnings target led us to focusing on SUSP, under the assumptions that the market considers firms that meet or just beat an earnings target as potential manipulators and the market anticipates that high DOL firms are more likely to engage in aggressive revenue recognition to meet earnings targets.

[16] Equation 11 includes controls to capture the relation between earnings volatility (which is not directly included in the regression) and determinants other than the degree of operating leverage in order to isolate the effect on ERC induced by the degree of operating leverage. Equation 14 does not include such controls because it directly incorporates the structural determinants of ERC such as earnings properties and systematic risk.

recognition is then inferred by multiplying the relevant coefficient in the first two regressions with the coefficient associated with the determinant under consideration in the third regression. For example, the effect of the degree of operating leverage on ERC through its correlation with earnings volatility can be computed by multiplying $\gamma$ from Equation 12 with $\beta_2$ from Equation 14. The direct effect of the degree of operating leverage on the earnings response coefficient is represented by the coefficient $\beta_1$ in Equation 14.

Table 6 reports the results of the system of equations, while Figure 1 portrays the results of the path analysis.[17] We find that the direct effect of the mediating variable *Volatility* on *CAR* is negative and significant ($p$-value $<0.01$). We also find that the direct effect of *SUSP* on *CAR* is negative and significant ($p$-value $<0.01$). These results persist when *BHAR* is the dependent variable. We also find support for our previous findings that earnings volatility and the incentive to engage in aggressive revenue recognition increases in the degree of operating leverage as evidenced by positive coefficients *DOL* from estimates of Equations 12 and 13.

Turning to our hypotheses, we find that the degree of operating leverage influences the informativeness of earnings through earnings volatility and the incentive to engage in aggressive revenue recognition. Specifically, consistent with our hypotheses, we find that earnings response coefficients decline in the degree of operating leverage through the relation between the degree of operating leverage and earnings volatility and the incentive to engage in aggressive revenue recognition, as evidenced by the negative and significant coefficients ($p$-value $< 0.01$ for volatility and $p$-value $< 0.10$ for suspected manipulation). On aggregate, we find evidence that that the negative relation between the degree of operating leverage and earnings informativeness documented in Table 6 Panel A extends from the relation between the degree of operating leverage and earnings volatility, which accounts for about 93% of the negative indirect effect. This result suggests that the uncertainty introduced in the earnings stream by higher degrees of operating leverage plays a significant role in the usefulness of

[17] Table 6 Panel A presents a table of the results.

earnings to shareholders. The incentive to engage in aggressive revenue recognition to meet an earnings target induced by higher degrees of operating leverage explains the remaining 7% of the association between the degree of operating leverage and the usefulness of earnings.

Results when estimating *BHAR,* documented in Table 6 Panel B and Figure 2, show a similar pattern. In support of our hypothesis, we observe that the value relevance of earnings declines through the relation between the degree of operating leverage and earnings volatility as evidenced by the negative and statistically significant coefficients on *DOL* ($p$-value $<0.01$). In weak support of our hypothesis, the coefficient on relation between the degree of operating leverage and the incentive to engage in aggressive revenue recognition is also negative, but not statistically different from zero ($p$-value $= 0.204$).

Overall, we observe that the informativeness of earnings declines with the degree of operating leverage: investor response to earnings declines with the degree of operating leverage. We also find that value relevance declines with the degree of operating leverage: the extent to which earnings explain abnormal stock returns cumulated over the fiscal year declines with the degree of operating leverage. These results support the findings in the previous section, and suggest that market participants recognize the relation between earnings properties and the degree of operating leverage. We also find evidence that the relation between the degree of operating leverage and volatility in earnings is the most important contributing factor to the negative relation between the degree of operating leverage and earnings usefulness, while incentives to aggressively recognize revenue also contribute to a decline in the usefulness of earnings to market participants.

*5.2.2. The Costs of Missing an Earnings Target*

We next test whether the stock market reaction to earnings announcements (earnings informativeness) is a function of the degree of operating leverage for the subset of firms that barely miss an earnings target. We conjecture that shareholder skepticism about the underlying economic performance of a firm is stronger for firms with a high degree of operating leverage that just miss an earnings target. We expect shareholders to be more skeptical about the underlying economic performance of firms that barely miss an earnings target because these firms had a strong incentive to engage in aggressive revenue recognition to meet the earnings target, but were unable to meet the target (Shin, 1994). To test this conjecture we first estimate the following regression model:

$$\begin{aligned} CAR_{i,t} &= \alpha + \beta_1 UE_{i,t} + \beta_2 DOL_{i,t} + \beta_3 UE_{i,t} * DOL_{i,t} + \\ &+ \eta_1 UE_{i,t} * MISS_{i,t} + \eta_2 DOL_{i,t} * MISS_{i,t} + \eta_3 UE_{i,t} * DOL_{i,t} * MISS_{i,t} + \\ &+ \sum \delta X_{i,t} + \sum \zeta UE * X_{i,t} + \epsilon_{i,t} \end{aligned} \tag{15}$$

$CAR$ measures the stock market reaction cumulated over the three days around the earnings announcement date. Unexpected earnings ($UE$) is the difference between reported earnings per share and the most recent IBES consensus forecast available before the earnings announcement. $MISS$ identifies instances in which a firm barely misses an earnings target, and it is measured as an indicator equal to 1 if the firm missed the earnings target by 1 cent, 0 otherwise. The model includes the same controls described for equation 11.

We predict that the stock market reaction to earnings announcement that barely missed an earnings target is more negative for firms with a high degree of operating leverage, a negative coefficient on the interaction term $UE_{i,t} * DOL_{i,t} * MISS_{i,t}$ ($\eta_3$). Consistent with our prediction, we find a negative and significant $\eta_3$ in three of six specifications (*p-value* $< 0.01$). These results are consistent with our conjecture that shareholders react more negatively to earnings announcements that barely miss an earnings target when the firm exhibits a high degree of operating leverage.

To provide further evidence on whether shareholder skepticism about the underlying economic performance of a firm is stronger for firms with a high degree of operating leverage that just miss an earnings target we estimate the following regression model on the subset of firms that barely miss an earnings target:

$$CAR_{i,t} = \alpha + \beta_1 DOL_{i,t} + IndustryFE + YearFE + \epsilon_{i,t} \tag{16}$$

We predict that, among the sub-sample of firms that barely miss an earnings target, the market reaction to missing the target is decreasing in the degree of operating leverage. That is, we expect the market to react negatively to firms that had greater opportunities to engage in aggressive revenue revenue recognition to meet an earnings target but miss the target. Table 6, Panel B reports the coefficients from estimating equation 16. The table shows that the coefficient of interest, $\beta_1$, is negative in all cases, and statistically different from zero at the 10% level in five out of six estimations.

Together, these results support our prediction that market participants recognize that the incentive and opportunity to meet an earnings threshold with aggressive revenue recognition increases with the degree of operating leverage such that the market reacts more negatively when these firms miss an earnings target. This result provides additional support for our inference that the usefulness of earnings declines in the degree of operating leverage through the incentievs to aggressively recignzie revenue to meet an earnings target.

## 6. Conclusion

We study the relation between the degree of operating leverage, earnings properties, reporting incentives, and the usefulness of earnings to shareholders. After validating two proxies for the degree of operating leverage, we first document that the degree of operating leverage is positively related to volatile earnings, which is consistent with an increase in the effect of demand shocks on earnings as the cost structure leans towards fixed costs. We further suggest that cost structure influences how managers respond to the incentives to meet earnings targets by documenting that the increased marginal effect of revenue on earnings associated with high degrees of operating leverage results in more aggressive revenue recognition to meet an earnings target. Overall, these findings indicate that the cost structure of the firm is related to earnings properties.

We then observe that the correlation between the degree of operating leverage, earnings properties and reporting incentives influences the usefulness of earnings to shareholders. The earnings of higher degree of operating leverage firms are less informative in that there is a lower revision of shareholders' beliefs at the announcement date, and less value relevant in that they capture a lower portion of the amount of value relevant information accrued to the market during the fiscal year. We then disentangle the channels through which the degree of operating leverage influences the usefulness of earnings to shareholders using a recursive structural equation model. The results suggest that the correlations between the degree of operating leverage, earnings volatility, and the incentive to engage in aggressive revenue recognition to meet an earnings target are both at play. The correlation between the degree of operating leverage and earnings volatility is the most important factor that influences the usefulness of earnings. However, we also find that market participants recognize the incentive and opportunity to meet an earnings threshold with aggressive revenue recognition and react less to firms that meet and earnings target and more negatively to firms that miss an earnings target for firms with high degree of operating leverage. Together, our results suggest that cost structure influences the information content of earnings in a way that affects market participants reaction to earnings.

We contribute to the literature by shedding light on how cost structure influences the information environment and the usefulness of earnings to shareholders through its relation with earnings properties. We bring together the stream of literature associating earnings properties and earnings usefulness with the stream of literature connecting firm fundamentals and earnings. In doing so, we highlight the importance of considering the channels that relate firm fundamentals to earnings usefulness to provide a more complete understanding of this complex relation. Finally, we make a methodological contribution by evaluating and validating two proxies for the degree of operating leverage and providing evidence through simulation that they capture the underlying construct of interest.

## Appendix A - The Simulation Approach

The simulation process is designed according to the following six steps.

*Step 1: General structure*

We simulate 1,000 samples of 100 firms observed over 40 Quarters.

*Step 2: Parameter Calibration*

One of the most important and difficult aspects of designing simulations on managerial accounting topics is the calibration of the relevant parameters in a way that ensures external validity (Labro, 2015). We maximize external validity by designing the distribution of parameters in the model using the distribution of the associated variables as observed in Compustat. Specifically, we use Compustat Quarterly data to estimate the distribution of revenues and total operating costs from the longest sample period available in the data (1961-2014). Parameter values are drawn from the last five years in the sample (2009-2014). This approach ensures that the distribution approximates revenues and total operating costs behavior over time, while also reflecting recent economic magnitudes.

*Step 3: First Quarter Parameter Definition*

Revenues and total operating costs are assigned to each firm during the first simulated quarter using a joint log-normal distribution based on the following information:

- Revenues follow a log-normal distribution with parameters $N \sim (4.068, 2.798)$ .
- Total operating costs follow a log-normal distribution with parameters $N \sim (4.166, 2.438)$.
- Revenues and total operating costs have a correlation coefficient of 98.8%.

We then randomly assign the 100 firms to 5 industries. Each industry is characterized by a different cost structure[18][19], where:

- Industry 1 has fixed costs as a percentage of TOC uniformly distributed over [0,0.2].
- Industry 2 has fixed costs as a percentage of TOC uniformly distributed over [0.2,0.4].
- Industry 3 has fixed costs as a percentage of TOC uniformly distributed over [0.4,0.6].
- Industry 4 has fixed costs as a percentage of TOC uniformly distributed over [0.6,0.8].
- Industry 5 has fixed costs as a percentage of TOC uniformly distributed over [0.8,1].

We finally use the resulting fixed costs ($FC$) to calculate variable costs per unit ($VC/u$):

$$VC/u = \frac{(TOC - FC)}{REV} \tag{17}$$

[18] This procedure is similar to Balakrishnan et al. (2014), although they consider four industries with different mean values.

[19] The choice of the different cost structures and the distribution of the cost structure for the five industries is somehow discretionary. Ideally, one would use real data to select parameters and generate more realistic simulations. However, the lack of public data and surveys on cost structure (Labro, 2015) makes this solution unavailable.

*Step 4: Expansion of the sample over 40 Quarters*

We then expand the sample over the next 39 quarters where REV, VC/u, and FC follow the following time-series distribution. The change in revenues follow the distribution of the quarterly change in revenues observed in Compustat over the period 1961-2014 ($N\sim$(0.0526, 0.331)).[20] We model the change in VC/u over time as an AR(1) process with drift, where VC/u decrease on average by 1% every quarter with error $\varepsilon \sim N(0, 0.025)$.[21] The fixed costs remain constant, unless a shock to the cost structure of the firm occurs We introduce three categories of of 300 shocks randomly assigned and evenly distributed. The three categories of shocks are as follows:

- Step Cost Function: FC increase (decrease) as a consequence of a cumulated positive (negative) revenue growth in the previous four quarters, while VC/u remain constant. This shock captures the need for firms that have saturated their production capacity to expand their production facilities, or the need for firms operating at a too low saturation level to decrease their deployed capital.

- Vertical Integration: FC increase and VCu decrease such that TOC remain constant. This shock represents the case of firms internalizing the production of an input or the rendering of a service that was previously bought from external suppliers.

- Outsourcing: FC decrease and VCu increase such that TOC remain constant.[22] This shock represents the case of firms outsourcing the production of an input or the rendering of a service that was previously produced/rendered internally.

*Step 5: Calculation of DOL*

We calculate the simulated degree of operating leverage ($DOL$) as:

$$DOL_{i,t} = \frac{FC_{i,t}}{TOC_{i,t}} \tag{18}$$

where $i$ and $t$ are firm and year indicators. We also calculate the proxies for the degree of operating leverage as described in Section 3.

*Step 6: Repetition of the process (1,000 times)*

Finally, we repeat the simulation process 1,000 times. Each time, we store information on:

[20] The specification assumes that revenues follow a martingale process, where the best predictor for revenues in *t+1* is represented by revenues in *t*. An alternative specification for revenue change could be the use of an AR(.) process with parameters calculated from Compustat data. The problem with this approach is that the length and cyclicality of the business cycle change from firm to firm, making the application of a single AR specification to all firms problematic.

[21] The average decline in VCu is justified by the assumption that firms engage in employee training programs and introduce technology advancements that enable them to reduce VCu, while the choice of the distribution of errors with standard deviation of 0.025 is made to guarantee that changes in VCu make economic sense. The adopted specification guarantees that VCu does not change from quarter to quarter by more than ±10%.

[22] We expect firms to engage in Vertical Integration or Outsourcing only when such a decision brings about benefits to them, i.e. lower total operating costs. However, the difficulty in modeling the magnitude of these benefits made su opt for a specification that does not take them into consideration.

- The correlation between the simulated degree of operating leverage and the proxies.
- The p-value resulting from testing whether the correlation between the degree of operating leverage and the proxies is different from zero.
- The mean and median difference and standard deviation of the difference between *DOL* and *DOL_H-L* and *DOL* and *DOL_Lev*[23] and *DOL* are calculated. Given that DOL_H-L and DOL_Lev lie by definition between 0 and 1, the distance between simulated and measured degree of operating leverage represents by how much, on average and at the median, the proxy over/under estimates operating leverage. Furthermore, the standard deviation is used to verify the magnitude of positive and negative errors.

From the simulations we find that the proxies perform well. Correlation coefficients are above 90% in all simulations, and they are in all cases significantly different from zero at the 1% level. The second test, applicable only to DOL_H-L and DOL_Lev, tries to measure by how much the estimated degree of operating leverage differs from the simulated degree of operating leverage. The analysis looks at the distribution of the mean and median distance (Panel B) and standard deviation of the distance (Panel C) between the simulated and estimated degree of operating leverage over the 1,000 simulations. We observe that the distance is small on average and at the median, and also only concentrated around the mean, as reflected by the small standard deviation.

[23] This information is available only for the first two proxies because the nature of DOLCH does not make it directly comparable with the real degree of operating leverage.

Table A.1

| **Panel A: Corr. Coeff.** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Proxy | Mean | Std. Dev. | Min | 10% | 25% | 50% | 75% | 90% | Max | Sig. |
| DOL_H-L | 90.21% | 1.21% | 85.90% | 88.71% | 89.44% | 90.22% | 90.99% | 91.73% | 93.35% | 100% |
| DOL_Lev | 94.39% | 0.87% | 90.22% | 93.22% | 93.84% | 94.46% | 94.97% | 95.45% | 96.64% | 100% |
| DOLCH | -91.14% | 4.03% | -39.75% | -89.34% | -90.64% | -91.74% | -92.63% | -93.26% | -94.96% | 100% |
| **Panel B: Diff. Distr.** | | | | | | | | | | |
| MeanDIFF1 | -3.18% | 0.46% | -4.78% | -3.76% | -3.48% | -3.19% | -2.89% | -2.61% | -1.60% | |
| MedDIFF1 | -0.16% | 0.06% | -0.42% | -0.24% | -0.20% | -0.15% | -0.11% | -0.08% | -0.02% | |
| MeanDIFF2 | -0.34% | 0.53% | -1.91% | -1.02% | -0.69% | 0.00% | 0.03% | 0.33% | 1.40% | |
| MedDIFF2 | -0.05% | 0.07% | -0.47% | -0.14% | -0.07% | -0.03% | 0.00% | 0.00% | 0.16% | |
| **Panel C: SD of Diff.** | | | | | | | | | | |
| DOL_H-L | 14.72% | 0.97% | 11.81% | 13.48% | 14.06% | 14.75% | 15.38% | 15.96% | 18.30% | |
| DOL_Lev | 11.55% | 0.82% | 9.17% | 10.51% | 10.98% | 11.51% | 12.10% | 12.60% | 15.62% | |

The table reports the results of the simulation analysis. Panel A describes the distribution of the correlation coefficient between simulated and estimated degree of operating leverage. Panel B reports the distribution of the difference between actual and measured operating leverage, while Panel C shows the distribution of the standard deviation of the difference between simulated and estimated degree of operating leverage.

Appendix B Variable Definitions

| Measure | Description |
|---|---|
| DOL_H-L | Degree of Operating Leverage, calculated using the high-low activity approach. |
| DOL_Lev | Degree of Operating Leverage, calculated using the level regression approach. |
| Accruals | Earnings minus operating cash flow, scaled by total assets. |
| Beta | Stock market beta, calculated using the monthly stock return over the 60 months (minimum 30 non-missing observations) before the earnings announcement. |
| BHAR | Stock return cumulated over the twelve months period ending three months after the fiscal year end. |
| CAR | Market-adjusted stock return cumulated over the three days period centered around the earnings announcement. |
| Div | 1 if the firm distributes dividend during the year, 0 otherwise. |
| Discretionary Rev | Error term resulting from a regression of account receivable changes on contemporaneous sales changes as in Stubben (2010). |
| Earnings | Income before extraordinary items scaled by total assets. |
| Intang | Intangible assets scaled by total assets. |
| Leverage | Short term plus long term debt, scaled by total assets. |
| Life Cycle | Life-cycle stage of the firm, calculated as in Collins et al. (2014). |
| Loss | 1 if net income is smaller than zero, 0 otherwise. |
| MTB | Market value of equity over book value of equity. |
| Persistence | Coefficient of an AR(1) model in seasonal changes calculated over twenty trailing quarters. |
| Roa | Net income over lagged total assets. |
| Ret_Vol | Standard deviation of monthly stock returns over the 60 months (minimum 30 non-missing observations) before the earnings announcement. |
| Volatility1 | Rolling standard deviation of quarterly earnings calculated over the last twenty quarters. |
| Volatility2 | Rolling standard devation of annual earnings calculated over the last ten years. |
| Size | Natural logarithm of lagged total assets. |
| Special Items | Special items scaled by total assets. |
| Unexpected Earnings | Difference between reported earnings per share and the most recent analysts consensus forecast reported in IBES. |

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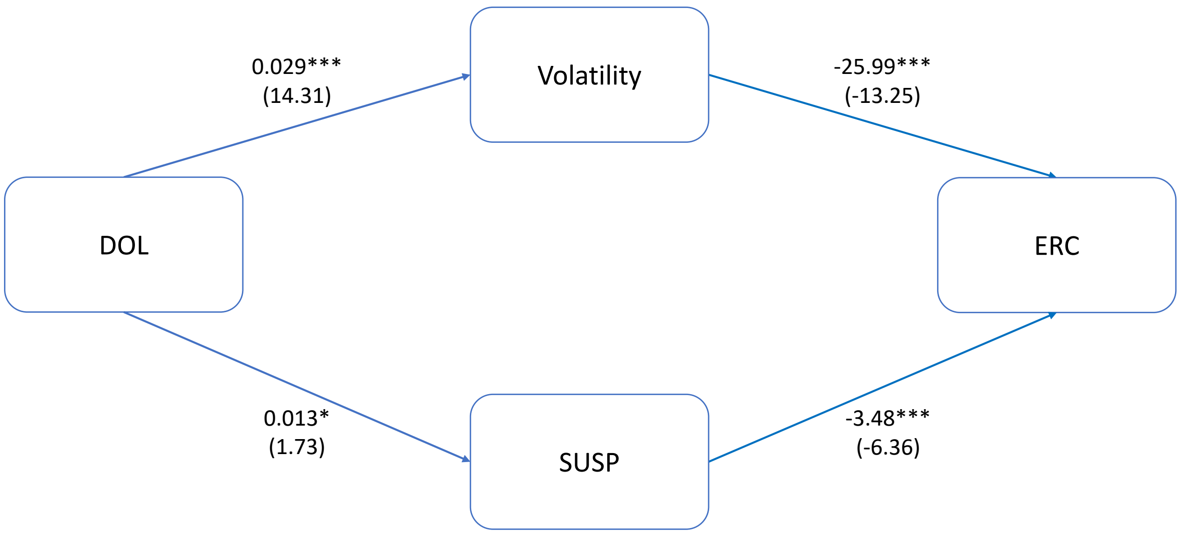
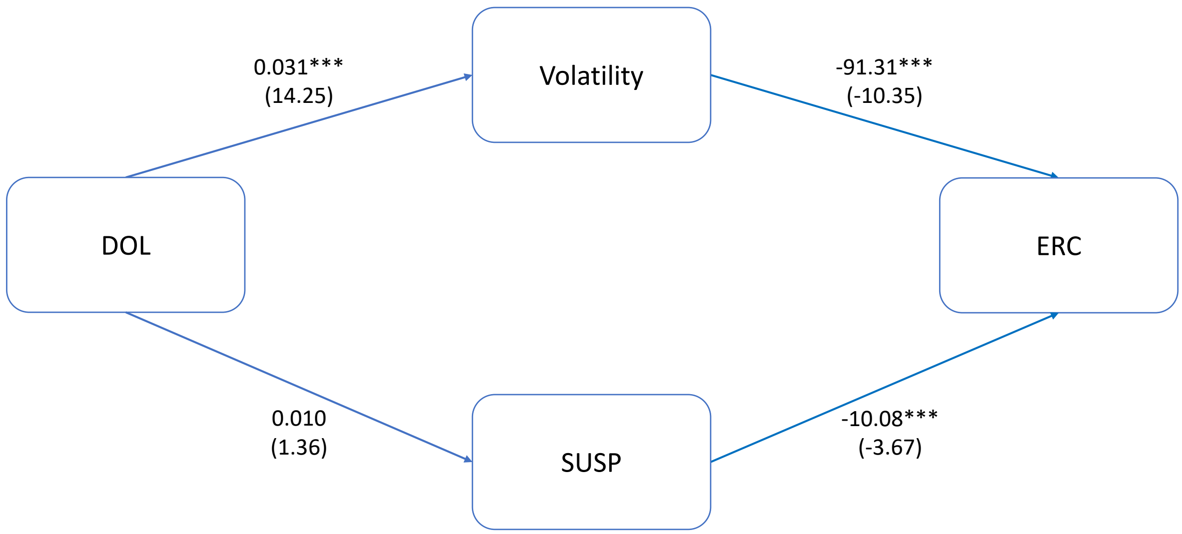
Figure 1




The figure describes the results from estimating recursive structural equations as in Section 5.2. The effect of the degree of operating leverage on the informativeness of earnings through the channel of each earnings property is estimated by multiplying the coefficient describing the relation between the degree of operating leverage and the earnings property and the coefficient describing the relation between the earnings property and the informativeness of earnings.
The degree of operating leverage:

- decreases the informativeness of earnings through earnings volatility. The coefficient is -0.635 and it is statistically significant at the 1% level ($p$-value $< 0.01$).
- decreases the informativeness of earnings through the likelihood of manipulation. The coefficient is -0.044 and it is statistically significant at the 10% level ($p$-value $= 0.096$).

Figure 2




The figure describes the results from estimating recursive structural equations as in Section 5.2. The effect of the degree of operating leverage on the value relevance of earnings through the channel of each earnings property is estimated by multiplying the coefficient describing the relation between the degree of operating leverage and the earnings property and the coefficient describing the relation between the earnings property and the value relevance of earnings.
The degree of operating leverage:

- decreases the value relevance of earnings through earnings volatility. The coefficient is -2.792 and it is statistically significant at the 1% level ($p$-value $< 0.01$).
- marginally decreases the value relevance of earnings through the likelihood of manipulation. The coefficient is -0.098, but not statistically different from 0 ($p$-value $=$ 0.203).

**Table 1: Summary Statistics**

Panel A: Descriptive Statistics

| | N | Mean | SD | P25 | P50 | P75 |
|---|---|---|---|---|---|---|
| DOL_H-L | 32,418 | 0.277 | 0.212 | 0.110 | 0.227 | 0.398 |
| DOL_Lev | 42,382 | 0.258 | 0.243 | 0.074 | 0.178 | 0.369 |
| Accruals | 42,382 | -0.064 | 0.126 | -0.096 | -0.050 | -0.011 |
| Beta | 38,604 | 1.164 | 0.783 | 0.664 | 1.068 | 1.540 |
| Bhar | 37,362 | 0.001 | 0.581 | -0.303 | -0.057 | 0.207 |
| Car | 28,099 | 0.005 | 0.076 | -0.034 | 0.003 | 0.043 |
| Discretionary Rev | 40,196 | -0.001 | 0.044 | -0.019 | -0.003 | 0.014 |
| Div | 42,382 | 0.370 | 0.483 | 0.000 | 0.000 | 1.000 |
| Earnings | 42,382 | 0.003 | 0.178 | -0.012 | 0.039 | 0.080 |
| Intang | 42,382 | 0.127 | 0.167 | 0.000 | 0.054 | 0.194 |
| Leverage | 42,382 | 0.195 | 0.178 | 0.021 | 0.168 | 0.311 |
| Life Cycle | 42,382 | 2.498 | 1.326 | 1.000 | 2.000 | 3.000 |
| MTB | 42,382 | 2.627 | 2.786 | 1.108 | 1.823 | 3.071 |
| Persistence | 42,382 | 0.270 | 0.285 | 0.058 | 0.252 | 0.479 |
| Roa | 42,382 | 0.018 | 0.174 | -0.015 | 0.043 | 0.092 |
| Size | 42,382 | 5.509 | 2.223 | 3.832 | 5.454 | 7.054 |
| Special Items | 42,382 | -0.014 | 0.059 | -0.009 | 0.000 | 0.000 |
| Unexpected Earnings | 26,766 | -0.002 | 0.021 | -0.001 | 0.000 | 0.002 |
| Vol1 | 42,382 | 0.049 | 0.145 | 0.011 | 0.023 | 0.051 |
| Vol2 | 30,542 | 0.093 | 0.112 | 0.029 | 0.054 | 0.110 |

*DOL_H-L* is the degree of operating leverage calculated using the high-low activity approach. *DOL_Lev* is the degree of operating leverage calculated using the level regression approach. *Accruals* is earnings minus operating cash flow, scaled by total assets. *Beta* is the firm beta calculated using montly stock returns over the 60 months before the earnings announcement. *BHAR* is the buy and hold abnormal stock return cumulated over the twelve months period ending three months after the fiscal year end. *CAR* is the market-adjusted stock return cumulated over the three days period centered around the earnings announcement. *Discretionary Rev* is the error term resulting from a regression of account receivable changes on contemporaneous sales changes. *Div* is an indicator variable equal to 1 if the firm distributes dividends during the year, 0 otherwise. *Earnings* is income before extraordinary items, scaled by total assets. *Intang* is intangible assets over total assets. *Leverage* is short term plus long term debt over total assets. *Life Cycle* is the life-cycle stage of the firm, calculated as in Collins et al. (2014). *MTB* is the market value of equity over the book value of equity. *Persistence* is the coefficient of an AR(1) model in seasonal changes calculated over twenty trailing quarters. *Roa* is net income over lagged total assets. *Size* is the natural logarithm of lagged total assets. *Special Items* is special items over total assets. *Unexpected Earnings* is the difference between reported earnings per share and the most recent analysts consensus forecast reported in IBES. *Volatility1* is the rolling standard deviation of annual changes in earnings calculated over the last ten years. *Volatility2* is the rolling standard deviation of quarterly earnings calculated over the last twenty quarters.

Panel B: Correlation Matrix

| | DOL_H-L | DOL_Lev | Intang | Leverage | LifeCycle | MTB | Roa | Size |
|---|---|---|---|---|---|---|---|---|
| DOL_H-L | 1.00 | | | | | | | |
| DOL_Lev | 0.58* | 1.00 | | | | | | |
| Intang | -0.02* | -0.09* | 1.00 | | | | | |
| Leverage | -0.05* | -0.11* | 0.15* | 1.00 | | | | |
| Life Cycle | 0.07* | 0.13* | -0.31* | -0.12* | 1.00 | | | |
| MTB | 0.05* | 0.05* | 0.02* | 0.02* | -0.00 | 1.00 | | |
| Roa | -0.25* | -0.29* | -0.04* | -0.05* | -0.13* | -0.09* | 1.00 | |
| Size | -0.11* | -0.17* | 0.26* | 0.23* | -0.62* | 0.01 | 0.23* | 1.00 |

*DOL_H-L* is the degree of operating leverage calculated using the high-low activity approach. *DOL_Lev* is the degree of operating leverage calculated using the level regression approach. *Intang* is intangible assets over total assets. *Leverage* is short term plus long term debt over total assets. *Life Cycle* is the life-cycle stage of the firm, calculated as in Collins et al. (2014). *MTB* is the market value of equity over the book value of equity. *Roa* is net income over lagged total assets. *Size* is the natural logarithm of lagged total assets.

Panel C: Degree of Operating Leverage by Industry

| | **Mean** | | **Median** | |
|---|---|---|---|---|
| **Industries** | **DOL_H-L** | **DOL_Lev** | **DOL_H-L** | **DOL_Lev** |
| Chemicals | 0.281 | 0.244 | 0.237 | 0.184 |
| Computers | 0.336 | 0.322 | 0.294 | 0.263 |
| Electrical Eq. | 0.286 | 0.259 | 0.236 | 0.192 |
| Extractive Ind. | 0.349 | 0.336 | 0.301 | 0.277 |
| Food | 0.223 | 0.190 | 0.175 | 0.139 |
| Instruments | 0.313 | 0.301 | 0.273 | 0.244 |
| Machinery | 0.236 | 0.213 | 0.188 | 0.166 |
| Metal | 0.237 | 0.204 | 0.185 | 0.158 |
| Misc. Manufacturing | 0.259 | 0.218 | 0.212 | 0.167 |
| Misc. Retail | 0.184 | 0.151 | 0.148 | 0.111 |
| Others | 0.313 | 0.281 | 0.252 | 0.206 |
| Pharmaceutical | 0.382 | 0.378 | 0.349 | 0.326 |
| Restaurant | 0.244 | 0.183 | 0.198 | 0.116 |
| Rubber & oth. | 0.259 | 0.231 | 0.217 | 0.189 |
| Services | 0.298 | 0.255 | 0.239 | 0.180 |
| Text., Print., Publ. | 0.243 | 0.203 | 0.198 | 0.148 |
| Transpotation Eq. | 0.200 | 0.166 | 0.143 | 0.112 |
| Wholesale | 0.173 | 0.137 | 0.113 | 0.080 |

*DOL_H-L* is the degree of operating leverage calculated using the high-low activity approach. *DOL_Lev* is the degree of operating leverage calculated using the level regression approach. Industries are defined as in Barth et al. (2005).

**Table 2: Degree of Operating Leverage and Earnings Volatility**

$$Volatility_{i,t} = \alpha + \beta DOL_{i,t} + \sum \gamma X_{i,t} + \epsilon_{i,t}$$

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| DOL_H-L | 0.032*** | 0.048*** | | |
| | (8.389) | (10.033) | | |
| DOL_Lev | | | 0.036*** | 0.062*** |
| | | | (10.044) | (12.644) |
| \|Accruals\| | 0.154*** | 0.202*** | 0.156*** | 0.186*** |
| | (6.678) | (11.790) | (5.940) | (15.118) |
| Div | -0.015*** | -0.035*** | -0.015*** | -0.036*** |
| | (-9.127) | (-15.300) | (-9.438) | (-15.922) |
| Intang | 0.022*** | 0.026*** | 0.028*** | 0.038*** |
| | (3.421) | (2.910) | (3.468) | (4.387) |
| Leverage | -0.018*** | -0.018** | -0.016*** | -0.018*** |
| | (-3.838) | (-2.726) | (-3.046) | (-2.882) |
| Life Cycle | -0.003** | -0.005*** | -0.003** | -0.006*** |
| | (-2.264) | (-3.451) | (-2.203) | (-4.279) |
| MTB | 0.005*** | 0.005*** | 0.005*** | 0.005*** |
| | (6.516) | (6.281) | (7.228) | (6.778) |
| Persistence | -0.034*** | -0.021*** | -0.035*** | -0.022*** |
| | (-8.636) | (-5.715) | (-9.204) | (-5.875) |
| Size | -0.012*** | -0.016*** | -0.011*** | -0.017*** |
| | (-8.883) | (-16.775) | (-10.338) | (-18.717) |
| \|Special Items\| | 0.079*** | 0.109*** | 0.074* | 0.105*** |
| | (2.931) | (5.294) | (1.995) | (5.356) |
| Observations | 37525 | 27947 | 42382 | 31836 |
| $R^2$ | 0.094 | 0.306 | 0.089 | 0.313 |

We include industry and year fixed effects. Standard errors are adjusted for clustering at the firm and year level. Statistical significance indicated as follows, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. $t$ statistics in parentheses. *Volatility* is defined alternatively as *Volatility1*, the rolling standard deviation of seasonal changes in quarterly earnings calculated over the last 20 quarters (5 years) (colums (1) and (3)), or *Volatility2*, the rolling standard deviation of annual earnings changes calculated over the last 10 years (colums (2) and (4)). *DOL_H-L* is the degree of operating leverage calculated using the high-low activity approach. *DOL_Lev* is the degree of operating leverage calculated using the level regression approach. Control variables are defined as in Appendix B.

**Table 3: Degree of Operating Leverage and Revenue Recognition**

Panel A: Meet or beat earnings thresholds

$$DiscretionaryRev_{i,t} = \alpha + \beta_1 SUSP_{i,t} + \beta_2 DOL_{i,t} + \beta_3 SUSP_{i,t} \cdot DOL_{i,t} + \sum \gamma X_{i,t} + \sum \gamma SUSP_{i,t} \cdot X_{i,t} + \epsilon_{i,t}$$

| | Zero Earnings | | Analysts' Forecast | | Last year's EPS | |
|---|---|---|---|---|---|---|
| SUSP | 0.001 | -0.006 | 0.005 | 0.007 | -0.033*** | -0.022** |
| | (0.090) | (-1.033) | (0.975) | (1.655) | (-3.283) | (-2.482) |
| DOL_H-L | -0.018*** | | -0.024*** | | -0.024* | |
| | (-3.622) | | (-4.286) | | (-1.819) | |
| SUSP * DOL_H-L | 0.011* | | 0.011* | | 0.023* | |
| | (1.762) | | (1.958) | | (1.732) | |
| DOL_Lev | | -0.009* | | -0.006 | | -0.032*** |
| | | (-1.789) | | (-1.614) | | (-3.182) |
| SUSP * DOL_Lev | | 0.011* | | 0.007 | | 0.024** |
| | | (1.910) | | (1.536) | | (2.117) |
| \|Accruals\| | -0.168*** | -0.171*** | -0.052*** | -0.063*** | -0.096* | -0.084 |
| | (-4.104) | (-4.488) | (-3.122) | (-4.539) | (-1.789) | (-1.574) |
| Leverage | -0.012 | -0.002 | -0.010** | -0.006 | -0.005 | -0.015 |
| | (-1.688) | (-0.307) | (-2.140) | (-1.444) | (-0.343) | (-1.233) |
| MTB | 0.003*** | 0.002** | 0.001** | 0.000 | 0.001 | 0.002* |
| | (3.717) | (2.486) | (2.430) | (1.115) | (1.201) | (1.803) |
| Persistence | -0.002 | 0.001 | -0.001 | -0.001 | -0.022** | -0.021** |
| | (-0.475) | (0.115) | (-0.338) | (-0.227) | (-2.095) | (-2.247) |
| Size | -0.000 | -0.001 | -0.001* | -0.001 | -0.003* | -0.001 |
| | (-0.679) | (-1.494) | (-2.013) | (-1.680) | (-1.895) | (-0.999) |
| \|Special Items\| | -0.054 | 0.048 | -0.000 | 0.022 | -0.045 | -0.094 |
| | (-0.748) | (0.597) | (-0.022) | (0.817) | (-0.262) | (-0.722) |
| Volatility | -0.025* | -0.026* | 0.004 | 0.003 | -0.009 | -0.015 |
| | (-1.834) | (-1.972) | (1.671) | (0.802) | (-0.384) | (-0.774) |
| Observations | 2,800 | 3,058 | 4,321 | 4,836 | 953 | 1,078 |
| $R^2$ | 0.052 | 0.034 | 0.037 | 0.020 | 0.039 | 0.029 |

We include, but do not report, the interactions $SUSP \times Controls$, industry, and year fixed effects. Standard errors are adjusted for clustering at the firm and year level. Statistical significance indicated as follows, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. $t$ statistics in parentheses. *Discretionary Rev* is the error term resulting from a regression of account receivable changes on contemporaneous sales changes. *SUSP* is an indicator variable equal to 1 if the firm meet or just beat (by less than \$0.01) the zero earnings threshold, 0 if it missed it by \$0.01 (columns 1 and 2); an indicator variable equal to 1 if the firm meet or just beat (by less than \$0.01) the average analysts' earnins forecast, 0 if it missed it by \$0.01 (columns 3 and 4); or an indicator variable equal to 1 if the firm meet or just beat (by less than \$0.01) last year's EPS, 0 if it missed it by \$0.01 (columns 5 and 6). *DOL_H-L* is the degree of operating leverage calculated using the high-low activity approach. *DOL_Lev* is the degree of operating leverage calculated using the level regression approach. Control variables are defined as in Appendix B.

Panel B: Placebo - Discretionary Accruals

$$DiscretionaryAcc_{i,t} = \alpha + \beta_1 SUSP_{i,t} + \beta_2 DOL_{i,t} + \beta_3 SUSP_{i,t} \cdot DOL_{i,t} + \sum \gamma X_{i,t} + \sum \gamma SUSP_{i,t} \cdot X_{i,t} + \epsilon_{i,t}$$

| | Zero Earnings | | Analysts' Forecast | | Last year's EPS | |
|---|---|---|---|---|---|---|
| SUSP | 0.013 | 0.012* | -0.005 | -0.002 | -0.000 | 0.002 |
| | (1.578) | (1.742) | (-0.456) | (-0.289) | (-0.000) | (0.144) |
| DOL_H-L | 0.017** | | -0.007 | | 0.008 | |
| | (2.202) | | (-0.579) | | (0.373) | |
| SUSP * DOL_H-L | -0.004 | | 0.005 | | -0.024 | |
| | (-0.350) | | (0.339) | | (-0.973) | |
| DOL_Lev | | 0.011 | | 0.004 | | -0.013 |
| | | (1.380) | | (0.568) | | (-0.758) |
| SUSP * DOL_Lev | | 0.008 | | -0.001 | | -0.024 |
| | | (0.981) | | (-0.095) | | (-1.149) |
| Leverage | 0.007 | 0.021* | -0.002 | -0.006 | 0.013 | 0.006 |
| | (0.705) | (1.810) | (-0.155) | (-0.615) | (0.551) | (0.343) |
| MTB | -0.003*** | -0.003*** | -0.001* | -0.001* | 0.000 | -0.001 |
| | (-2.792) | (-3.425) | (-1.867) | (-1.719) | (0.275) | (-0.759) |
| Persistence | 0.003 | 0.003 | -0.006 | -0.003 | -0.021 | -0.005 |
| | (0.428) | (0.451) | (-0.702) | (-0.431) | (-1.578) | (-0.412) |
| Size | -0.002 | -0.002** | 0.000 | 0.000 | -0.003 | -0.002 |
| | (-1.288) | (-2.353) | (0.253) | (0.197) | (-1.329) | (-1.236) |
| \|Special Items\| | -0.403*** | -0.300*** | -0.877*** | -0.868*** | -0.488* | -0.307 |
| | (-5.024) | (-3.809) | (-8.129) | (-8.371) | (-2.009) | (-1.046) |
| Volatility | -0.003 | 0.016 | -0.043*** | -0.041*** | -0.180*** | -0.170*** |
| | (-0.039) | (0.452) | (-6.316) | (-6.839) | (-5.110) | (-5.303) |
| Observations | 2361 | 2578 | 4056 | 4531 | 882 | 991 |
| $R^2$ | 0.122 | 0.118 | 0.295 | 0.266 | 0.078 | 0.107 |

We include, but do not report, the interactions $SUSP \times Controls$, industry, and year fixed effects. Standard errors are adjusted for clustering at the firm and year level. Statistical significance indicated as follows, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. $t$ statistics in parentheses. *Discretionary Acc* is discretionary accruals estimated with the modified Jones model. *SUSP* is an indicator variable equal to 1 if the firm meet or just beat (by less than \$0.01) the zero earnings threshold, 0 if it missed it by \$0.01 (columns 1 and 2); an indicator variable equal to 1 if the firm meet or just beat (by less than \$0.01) the average analysts' earnins forecast, 0 if it missed it by \$0.01 (columns 3 and 4); or an indicator variable equal to 1 if the firm meet or just beat (by less than \$0.01) last year's EPS, 0 if it missed it by \$0.01 (columns 5 and 6). *DOL_H-L* is the degree of operating leverage calculated using the high-low activity approach. *DOL_Lev* is the degree of operating leverage calculated using the level regression approach. Control variables are defined as in Appendix B.

**Table 4: Degree of Operating Leverage and The Usefulness of Earnings**

$$AbnormalReturn_{i,t} = \alpha + \beta_1 UE_{i,t} + \beta_2 DOL_{i,t} + \beta_3 UE_{i,t} \cdot DOL_{i,t} + \sum \gamma X_{i,t} + \sum \gamma UE_{i,t} \cdot X_{i,t} + \epsilon_{i,t}$$

| | CAR | | | BHAR | | |
|---|---|---|---|---|---|---|
| UE | 0.790*** | 2.134*** | 1.912*** | 3.426*** | 9.902*** | 8.756*** |
| | (6.377) | (3.491) | (4.214) | (3.963) | (3.274) | (4.067) |
| DOL_H-L | | -0.011*** | | | -0.158*** | |
| | | (-3.962) | (-3.917) | | (-8.763) | (-3.208) |
| UE * DOL_H-L | | -0.674*** | | | -1.975** | |
| | | (-2.912) | | | (-2.429) | |
| DOL_Lev | | | -0.009*** | | | -0.069*** |
| | | | (-3.917) | | | (-3.208) |
| UE * DOL_Lev | | | -0.769*** | | | -2.139*** |
| | | | (-4.925) | | | (-3.096) |
| \|Accruals\| | | -0.006 | -0.002 | | 0.027 | 0.010 |
| | | (-0.385) | (-0.202) | | (0.364) | (0.131) |
| Beta | | 0.002** | 0.001 | | -0.008 | -0.010 |
| | | (2.408) | (1.021) | | (-0.444) | (-0.606) |
| Div | | -0.004** | -0.004** | | -0.045*** | -0.043*** |
| | | (-2.608) | (-2.777) | | (-3.796) | (-4.552) |
| Intang | | 0.001 | -0.001 | | -0.019 | 0.003 |
| | | (0.348) | (-0.249) | | (-0.501) | (0.089) |
| Leverage | | 0.003 | 0.002 | | -0.094* | -0.089* |
| | | (0.707) | (0.576) | | (-1.772) | (-1.961) |
| Life Cycle | | -0.002** | -0.002** | | -0.003 | 0.001 |
| | | (-2.139) | (-2.778) | | (-0.551) | (0.172) |
| Loss | | -0.002 | 0.001 | | -0.168*** | -0.165*** |
| | | (-0.744) | (0.581) | | (-12.500) | (-13.896) |
| MTB | | -0.000 | -0.000* | | 0.044*** | 0.042*** |
| | | (-0.908) | (-1.722) | | (5.603) | (6.359) |
| Ret_Vol | | -0.051*** | -0.053*** | | 0.631*** | 0.530*** |
| | | (-3.089) | (-3.514) | | (3.321) | (3.412) |
| Size | | -0.001 | -0.001 | | -0.008 | -0.007 |
| | | (-1.120) | (-0.997) | | (-1.509) | (-1.512) |
| \|Special Items\| | | -0.029 | -0.026 | | -0.566*** | -0.510*** |
| | | (-1.522) | (-1.522) | | (-3.128) | (-3.219) |
| Observations | 26,074 | 23,580 | 26,074 | 29,656 | 26,901 | 29,656 |
| $R^2$ | 0.022 | 0.039 | 0.038 | 0.021 | 0.110 | 0.101 |

We include, but do not report, the interactions *UnexpectedEarnings* × *Controls*, industry, and year fixed effects. Standard errors are adjusted for clustering at the firm and year level. Statistical significance indicated as follows, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. $t$ statistics in parentheses. *Abnormal Return* is *CAR*, the market-adjusted stock return cumulated over the three days period centered around the earnings announcement, in Columns (1) to (3) and *BHAR*, the buy and hold abnormal stock return cumulated over the twelve months period ending three months after the fiscal year end, in Columns (4) to (6). *UE* is the difference between reported earnings per share and the most recent analysts consensus forecast reported in IBES. *DOL_ H-L* is the degree of operating leverage calculated using the high-low activity approach. *DOL_ Lev* is the degree of operating leverage calculated using the level regression approach. Control variables are defined as in Appendix B.

**Table 5: Seemingly Unrelated Regression of The Usefulness of Earnings**

Panel A: Earnings Informativeness

| | **VOL** | **SUSP** | **ERC** | **VOL** | **SUSP** | **ERC** |
|---|---|---|---|---|---|---|
| DOL_H-L | 0.029*** | 0.013* | 0.45 | | | |
| | (14.49) | (1.71) | (0.84) | | | |
| DOL_Lev | | | 0.45 | 0.033*** | 0.014** | -0.773* |
| | | | | (23.21) | (2.39) | (-1.86) |
| Volatility | | | -25.99*** | | | -23.92*** |
| | | | (-13.25) | | | (-11.69) |
| SUSP | | | -3.499*** | | | -3.798*** |
| | | | (-6.38) | | | (-7.29) |
| Beta | | | -0.08 | | | -0.216 |
| | | | (-0.52) | | | (-1.58) |
| \|Accruals\| | 0.088*** | -0.050** | | 0.088*** | -0.063*** | |
| | (13.86) | (-2.13) | | (13.86) | (-3.09) | |
| Div | -0.015*** | -0.011*** | | -0.015*** | -0.001*** | |
| | (-17.51) | (-3.30) | | (-20.20) | (-3.22) | |
| Intang | -0.005** | -0.012 | | 0.002 | -0.014* | |
| | (-2.32) | (-1.49) | | (0.91) | (-1.74) | |
| Leverage | -0.014*** | 0.110*** | | -0.009*** | 0.111*** | |
| | (-5.49) | (11.95) | | (-4.36) | (12.99) | |
| Life Cycle | 0.000 | 0.000 | | -0.001 | -0.001 | |
| | (0.61) | (0.23) | | (-1.62) | (-0.79) | |
| MTB | 0.002*** | -0.005*** | | 0.001*** | -0.005*** | |
| | (11.32) | (-9.72) | | (11.19) | (-10.71) | |
| Persistence | -0.029*** | -0.004 | | -0.028*** | -0.011** | |
| | (-20.82) | (-0.77) | | (-24.23) | (-2.30) | |
| Size | -0.005*** | -0.001 | | -0.005*** | -0.003*** | |
| | (-16.06) | (-1.03) | | (-21.57) | (-3.11) | |
| \|Special Items\| | 0.098*** | -0.034 | | 0.085*** | -0.036 | |
| | (9.74) | (-0.99) | | (10.44) | (-1.10) | |
| Obs. | 17,281 | 17,281 | 17,281 | 19,507 | 19,507 | 19,507 |
| $R^2$ | 0.145 | 0.014 | 0.011 | 0.202 | 0.015 | 0.011 |
| DOL*Volatility | | | -0.750*** | | | -0.788*** |
| | | | (-9.77) | | | (-10.44) |
| DOL*SUSP | | | -0.044* | | | -0.052** |
| | | | (-1.67) | | | (-2.27) |

The model is estimated using a recursive structural equation model. Statistical significance indicated as follows, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. $t$ statistics in parentheses. *ERC* is the earnings response coefficient estimated using a rolling regression of Car on UnexpectedEarnings over a ten years window. *DOL_H-L* is the degree of operating leverage calculated using the high-low activity approach. *DOL_Lev* is the degree of operating leverage calculated using the level regression approach. *SUSP* is equal to 1 if the firm meet or just beat the zero earnings threshold, 0 otherwise. *Volatility* is the rolling standard deviation of seasonal changes in quarterly earnings calculated over the last 20 quarters. Control variables are defined as in Appendix B.

Panel B: Earnings Value Relevance

| | VOL | SUSP | ERC | VOL | SUSP | ERC |
|---|---|---|---|---|---|---|
| DOL | 0.031*** | 0.010 | -6.819** | 0.036*** | 0.012** | -9.593*** |
| | (14.25) | (1.36) | (-2.59) | (22.81) | (2.06) | (-4.62) |
| Volatility | | | -91.311*** | | | -108.507*** |
| | | | (-10.35) | | | (-12.25) |
| SUSP | | | -10.078*** | | | -13.302*** |
| | | | (-3.71) | | | (-5.12) |
| Beta | | | -0.243 | | | -0.537 |
| | | | (-0.34) | | | (-0.80) |
| \|Accruals\| | 0.096*** | -0.055** | | 0.099*** | -0.063*** | |
| | (14.63) | (-2.53) | | (18.49) | (-3.28) | |
| Div | -0.016*** | -0.011*** | | -0.015*** | -0.009*** | |
| | (-15.94) | (-3.27) | | (-17.83) | (-2.87) | |
| Intang | 0.001 | -0.009 | | 0.006*** | -0.013 | |
| | (0.27) | (-1.07) | | (2.60) | (-1.59) | |
| Leverage | -0.014*** | 0.106*** | | -0.011*** | 0.106*** | |
| | (-5.36) | (11.88) | | (-4.58) | (12.57) | |
| Life Cycle | 0.001* | 0.000 | | -0.000 | -0.002 | |
| | (1.74) | (0.14) | | (-0.95) | (-1.23) | |
| MTB | 0.002*** | -0.005*** | | 0.002*** | -0.005*** | |
| | (12.26) | (-9.55) | | (12.23) | (-10.57) | |
| Persistence | -0.030*** | -0.003 | | -0.030*** | -0.010** | |
| | (-19.64) | (-0.64) | | (-22.92) | (-2.21) | |
| Size | -0.006*** | -0.001 | | -0.006*** | -0.003*** | |
| | (-17.23) | (-1.14) | | (-22.21) | (-3.06) | |
| \|Special Items\| | 0.090*** | -0.036 | | 0.075*** | -0.040 | |
| | (8.39) | (-1.02) | | (8.44) | (-1.24) | |
| Obs. | 17,618 | 17,618 | 17,618 | 19,862 | 19,862 | 19,862 |
| $R^2$ | 0.163 | 0.014 | 0.001 | 0.194 | 0.015 | 0.013 |
| DOL*Volatility | | | -2.792*** | | | -3.911*** |
| | | | (-8.37) | | | (-10.79) |
| DOL*SUSP | | | -0.099 | | | -0.153* |
| | | | (-1.27) | | | (-1.91) |

The model is estimated using a recursive structural equation model. Statistical significance indicated as follows, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. $t$ statistics in parentheses. *ERC* is the earnings response coefficient estimated using a rolling regression of Bhar on UnexpectedEarnings over a ten years window. *DOL_ H-L* is the degree of operating leverage calculated using the high-low activity approach. *DOL_ Lev* is the degree of operating leverage calculated using the level regression approach. *SUSP* is equal to 1 if the firm meet or just beat the zero earnings threshold, 0 otherwise. *Volatility* is the rolling standard deviation of seasonal changes in quarterly earnings calculated over the last 20 quarters. Control variables are defined as in Appendix B.

**Table 6: Degree of Operating Leverage, The Usefulness of Earnings, and Shareholders' Skepticism**

$$CAR_{i,t} = \alpha + \beta_1 UE_{i,t} + \beta_2 DOL_{i,t} + \beta_3 UE_{i,t} \cdot DOL_{i,t} + \eta_1 UE_{i,t} \cdot MISS_{i,t} + \\ + \eta_2 DOL_{i,t} \cdot MISS_{i,t} + \eta_{63} UE_{i,t} \cdot DOL_{i,t} \cdot MISS_{i,t} \\ + \sum \gamma X_{i,t} + \sum \gamma UE_{i,t} \cdot X_{i,t} + \epsilon_{i,t}$$

| | Zero Earnings | | Analysts' Forecast | | Last Year's EPS | |
|---|---|---|---|---|---|---|
| UE | 2.111*** | 1.877*** | 2.115*** | 1.889*** | 2.128*** | 1.895*** |
| | (3.438) | (4.194) | (3.494) | (4.219) | (3.488) | (4.221) |
| DOL_H-L | -0.010*** | | -0.009*** | | -0.010*** | |
| | (-3.737) | | (-3.364) | | (-3.829) | |
| UE * DOL_H-L | -0.646** | | -0.655*** | | -0.664*** | |
| | (-2.605) | | (-2.849) | | (-2.853) | |
| UE_MISS | 0.827 | | 20.762*** | | 1.765 | |
| | (1.320) | | (4.165) | | (1.121) | |
| DOL_H-L * MISS | -0.008 | | -0.060*** | | -0.019* | |
| | (-0.757) | | (-5.357) | | (-1.732) | |
| UE * DOL_H-L * MISS | -1.206 | | -59.563*** | | -3.333 | |
| | (-0.603) | | (-3.901) | | (-0.633) | |
| DOL_Lev | | -0.008*** | | -0.008*** | | -0.009*** |
| | | (-3.779) | | (-3.308) | | (-3.694) |
| UE * DOL_Lev | | -0.728*** | | -0.766*** | | -0.744*** |
| | | (-4.463) | | (-4.924) | | (-4.895) |
| UE_MISS | | 0.890** | | 21.077*** | | 2.767*** |
| | | (2.098) | | (4.706) | | (3.270) |
| DOL_Lev * MISS | | -0.020* | | -0.040*** | | -0.027** |
| | | (-1.708) | | (-3.877) | | (-2.124) |
| UE * DOL_Lev * MISS | | -1.228 | | -40.829*** | | -7.444*** |
| | | (-0.895) | | (-2.937) | | (-3.174) |
| Observations | 23,580 | 26,074 | 23,580 | 26,074 | 23,580 | 26,074 |
| $R^2$ | 0.040 | 0.038 | 0.043 | 0.041 | 0.039 | 0.038 |

We include, but do not report, *Controls*, the interactions $UnexpectedEarnings \times Controls$, industry, and year fixed effects. Standard errors are adjusted for clustering at the firm and year level. Statistical significance indicated as follows, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. $t$ statistics in parentheses. *CAR* is the market-adjusted stock return cumulated over the three days period centered around the earnings announcement. *UE* is the difference between reported earnings per share and the most recent analysts consensus forecast reported in IBES. *DOL_H-L* is the degree of operating leverage calculated using the high-low activity approach. *DOL_Lev* is the degree of operating leverage calculated using the level regression approach. *MISS* is an indicator variable equal to 1 if the firm missed the earnings threshold by $0.01, 0 otherwise. The earnings threshold is defined as zero earnings in Columns (1) and (2), analysts' forecast in Columns (3) and (4), and last year's EPS in Columns (5) and (6) . Control variables are defined as in Appendix B.

Panel B: Sub Sample

$$CAR_{i,t} = \alpha + \beta_1 DOL_{i,t} + \epsilon_{i,t}$$

| | Zero Earnings | | Analysts' Forecast | | Last year's EPS | |
|---|---|---|---|---|---|---|
| DOL_H-L | -0.020* | | -0.013* | | -0.031* | |
| | (-1.705) | | (-1.673) | | (-1.851) | |
| DOL_Lev | | -0.022** | | -0.007 | | -0.030* |
| | | (-2.012) | | (-1.068) | | (-1.909) |
| Observations | 925 | 934 | 1,987 | 2,030 | 432 | 461 |
| $R^2$ | 0.002 | 0.003 | 0.001 | 0.000 | 0.006 | 0.006 |

Statistical significance indicated as follows, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. $t$ statistics in parentheses. *Car* is the market-adjusted stock return cumulated over the three days period centered around the earnings announcement.*DOL_ H-L* is the degree of operating leverage calculated using the high-low activity approach. *DOL_ Lev* is the degree of operating leverage calculated using the level regression approach. The regression is estimated on sub-samples of firms missing an earnings threshold by $0.01. We extend the sample when using last year's EPS to include firms missing the threshold by $0.02 because of the small number of observations. The earnings threshold is defined as zero earnings in columns 1 and 2, analysts' forecast in columns 3 and 4, and last year's EPS in columns 5 and 6.