The Use of DuPont Analysis by Market Participants

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ABSTRACT: DuPont analysis, a common form of financial statement analysis, decomposes return on net operating assets into two multiplicative components: profit margin and asset turnover. These two accounting ratios measure different constructs and, accordingly, have different properties. Prior research has found that a change in asset turnover is positively related to future changes in earnings. This paper comprehensively explores the DuPont components and contributes to the literature along three dimensions. First, the paper contributes to the financial statement analysis literature and finds that the information in this accounting signal is in fact incremental to accounting signals studied in prior research in predicting future earnings. Second, it contributes to the literature on the stock market's use of accounting information by examining immediate and future equity return responses to these components by investors. Finally, it adds to the literature on analysts' processing of accounting information by again testing immediate and delayed response of analysts through contemporaneous forecast revisions as well as future forecast errors. Consistent across both groups of market participants, the results show that the information is useful as evidenced by associations between the DuPont components and stock returns as well as analyst forecast revisions. However, I find predictable future forecast errors and future abnormal returns indicating that the information processing does not appear to be complete. Taken together, the analysis indicates that the DuPont components represent an incremental and viable form of information about the operating characteristics of a firm.

Keywords: *financial statement analysis; DuPont analysis; market returns; analyst forecasts.*

JEL Classification: *M4.*

I. INTRODUCTION

In this paper I examine whether the information contained in DuPont analysis is associated with stock market returns and analyst forecasts. Prior studies document that the components from DuPont analysis, which decomposes return on net operating assets into profit margin and asset turnover, have explanatory power with respect to changes in future profitability. This paper adds to the literature by comprehensively examining investor and analyst reactions to the DuPont components along three dimensions. First, it replicates the previously documented forecasting ability and examines whether it is robust and incremental to the existence of other predictors already considered in the literature. Second, it explores the use of these components by stock market investors by looking at both contemporaneous and future returns. In contemporaneous long-window association and short-window information tests, the results indicate a positive association between the DuPont components and equity returns. But small future abnormal returns to a trading strategy indicate a possibly incomplete processing of information. Finally, it examines both current forecast revisions and future forecast errors by sell-side analysts. Although they appear to revise their forecasts of future earnings consistent with the information in these DuPont components, the revision seems to be incomplete as evidenced by predictable future forecast errors. Consistent across both groups of market participants, the contemporaneous results show that the information is useful but the future tests indicate that the information processing does not appear to be complete.

Work by Nissim and Penman (2001) provides an approach to equity valuation using the residual income framework that gives a simple direct mapping of financial ratios to equity valuation. In particular they use DuPont analysis, which decomposes a firm's return on net operating assets ($RNOA$) into profit margin (PM) and asset turnover (ATO) where $RNOA = PM \times ATO$.[1] PM and ATO are accounting signals that measure different constructs about a firm's operations. PM is often derived from pricing power, such as product innovation, product positioning, brand name recognition, first mover advantage, and market niches.[2] ATO measures asset utilization and efficiency, which generally comes from the efficient use of property, plant, and equipment; efficient inventory processes; and other forms of working capital management.[3]

There are reasons to expect competitive forces to affect these two sources of profitability differently. Large profit margins often draw new entrants into the marketplace or quick imitation of new ideas from existing rivals. The resulting competition causes high profit margins to revert to normal levels, suggesting more transitory benefits. Unlike profit margin, however, competition may be less threatening to an efficient deployment of assets. It is more difficult to imitate another firm's efficient production processes because such imitation often involves large and costly overhauls of current factories and operations.

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[1] Specifically, $RNOA$ = Operating Income/Average Net Operating Assets, PM = Operating Income/Sales, and ATO = Sales/Average Net Operating Assets. Hereafter, PM and ATO are referred to as the ''DuPont Components.'' Another common form is to decompose ROE = (Profit Margin × Asset Turnover × Leverage) or [$NI/Sales \times Sales/Assets \times Assets/Equity$]. As discussed in the ''Valuation Theory and $RNOA$'' section, I use $RNOA$ in my analyses in order to focus on operations and thus abstract from the firm's financing decision.

[2] For example, Abercrombie and Fitch earns high margins by selling used-looking clothing that is considered trendy and is demanded by teenagers. Their strong brand is difficult to imitate and allows them to charge a premium.

[3] A good example of high abnormal ATO is Dell. Their business model is based on maintaining extremely low inventory and high turnover. Historically, their ATO has exceeded the industry median by about 1.2 turns.

Theoretical work supports these conjectures. Romer (1986) contends that knowledge is easily diffused and transferred throughout an economy, making returns based on knowledge-based assets transitory and diminishing.[4] In this setting, to the degree that the source of profit margin is derived from ideas that can be imitated by others, it is more likely to be more transitory. Moreover, Romer (1986) concludes that returns derived from capital are more persistent because of the larger frictions to the movement of capital through an economy.[5]

Work by Fairfield and Yohn (2001); Nissim and Penman 2001 and Penman and Zhang (2003) is consistent with the intuition above and shows that assert turnover is more persistent than profit margin and that changes in *ATO* are predictive of future changes in *RNOA* after controlling for *RNOA*.[6] In this paper, I begin with a replication to investigate whether this finding is robust to the inclusion of variables in existing research on fundamental analysis. I find that despite the correlation that exists between these variables, the change in *ATO* is still significant in explaining future changes in *RNOA* after controlling for the nine fundamental signals from Abarbanell and Bushee (1997; hereafter, AB) and the variables in the extended accrual decomposition of Richardson et al. (2005; hereafter, RSST).

The focus of this study, however, explores the use of the information in these components by those who have a vested interest in the prediction of future earnings. Numerous studies have explored how market participants, either stock investors or analysts, incorporate the information in earnings into their decisions. Along similar veins, this paper extends the literature on equity holders and analysts by exploring the immediate and delayed reactions to these accounting signals. These two complementary approaches guide the analyses throughout the paper: First, contemporaneous tests examine whether the information in these components is associated with current actions by market participants; and second, future tests examine whether market participants *fully* use the information.

To test whether stock market returns are associated with the DuPont components, I conduct both long-window association and short-window information tests.[7] The long-window association tests show that the DuPont components are incremental to earnings and earnings changes in explaining contemporaneous returns, and that adding them to the regression doubles the traditionally low adjusted R^2s that come with these tests (Lev 1989; Kothari 2001).[8] The short-window return tests show that changes in the DuPont components are informative to the marketplace and incremental to the earnings surprise. The two results

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[4] Of course, there are many ways a firm can protect abnormally high profit margins from competition, such as established marketing channels, brand name recognition, customer loyalty, unique supply sources, favorable contracts with customers or suppliers, and legal frictions such as patents and copyrights. All these factors work to promote the persistence of profit margin.

[5] Additionally, there are simple accounting reasons to expect *ATO* to be different in nature than *PM*. *ATO* is calculated as sales (a flow variable) divided by net operating assets (a stock variable); both of these line items have relatively low variance (Nissim and Penman 2001). However, *PM* is calculated by dividing operating income by sales (two flow variables), and operating income simply has higher volatility than net operating assets or sales. This also could lead to differing persistence. Thus, the very construction of these ratios and the accounting behind them also leads to expecting different time-series properties, i.e., that *PM* will be less persistent and more volatile than *ATO*. Accordingly, any shift in *ATO* is more likely to be the result of an economic occurrence rather than changes due to simple variation in the accounting numbers.

[6] For example, compare Toyota to Ford. Toyota has far more efficient and technologically advanced factories. To compete along this dimension, Ford would have to restructure and rebuild billions of dollars' worth of factories and manufacturing plants. Of course, counter examples exist to this notion. For example, Lowe's Hardware entered into Home Depot's market and successfully competed with their massive scale and efficiency.

[7] See Kothari (2001) for a summary of this large literature on the relation between returns and earnings.

[8] A supplemental finding is that adding *RNOA* along with earnings in these regressions increases the adjusted R^2 significantly. This lends support to claims that *RNOA* is a more appropriate measure when examining how accounting profitability maps into equity returns in these types of long-window regressions.

suggest that the DuPont components not only reflect information in the marketplace (long-window return tests), but also that changes in *ATO* appear to provide information to stock market participants within a small window around the earnings announcement (short-window). Finally, a future return tests produce an annual abnormal return of about 5 percent from using the information in the change in *ATO*. Thus, although the future predictive ability of earnings is reflected in short-window announcement returns, the market does not appear to completely use the information in this variable.

This paper also contributes to the literature on sell-side analysts' use of accounting information. If the DuPont components map into equity value, then analysts should use this information when creating forecasts and revising their priors about the future profitability of the firm. Consistent with the immediate and delayed analysis of returns above, two measures of analyst forecasts are examined. First, I use analyst forecast revisions measured as the change in the forecast of next year's earnings immediately before and after the earnings announcement. Consistent with the earnings prediction tests, I find that analysts' immediate reaction is to revise their forecasts based on changes in *ATO* after controlling for the earnings surprise. Second, I look at future forecast errors of year $t+1$ earnings and examine whether analysts fully understand the implications of the DuPont components in year t for future profitability. I find that the DuPont components have predictive power for future forecast errors, suggesting that analysts do not completely utilize the information in these components when issuing their forecasts. Taken together, the evidence suggests that although analysts appear to use the information in revising their forecasts of the following year's earnings, the updating is incomplete and analysts leave some information ''on the table.'' This result is entirely consistent with future abnormal returns above. Thus, both equity investors and analysts appear to use some of the information available, but not all of it.

The remainder of the paper is organized as follows. The next section develops the predictions and research design. Section III describes the empirical analysis, Section IV presents the results, and Section V concludes.

II. PREDICTIONS AND RESEARCH DESIGN

Since the landmark studies of Ball and Brown (1968) and Beaver (1968), accounting researchers have worked to understand how and why earnings and security returns are associated. Beaver (1998) argues that one theoretical link between earnings and share prices is that current earnings provide information to predict future earnings. Consistent with this theme, researchers have looked for current financial statement information that aids in predicting future earnings, arguing that this should be the primary goal of fundamental analysis (Penman 1992; Lee 1999). To this end, several approaches have emerged in the literature. Lipe (1986) and Kormendi and Lipe (1987) decompose earnings into six components and find that more transitory components have a smaller relation with stock returns. Along the same lines, Fairfield et al. (1996) use the order of line items on the income statement to decompose earnings to improve predictions of *ROE* and find that line items farther down the income statement are less persistent. Ou and Penman (1989) combine a large group of financial ratios into one summary measure and estimate its association with future stock returns. Holthausen and Larcker (1992) extend this analysis and use the variables to directly predict future returns.

Lev and Thiagarajan (1993) take a different approach and identify a group of financial ratios used in practice by ''experts'' and examine their correspondence with contemporaneous long-window stock returns. AB (1997, 1998) extend this analysis by using the same variables and find that some of the ratios (1) predict future earnings changes, (2) are used

by analysts, and (3) can predict future returns. Sloan (1996) decomposes earnings into accruals and cash flows and finds that firms with higher operating accruals tend to have lower future earnings and returns. RSST (2005) expand the definition of accruals to map out the entire balance sheet and find that investing accruals are more effective than operating accruals in predicting future earnings and returns. Although the approaches mentioned above were successful in predicting future earnings, they lack a unifying framework guiding the analysis despite the fact that most of these studies were ultimately examining equity returns.[9]

Valuation Theory and *RNOA*

The theory of finance describes stock price as a function of expected future dividends leading to the familiar dividend-discount model that sets firm value to the present value of the firms expected future dividends. An algebraically equivalent model, commonly referred to as the *residual income model*, stems from the assumption of clean-surplus accounting and expresses firm value in terms of accounting numbers.[10] The stock price can be rewritten in terms of *ROE* and reported book value plus an infinite sum of discounted residual income:

$$P_t = B_t + \sum_{i=1}^{\infty} \frac{E_t[(ROE_{t+i} - r_e)B_{t+i-1}]}{(1 + r_e)^i}$$

where:

P_t = *current stock price*;
B_t = book value at time *t*;
$E_t(.)$ = expectation based on information available at time *t*;
ROE_{t+1} = the return on book equity for period *t*+1;
$E_t(D_{t+i})$ = expected future dividends for periods *t*+*i* conditional on information available at time *t*; and
r_e = cost of equity capital.

Work by Ohlson (1995) and Feltham and Ohlson (1995) highlights the theoretical importance of *ROE* in the implementation of valuation models in general, and in the residual income model in particular. Standard DuPont analysis decomposes *ROE* into the three multiplicative ratios of Profit Margin, Asset Turnover, and Leverage as follows:

$$ROE = [NI/Sales \times Sales/Assets \times Assets/BVEquity].$$

As the equation above shows, *ROE* can be affected by the firm's choice of capital structure, yet changes in the firm's capital structure may not be value relevant.[11] Nissim and

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[9] Barth et al. (1999) use an Ohlson (1999) framework to justify and determine the accruals and cash flow valuation coefficients and place their analysis within a broader valuation context.

[10] The model is sometimes referred to as the Edwards-Bell-Ohlson (EBO) valuation equation. Clean surplus accounting requires that all gains and losses affecting book value be included in earnings such that changes in book value are equal to earnings minus net dividends ($b_t = b_{t-1} + NI_t - D_t$).

[11] Modigliani and Miller (1958) assert that it is the value of the operations that matters and not the financing of those assets. Penman (2001, 433–434) shows that despite the fact that *ROE* can be mechanically increased through leverage (assuming positive spread), the increase in the discount rate results in no change in equity value.

Penman (2001) algebraically rearrange *ROE* to abstract away from financial leverage and arrive at *RNOA* as follows:[12]

$$ROE = RNOA + [FLEV \times SPREAD].$$

RNOA captures the firm's operating profitability without the effects of financial leverage and is becoming commonly used in the valuation literature (e.g., Fairfield and Yohn 2001; Nissim and Penman 2001; Penman and Zhang 2003; Fairfield et al. 2003a; Richardson et al. 2006). Using this residual-income valuation framework, they algebraically derive how equity prices should map into *RNOA* and decompose it into the DuPont components. After removing leverage and any associated returns (e.g., interest income/expense), *RNOA* can be multiplicatively decomposed into *PM* and *ATO* as follows: $RNOA = PM \times ATO$ where *PM* = Operating Income/Sales and *ATO* = Sales/Net Operating Assets.

Nissim and Penman (2001) find that these two components of *RNOA* (*PM* and *ATO*) have different time-series properties. *PM* measures the firm's ability to control the costs incurred to generate sales and gives insight into the sensitivity of operating income to product price and cost structure. Δ*PM* measures the growth rate in operating income relative to the growth rate in sales. *ATO* captures the firm's efficiency in using operating assets to generate sales and is often interpreted as a measure of asset utilization by managers. Δ*ATO* reflects change in the productivity of the firm's assets and ultimately measures growth in sales relative to growth in operating assets. Ultimately this measure evaluates sales growth while controlling for growth in net operating assets used to generate those sales. As discussed in the introduction, each component measures a different aspect of a firm's operations. Thus, simply using the aggregated level of *RNOA* may result in the loss of some predictive information. Two research questions immediately follow: (1) Do these two components have incremental explanatory power with respect to future earnings? (2) If so, then do market participants, such as equity analysts and stock market investors, use this information when valuing stocks? The focus of this paper is centered on the second question.

Predictions of Future *RNOA* Using DuPont Components

The goal of these first tests is to ensure that the explanatory power documented by Fairfield and Yohn (2001) and Penman and Zhang (2003) is truly incremental and robust to other earnings predictors from the literature before moving on to the larger question of whether this predictive power is used by market participants. To do this, I first control for the fundamental signals proposed by Lev and Thiagarajan (1993). These signals were later used by AB (1997) and shown to predict future earnings (as well as future returns [AB 1998]).[13] This first step is important because one of the AB variables is gross margin, which is highly correlated to *PM*. In addition, their measures of inventory, accounts receivable, and capital expenditures are all parts of *ATO*. Thus, it is quite conceivable that earlier work on DuPont analysis was simply rediscovering the same underlying constructs using slightly different measures. Second, I examine whether the information in the DuPont components is subsumed by accruals. In particular, I use the three components of total accruals in RSST (2005): working capital, noncurrent operating and financing, labeled Δ*WC*, Δ*NCO*, and

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[12] *FLEV* is financial leverage and *SPREAD* is the difference between return of the firm's operations and borrowing costs.

[13] They include measures of inventory, accounts receivable, capital expenditures, gross margins, selling and administrative expenses, effective tax rates, earnings quality, audit quality, and labor force. See Table 3 for exact definitions.

ΔFIN. They find that ΔNCO accruals have more explanatory power of future earnings and returns than do operating accruals. This expanded definition of accruals subsumes the operating accruals definition used by Sloan (1996) and provides a more complete picture of the degree of accruals in the firm by examining the entire balance sheet.

Fairfield and Yohn (2001) were the first to address the question of future predictive power and find that ΔATO is positively associated with future changes in *RNOA*, but that levels of *PM* and *ATO* have no predictive value. This result is intuitive because the levels of *PM* and *ATO* are more informative toward a firm's operating structure or industry membership (Ge and Soliman 2007). Further, increases in *ATO* indicate that the firm's ability to generate sales from a given investment has increased and that this is an indicator of future efficiency of generating sales from assets. Thus, this type of increase in profitability tends to persist. In this section, I replicate Fairfield and Yohn's (2001) findings by applying their models to my sample. I first estimate the following regression on the *level* of the DuPont components:[14]

$$\Delta RNOA_{t+1} = \rho_0 + \rho_1 RNOA_t + \rho_2 PM_t + \rho_3 ATO_t + \rho_4 \Delta RNOA_t + \rho_5 \Delta NOA_t + \upsilon_{t+1}.$$

(1)

Next, I employ a changes specification similar to the one used by Fairfield and Yohn (2001) and examine the explanatory power of ΔPM and ΔATO with one notable exception. In their analysis, they do not control for changes in *RNOA* ($\Delta RNOA_t$). Thus, it is difficult to surmise from their analysis whether the explanatory power comes from ΔPM and ΔATO or whether the omitted variable, $\Delta RNOA$, is providing the information. Accordingly, I estimate the following changes regression and include $\Delta RNOA$ to determine whether changes in the components are incremental as follows:

$$\Delta RNOA_{t+1} = \rho_0 + \rho_1 RNOA_t + \rho_2 \Delta PM_t + \rho_3 \Delta ATO_t + \rho_4 \Delta RNOA_t$$
$$+ \rho_5 \Delta NOA_t + \upsilon_{t+1}.$$

(2)

Because pooled regressions are subject to cross-sectional correlation in the residuals, I estimate all the regressions in the paper separately for each year in the sample and then construct Fama-MacBeth t-statistics using the resulting set's time-series of annual coefficient estimates (Fama and MacBeth 1973). I also adjust for serial correlation in the annual coefficient estimates due to overlapping periods (Bernard 1987) by using the Newey and West (1987) adjustment (see Verbeek [2000] for a detailed explanation).

Thus, the first part of the analysis is primarily a replication of earlier work, but makes a small contribution in that it replicates the prior findings in a different sample and ensures that the result is robust to other control variables from the literature using slightly updated tests.[15]

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[14] This is the same specification as model 2 of Table 2 in Fairfield and Yohn (2001). As they point out, there is no hypothesized reason to include the level of *PM* or *ATO* since they only capture a firm's operating strategy. Nonetheless, they are included in my analysis to ensure comparability with prior studies. Note that both Equations (1) and (2) are also estimated using the AB and RSST controls.

[15] That is, Fama-MacBeth regressions coupled with Newey-West adjustment for serial correlation as opposed to pooled regressions.

Use of Information by Market Participants
Stock Return Tests

    In this section, I test whether stock market participants use the information contained in the components of DuPont analysis, particularly ΔATO. If the results from the profitability tests above are robust, then the natural question is whether stock market participants seem to impound the information in their decision making. The question addressed here is whether the information in the components of DuPont analysis is associated with equity returns. Stated differently, does this form of earnings decomposition (1) capture information that is relevant to market participants about the firm and its future prospects incremental to current earnings or (2) provide information to capital market participants that is associated with revised beliefs? To test these two questions, I employ long- and short-window return tests, respectively.

Long-Window Return Tests

    In the spirit of Ball and Brown (1968), I examine whether there is a statistical association between information in the components of DuPont and market equity returns. This would suggest that the information in the components is correlated with information used by investors (Francis and Schipper [1999] label this as "Interpretation 4" of value relevance), and therefore captures information that affects equity valuation. Finding statistical significance is consistent with the joint hypothesis that the information in the DuPont components reflects underlying events that affect future profitability and that such events also are reflected in the market prices of securities. Unlike short-window tests that suffer from a lack of power and only capture information that surprises the market, long-window, contemporaneous, 12-month annual return tests will help ascertain whether the DuPont components contain information that is useful to the market.[16]

    There is still much debate on the proper specification of the returns-earnings regression (see Kothari 2001). Kothari (1992) suggests that using an earnings-level specification reduces the bias in the coefficients because prices lead earnings. However, Easton and Harris (1991) argue that $\Delta EARN$ is also a relevant variable. Many papers simply include both (e.g., Amir and Lev 1996; Francis and Schipper 1999).[17] In addition, Ohlson (1995) claims that *ROE* (and through some algebra *RNOA*) is an important input into valuation models. If these arguments are true, then one would expect *RNOA* to have better correspondence with stock prices than earnings. Accordingly, I also add *RNOA* and $\Delta RNOA$ and estimate the following regression equation in pieces to see whether (1) *RNOA* is incremental to earnings and (2) the DuPont components are incrementally useful to earnings and *RNOA*:

$$R_t = \rho_0 + \rho_1 EARN_t + \rho_2 \Delta EARN_t + \rho_3 RNOA_t + \rho_4 \Delta RNOA_t + \rho_5 PM_t$$
$$+ \rho_6 ATO_t + \rho_7 \Delta PM_t + \rho_8 \Delta ATO_t + \varepsilon_t \tag{3}$$

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[16] Other researchers have used 15-month windows (e.g., Francis and Schipper 1999) in order to capture the earnings announcement period. However, because I also conduct short-window return tests around the earnings announcement (described below), the 15-month window overlaps with this analysis. As a robustness check, I use a 15-month window and find similar results.

[17] As a robustness check, I estimated these regressions with one or the other of either *EARN* or $\Delta EARN$ along with the DuPont components and found similar results on my variables of interest. Brown et al. (1999) point out that using returns on the LHS can help avoid econometric issues and mitigates any intertemporal constant correlated omitted variables.

where:

R_t = stock returns are measured using compounded buy-hold market-adjusted returns (raw return minus the corresponding value-weighted return), inclusive of dividends and other distributions computed over the 12 months beginning in the first month of the firm's fiscal year and ending at the end of the fiscal year t;

$EARN_t$ = EPS_t/P_{t-1}; earnings before extraordinary items per share in year t, deflated by the market value of equity per share at the end of fiscal year $t-1$;

$\Delta EARN_t$ = $\Delta EPS_t/P_{t-1}$; earnings before extraordinary items per share in year t minus its annual earnings per share in year $t-1$, deflated by the market value of equity per share at the end of fiscal year $t-1$.

DuPont components and *RNOA* are as defined earlier.[18]

Equation (3) examines the *contemporaneous* relation between returns and earnings and whether the components of DuPont analysis are incrementally informative to stock market participants. However, as Beaver et al. (1980) point out, prices lead earnings because there is a richer information set impounded in stock prices *vis-à-vis* earnings. Thus, an alternative approach is to include future earnings as an independent variable (Warfield and Wild 1992; Fama 1990). Similar in spirit to Kothari and Sloan (1992) and Collins et al. (1994), I add future levels of *RNOA* and DuPont components to model (3) as follows:[19]

$$R_t = \rho_0 + \rho_1 EARN_t + \rho_2 \Delta EARN_t + \rho_3 RNOA_t + \rho_4 \Delta RNOA_t + \rho_5 PM_t + \rho_6 ATO_t$$
$$+ \rho_7 \Delta PM_t + \rho_8 \Delta ATO_t + \rho_9 RNOA_{t+1} + \rho_{10} PM_{t+1} + \rho_{11} ATO_{t+1} + \varepsilon_t. \qquad (4)$$

This specification examines whether current market returns reflect *future* levels of profit margin and asset turnover in addition to future and current levels and changes of *RNOA, PM*, and *ATO*.

Short-Window Return Tests

Previous research has not studied the market reaction to the DuPont components and whether they are incremental to the earnings surprise.[20] Thus, holding both the expectation and the level of earnings constant, the question is whether the source of earnings is useful to market participants at the time of the earnings announcement, i.e., is the information in these DuPont variables timely?[21] Consistent with prior research, I examine the unexpected return reaction to the earnings surprise. I use changes throughout the analysis because of the short-window nature of the test. Changes in the DuPont components are added to see

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[18] The DuPont components are not scaled by stock price because they are ratios. As a robustness check all DuPont variables are scaled by beginning period stock price; inferences are unchanged.

[19] For both Equations (3) and (4), I estimate the regressions with the three Fama-French factors to control for risk. Results are qualitatively similar.

[20] To fully calculate *PM* and *ATO*, market participants would need some balance sheet information and sales, in addition to operating income, at the time of the annual earnings announcement. Most firms disclose sales at the time of the earnings announcement; and Chen et al. (2002) find that about 52 percent of quarterly earnings announcements contain balance sheet information. In addition, they find the highest proportion of balance sheet disclosure occurs in the 4th quarter, corresponding to the annual earnings announcements I examine.

[21] Of course, an alternative explanation could be that the market is reacting to different information provided by the company at the time of the earnings announcement and that this information is correlated with the DuPont components (Beaver et al. 1970).

whether they are incrementally significant to the earnings surprise and change in *RNOA* as follows:[22]

$$UR_t = \rho_0 + \rho_1 SUR_t + \rho_2 \Delta PM_t + \rho_3 \Delta ATO_t + \rho_4 \Delta RNOA_t + \varepsilon_t \qquad (5)$$

where:

UR_t = stock returns are measured using compounded buy-hold market-adjusted returns (raw return minus the corresponding value-weighted return), inclusive of dividends and other distributions computed over the five-day window surrounding the earnings announcement beginning two days before and ending two days after the annual earnings announcement for fiscal year t; and

SUR_t (*Annual Earnings Surprise*) = annual I/B/E/S earnings − the most recent median forecast of annual earnings for year t deflated by the market value of equity per share at the end of fiscal year $t-1$.

Future Return Tests

The final return test is based on the growing evidence that market participants do not fully understand the time-series properties of earnings. This stream of research shows that investors sometimes do not understand the future implications of current earnings mapping into future earnings (e.g., Bernard and Thomas 1989; Sloan 1996; Doyle et al. 2003) and that a trading strategy exploiting this information can earn abnormal returns. To implement this trading strategy, I explore whether investors understand the future implications of $\Delta RNOA$ as a function of the DuPont components using the following regression:

$$R_{t+1} = \rho_0 + \rho_1 \Delta RNOA_t + \rho_2 \Delta PM_t + \rho_3 \Delta ATO_t + \rho_4 RSST\ Controls$$
$$+ \rho_5 RNOA_t + \rho_6 PM_t + \rho_7 ATO_t + \rho_8 Fama\text{-}French\ Risk\ Factors + \varepsilon_{t+1} \quad (6)$$

where:

R_{t+1} = future stock returns are measured using compounded buy-hold market-adjusted returns (raw return minus the corresponding value-weighted return), inclusive of dividends and other distributions beginning four months after the end of the fiscal year t and continuing for one year.[23]

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[22] Because short-window return tests capture the updating of priors and represent new information, I only use changes in the DuPont components for this set of tests. Implicitly, this assumes that the market's expectations of profit margin and asset turnover are simply the prior years' expectations: a random walk model. The same reasoning holds for the testing of analyst forecast revisions below. There is the possibility that ΔATO is not a good measure of the surprise component of *ATO*. In untabulated tests, I only use innovations in the fourth quarter of *ATO* as a robustness check and find similar results.

[23] Beginning the return window four months after year-end is standard in the literature (e.g., Sloan 1996), since firms generally file Form 10-Ks within four months after the end of the fiscal year (see Alford et al. 1994). For firms that delist during the future return period, I calculate the remaining return by taking CRSP's delisting return and then reinvesting the proceeds in the value-weighted market portfolio. For firms that delist due to poor performance (delisting codes 500 and 520–584), I use a −35 percent delisting return for NYSE/AMEX firms and a −55 percent delisting return for NASDAQ firms, as recommended in Shumway (1997) and Shumway and Warther (1999). This mitigates concerns with potential survivorship biases.

If market participants fully appreciate the predictive power of the DuPont variables, then the coefficient is expected to be zero. As control variables, I include the Fama-French risk factors of book-to-market ratio (*BM*), size (*MVE*), and β (Beta) in my tests as risk factors (Fama and French 1993). In addition, I include the three accrual variables from RSST (described earlier), which also have been shown to be strong predictors of future abnormal returns. In these tests, I use rank regressions where the continuous value of the independent variable amount is replaced with its annual decile rank. These are more conservative statistical tests; the variables are scale-free and the only assumption about the regression's functional form is that the relations are monotonic (Iman and Conover 1979). To create decile ranks, all the continuous variables are sorted annually into ten equal-sized groups numbered 0 to 9 each year and then divided by 9. This allows for easy interpretation of the absolute value of the coefficient estimate on a variable as the hedge value moving from the top to the bottom decile created to optimize on the information in the variable, after controlling for the other variables in the regression (Bernard and Thomas 1989).

Analyst Forecast Tests

Because a primary task of equity analysts is to predict future earnings, it is expected that their forecasts contain all relevant information. A variety of research provides evidence consistent with differing degrees of analyst sophistication. Several studies find that analysts do not fully impound relevant accounting information into their earnings forecasts (e.g., Stober 1992). A number of studies show that analyst forecasts are inefficient in the sense that they do not fully incorporate past information available at the time of their forecasts. Lys and Sohn (1990), Klein (1990), and Abarbanell (1991) all suggest that analysts under-react to past information reflected in prices. Others have explored whether market anomalies can be traced to how information intermediaries such as equity analysts process accounting information. Abarbanell and Bernard (1992) find that although analyst forecasts under-react to earnings, the biases are not large enough to explain the post-earnings announcement drift completely. Bradshaw et al. (2001) explore whether equity analysts understand the lower persistence of accruals and find that they, like equity investors, do not fully understand accruals. Finally, AB explore whether the forecasts of equity analysts fully incorporate the information in the fundamental variables used by Lev and Thiagarajan (1993) and find that they do not.

Notwithstanding the studies above, another series of research studies indicates that the relation can go the other way, namely that equity investors can inefficiently utilize information contained in analysts' earnings forecasts. Mendenhall (1991), Walther (1997) and Elgers et al. (2001, 2003) document that investors underweigh information contained in analysts' forecasts. Thus, exploring tests of stock returns and analysts' forecasts are not perfect substitutes since neither one has been shown to subsume the other. Accordingly, whether analysts will comprehend the DuPont components in the same way equity investors do is still an open question and not immediately obvious from the results of the stock return tests.

To this end, I use two approaches to examine whether analysts fully impound the DuPont component information into their forecasts. First, I examine whether the DuPont components are associated with analyst forecast revisions of future earnings of period $t+1$ in the month immediately before and after the earnings announcement of year t. This approach examines whether the information is associated with analysts revising their prior forecasts (e.g., Barth and Hutton 2004). Significant coefficients on the DuPont components indicate that the information in these ratios is useful to analysts in revising their priors about the future prospects of the firm or is at least correlated with other information that

is. Positive coefficients indicate that the analysts are revising their forecasts upward. Once again, because of the nature of the dependent variable, I use changes in this specification to see if they are incremental to the surprise and changes in *RNOA* as follows:

$$Anal\_REV_t = \rho_0 + \rho_1 SUR_t + \rho_2 \Delta PM_t + \rho_3 \Delta ATO_t + \rho_4 \Delta RNOA_t + \varepsilon_t \qquad (7)$$

where:

Anal_REV$_t$ = analyst revision of one-year-ahead earnings forecast measured as the revision to the consensus analyst forecast of year $t+1$ earnings made just after year t earnings are announced. Specifically, it is the first median I/B/E/S consensus one-year-ahead forecast of year $t+1$ earnings, minus the last median consensus of year $t+1$ earnings made directly before the announcement of year t earnings, all scaled by share price at the end of fiscal year $t-1$.

The second test on equity analysts examines whether analysts completely understand the predictive power that the DuPont components have for future profitability. In contrast to Equation (7), the following tests explore whether analysts *fully* use the information in the DuPont components by testing whether future forecast errors for period $t+1$ are predictable. This type of research design has been used by others such as Bradshaw, Richardson, and Sloan (2001). In this specification, because future forecast errors can be seen as a level or a change, I include both the levels and changes of the DuPont components as follows:

$$FE_{t+1} = \rho_1 + \rho_2 \Delta RNOA_t + \rho_3 PM_t + \rho_4 ATO_t + \rho_5 \Delta PM_t + \rho_6 \Delta ATO_t + \varepsilon_{t+1} \qquad (8)$$

where:

FE$_{t+1}$ = forecast error is the realized earnings for year $t+1$ less the median forecast earnings from the month prior to the announcement of $t+1$ earnings, scaled by the stock price at the end of the month of the earnings announcement for year t.

The analyst tests above (Equations (7) and (8)) are complementary and provide two approaches to analysts' use of information. The first tests whether analysts use the information in revising expectations and thus provides a lower bound of relevance. The future forecast error tests examine whether analysts *fully* capture all the information in the components and thus place a higher threshold of sophistication on analysts. This latter test mirrors the future abnormal return tests presented earlier. Consistently, if analysts fully impound the information in the DuPont components when creating forecasts, then the expected coefficient is zero.

III. EMPIRICAL ANALYSIS
Sample

The empirical tests employ publicly available data from three sources: I/B/E/S, CRSP, and Compustat. I/B/E/S provides analyst forecast data. I restrict the sample to the 1984–2002 period because of weak coverage by I/B/E/S in earlier years. Financial statement data are obtained from the Compustat annual database, and stock return data are obtained

from the CRSP daily stock returns files. All firm-year observations with SIC codes 6000–6999 (financial companies) are excluded because the DuPont decomposition is not meaningful for these firms. This is consistent with previous studies on DuPont analysis (Nissim and Penman 2001; Fairfield and Yohn 2001) and thereby facilitates comparison among studies. Firm-year observations that are (1) not tracked by I/B/E/S, (2) have insufficient data on Compustat to compute the financial statement variables used in the tests, or (3) do not have contemporaneous and future return data on CRSP are eliminated. Requiring the sample to have I/B/E/S data biases the sample toward larger firms with analyst following.[24] In addition, all observations that do not have all the necessary information to perform my tests are removed as well as firm-year observations with negative *NOA* and operating income.[25] These criteria yield a final sample size of 38,716 firm-year observations with non-missing analyst forecasts, financial statement, and returns data. Thus, all tests are performed on the same sample.[26]

Variable Measurement
DuPont Decomposition

RNOA is operating income before interest (Compustat item #178) divided by average net operating assets (*NOA*), where *NOA* is Operating Assets$_t$ − Operating Liabilities$_t$. Operating assets is total assets (Compustat item #6) less cash and short-term investments (Compustat item #1 and item #32). Operating liabilities is total assets (Compustat item #6), less the long- and short-term portions of debt (Compustat items #9 and #34), less book value of total common and preferred equity (Compustat items #60 and #130), less minority interest (Compustat item #38). Growth in Net Operating Assets (ΔNOA) = (NOA_t − NOA_{t-1})/NOA_{t-1}. *RNOA* is decomposed into the multiplicative components of *PM* (Operating Income (Compustat item #178)/Total Sales (Compustat item #12)) and *ATO* (Sales/Average *NOA*). $\Delta PM_t = (PM_t - PM_{t-1})$, and *ATO* is measured similarly.[27] Future changes in *RNOA* is $\Delta RNOA_t = RNOA_{t+1} - RNOA_t$. All financial variables are winsorized at 1 percent and 99 percent to dampen the effect of outliers on the analysis.

Control Variable Definitions

Following AB (1997), I calculate nine fundamental signals (see Table 3 for exact definitions) and consistent with RSST (2005), components of total accruals are defined as $TACC = \Delta WC + \Delta NCO + \Delta FIN$.

Finally, the control variables used to proxy for risk in the future return tests are calculated as follows:

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[24] For example, in 2001 there were 2,707 firm-year observations with sufficient Compustat data to perform the tests of future $\Delta RNOA$ and the control variables. After requiring both I/B/E/S and CRSP, however, there are only 1,711 firm-year observations in the final sample for year 2001. It should be noted that those observations still comprise about 92 percent of the market capitalization of all Compustat firms in that year and therefore constitute a representative sample.

[25] Removing firms with negative operating income results in a loss of about 8,500 firm-year observations from my sample (about 18 percent), which is slightly less than the percentage Hayn (1995) reports because operating income is further up the income statement and does not include special items. This choice was made to (1) facilitate comparison with other studies (Fairfield and Yohn 2001), (2) remove firm-year observations where earnings do not map clearly into equity valuation (Burgstahler and Dichev 1997; Collins et al. 1999), and (3) allow for a clear ranking of performance. As an empirical matter, all the analysis was performed on the entire sample including loss firms with extremely similar results.

[26] As mentioned before, using delisting returns helps mitigate concerns of survivorship bias caused by requiring one-year-ahead future returns.

[27] As a robustness check, I also measure ΔPM and ΔATO in identical fashion as FY2001 (e.g., $\Delta PM_t = (PM_t - PM_{t-1})*ATO_{t-1}$). Inferences are not changed.

$$BM = \text{book value of equity (Compustat item \#60)/Market Value of}$$
Equity (shares × price − item #25 × item #199);

MVE (Size of the Firm) = Log(Market Value of Equity); and

BETA (β) = β for firm *i* for fiscal year *t* is estimated by a market model regression. The regression is run using weekly returns for a period of two years ending at the end of the fiscal year from which I obtain the data to compute each of the financial ratios.

IV. RESULTS

Table 1 presents descriptive statistics for the variables in the analysis. Most of the values are consistent with prior literature. *RNOA* and *PM* are slightly higher than the values reported in Nissim and Penman (2001) because (1) loss firms are excluded in this analysis and (2) I/B/E/S coverage is required in the sample, and analysts generally follow larger and more profitable firms (McNichols and O'Brien 1997). In addition, the distributions of both *PM* and *ATO* show that the means are larger than the medians, indicating positive skewness. Although not reflected in the 75th percentile, large outlier values of these ratios are present in the data. Table 2 presents Pearson and Spearman rank correlations between the variables of interest. Looking at the Spearman correlations, there is a strong negative correlation between *PM* and *ATO* at −0.364, consistent with Nissim and Penman (2001).

Future Δ*RNOA*

The prediction of future changes in *RNOA* ($\Delta RNOA_{t+1}$) is presented in Table 3. Panel A presents the results examining the levels of *PM* and *ATO*. Model 1 shows the DuPont components with changes in *NOA* and *RNOA* as control variables.[28] Consistent with prior literature, neither *PM* nor *ATO* predicts future changes in *RNOA*. In models 2, 3, and 4, I control for earnings predictors from prior literature. First, I examine the nine fundamental signals used by AB (1997) in model 2. Although the coefficients are not reported, most of the AB signals are consistent in sign and magnitude with AB (1997) with the exception of *AB_GM*, which is significant and positive in my analysis and negative in theirs.[29] In model 3, I control for the expanded definition of accruals from RSST (2005), and finally model 4 controls for all the variables simultaneously. In general, the RSST variables are still significant and consistent with prior work (i.e., Δ*FIN* is no longer significant). Interestingly, in the final specification when the AB variables are included along with the RSST variables, *ATO* is positive and significant although it is not significant in any of the other specifications or in prior literature (Fairfield and Yohn 2001; Soliman 2004). In unreported robustness checks, the significance appears to occur when adding the *CAPEX* variable, indicating that prior studies may have been misspecified without controlling for increases in capital expenditures above the industry average.

Finally, Panel B of Table 3 presents the changes specification used in prior studies. Consistent with prior literature (Fairfield and Yohn 2001; Penman and Zhang 2003), model 1 shows that only Δ*ATO* is positive and significant in predicting future changes in *RNOA*.[30] In models 2, 3, and 4, I show that this significance survives the inclusion of all the earnings

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[28] This is done primarily to mimic model 2 in Fairfield and Yohn (2001). Fairfield et al. (2003b) argue that Δ*NOA* is a proxy for growth find and that it subsumes the operating accrual anomaly proposed by Sloan (1996).

[29] Many design differences can explain this inconsistency between this paper and Abarbanell and Bushee (1997): (1) a different sample period, (2) use of Δ*RNOA* in this analysis versus Δ*EPS*, or (3) the inclusion of *PM* in the regression which is highly correlated with Gross Margin (*AB_GM*).

[30] With the notable exception that prior studies did not include (*RNOA* as a control variable.

TABLE 1
Descriptive Statistics

	Mean	**Std. Dev.**	**25%**	**Median**	**75%**
NOA_t	1,122	2,997	44.4	160.1	691.2
$RNOA_t$	0.279	0.354	0.113	0.181	0.300
PM_t	0.115	0.082	0.056	0.096	0.153
ATO_t	2.85	2.81	1.34	2.11	3.29
$\Delta RNOA_t$	0.000	0.431	−0.048	−0.002	0.038
ΔPM_t	0.000	0.058	−0.017	0.000	0.016
ΔATO_t	−0.009	0.150	−0.154	−0.022	0.140
$Anal\_REV_t$	−0.011	0.024	−0.003	0.000	0.001
SUR_t	−0.005	0.022	−0.004	0.000	0.002
R_t	0.066	0.608	−0.278	−0.033	0.244
$EARN_t$	0.128	0.794	0.037	0.076	0.137
$\Delta EARN_t$	0.009	0.213	−0.000	0.000	0.002

The sample size is 38,716 firm-year observations from 1984–2002. Variables are winsorized at the 1 percent and 99 percent levels.

Variable definitions:

NOA (*Net Operating Assets*) = Operating Assets minus Operating Liabilities; Operating Assets is calculated as total assets (item #6) less cash and short-term investments (item #1) and (item #32); Operating Liabilities is calculated as total assets less total debt (items #9 and #34), less book value of total common and preferred equity (items #60 and #130), less minority interest (item #38);

PM_t (*Profit Margin*) = Operating Income$_t$ (item #178)/Total Sales$_t$ (item #12);

ATO_t (*Asset Turnover*) = Sales$_t$/Average NOA_t $((NOA_t + NOA_{t-1})/2)$;

$RNOA_t$ (*Return on Net Operating Assets*) = $PM_t \times ATO_t$;

$\Delta RNOA_t$ = change in $RNOA$ from year t–1 through t $(RNOA_t - RNOA_{t-1})$;

ΔPM_t = change in *Profit Margin* $(PM_t - PM_{t-1})$;

ΔATO_t = change *Asset Turnover* $(ATO_t - ATO_{t-1})$;

$Anal\_REV_t$ (*Analyst Revision*) = one-year-ahead earnings forecasts measured as the revision to the consensus analyst forecast of year $t+1$ earnings made just after year t earnings are announced; specifically, it is the first median I/B/E/S consensus one-year-ahead forecast of year $t+1$ earnings minus the last median consensus of year $t+1$ earnings made directly before the announcement of year t earnings, all scaled by share price at the end of fiscal year $t-1$;

SUR_t (*Annual Earnings Surprise*) = annual I/B/E/S earnings minus the most recent median forecast of annual earnings for year t deflated by the market value of equity per share at the end of fiscal year $t-1$;

R_t = stock returns are measured using compounded buy-hold market-adjusted returns (raw return minus the corresponding value-weighted return), inclusive of dividends and other distributions computed over the 12 months beginning in the first month of the firm's fiscal year and ending at the end of the fiscal year t;

$EARN_t$ = EPS_t/P_{t-1}; the firm's earnings before extraordinary items per share in year t deflated by the market value of equity per share at the end of fiscal year $t-1$; and

$\Delta EARN_t$ = $\Delta EPS_t/P_{t-1}$; the firm's earnings before extraordinary items per share in year t minus its annual earnings per share in year t–1 deflated by the market value of equity per share at the end of fiscal year t–1.

predictors that exist in the current literature, particularly those of AB and RSST. Thus, despite the obvious collinearity that may exist between the DuPont components and the control variables, the predicative power of the ΔATO remains statistically significant. This

TABLE 2
Correlation Matrix: Pearson (above Diagonal) and Spearman (below Diagonal) (p-values shown in parentheses below correlations)

	$\Delta RNOA_{t+1}$	$\Delta RNOA_t$	PM_t	ATO_t	$RNOA_t$	$Anal\_Rev_t$	SUR_t	ΔPM_t	ΔATO_t	R_t
$\Delta RNOA_{t+1}$	—	−0.194 (0.0001)	−0.137 (0.0001)	−0.411 (0.0001)	−0.543 (0.0001)	0.071 (0.0001)	0.121 (0.0001)	−0.081 (0.0001)	−0.002 (0.676)	0.002 (0.757)
$\Delta RNOA_t$	0.0419 (0.0001)	—	0.111 (0.0001)	0.209 (0.0001)	0.319 (0.0001)	0.033 (0.0001)	0.025 (0.0001)	0.350 (0.0001)	0.292 (0.0001)	0.155 (0.0001)
PM_t	−0.151 (0.0001)	0.196 (0.0001)	—	−0.194 (0.0001)	0.373 (0.0001)	0.028 (0.0001)	0.106 (0.0001)	0.333 (0.0001)	0.011 (0.052)	0.125 (0.0001)
ATO_t	−0.157 (0.0001)	0.122 (0.0001)	−0.364 (0.0001)	—	0.655 (0.0001)	0.012 (0.025)	0.033 (0.0001)	0.026 (0.0001)	0.148 (0.0001)	0.108 (0.0001)
$RNOA_t$	−0.273 (0.0001)	0.298 (0.0001)	0.502 (0.0001)	0.536 (0.0001)	—	0.016 (0.002)	0.086 (0.0001)	0.227 (0.0001)	0.130 (0.0001)	0.176 (0.0001)
$Anal\_Rev_t$	0.187 (0.0001)	−0.189 (0.0001)	0.0731 (0.0001)	0.0627 (0.0001)	0.1244 (0.0001)	—	0.046 (0.0001)	0.063 (0.0001)	0.048 (0.0001)	0.106 (0.0001)
SUR_t	0.2494 (0.0001)	0.0693 (0.0001)	0.0409 (0.0001)	0.0416 (0.0001)	0.0747 (0.0001)	0.084 (0.0001)	—	0.066 (0.0001)	0.039 (0.0001)	0.068 (0.0001)
ΔPM_t	−0.018 (0.0001)	0.728 (0.0001)	0.2958 (0.0001)	0.055 (0.0001)	0.311 (0.0001)	0.179 (0.0001)	0.060 (0.0001)	—	0.109 (0.0001)	0.235 (0.0001)
ΔATO_t	0.1065 (0.0001)	0.6043 (0.0001)	0.0148 (0.0001)	0.124 (0.0001)	0.112 (0.0001)	0.117 (0.0001)	0.050 (0.0001)	0.179 (0.0001)	—	0.203 (0.0001)
R_t	0.0975 (0.0001)	0.3581 (0.0001)	0.177 (0.0001)	0.090 (0.0001)	0.247 (0.0001)	0.238 (0.0001)	0.090 (0.0001)	0.338 (0.0001)	0.215 (0.0001)	—

(*continued on next page*)

TABLE 2 (continued)

The sample size is 38,716 firm-year observations from 1984–2002. Variables are winsorized at the 1 percent and 99 percent levels.

Variable definitions:

NOA (*Net Operating Assets*) = Operating Assets minus Operating Liabilities; Operating Assets is calculated as total assets (item #6) less cash and short-term investments (item #1) and (item #32); Operating Liabilities is calculated as total assets less total debt (items #9 and #34), less book value of total common and preferred equity (items #60 and #130), less minority interest (item #38);

PM_t (*Profit Margin*) = Operating Income$_t$ (item #178)/Total Sales$_t$ (item #12);

ATO_t (*Asset Turnover*) = Sales$_t$/Average NOA_t ((NOA_t + NOA_{t-1})/2);

$RNOA_t$ (*Return on Net Operating Assets*) = $PM_t \times ATO_t$;

$\Delta RNOA_t$ = change in $RNOA$ from year $t-1$ through t ($RNOA_t$ − $RNOA_{t-1}$);

ΔPM_t = change in *Profit Margin* (PM_t − PM_{t-1});

ΔATO_t = change *Asset Turnover* (ATO_t − ATO_{t-1});

$Anal\_REV_t$ (*Analyst Revision*) = one-year-ahead earnings forecasts measured as the revision to the consensus analyst forecast of year $t+1$ earnings made just after year t earnings are announced; specifically, it is the first median I/B/E/S consensus one-year-ahead forecast of year $t+1$ earnings minus the last median consensus of year $t+1$ earnings made directly before the announcement of year t earnings, all scaled by share price at the end of fiscal year $t-1$;

SUR_t (*Annual Earnings Surprise*) = annual I/B/E/S earnings minus the most recent median forecast of annual earnings for year t deflated by the market value of equity per share at the end of fiscal year $t-1$; and

R_t = stock returns are measured using compounded buy-hold market-adjusted returns (raw return minus the corresponding value-weighted return), inclusive of dividends and other distributions computed over the 12 months beginning in the first month of the firm's fiscal year and ending at the end of the fiscal year t.

TABLE 3
Time-Series Means and t-Statistics for Coefficients from Annual Cross-Sectional Regressions of Future One-Year-Ahead Change in *RNOA* ($\Delta RNOA_{t+1}$) on the DuPont Components

Independent Variables	Model 1	Model 2	Model 3	Model 4
Panel A: Levels of DuPont Components				

$$\Delta RNOA_{t+1} = \rho_0 + \rho_1 RNOA_t + \rho_2 PM_t + \rho_3 ATO_t + \rho_4 \Delta RNOA_t + \rho_5 \Delta NOA_t$$
$$+ \ RSST\ Controls + AB\ Controls + \upsilon_{t+1}$$

Independent Variables	Model 1	Model 2	Model 3	Model 4
Intercept	0.038 (2.97)	0.066 (3.71)	0.045 (3.28)	0.072 (4.36)
$RNOA_t$	−0.263 (−4.53)	−0.265 (−5.58)	−0.365 (−4.63)	−0.257 (−5.25)
PM_t	0.220 (1.17)	0.107 (1.18)	0.321 (1.26)	0.121 (1.16)
ATO_t	−0.005 (−1.37)	−0.006 (−1.30)	0.002 (−1.53)	0.006 (2.14)
$\Delta RNOA_t$	−0.045 (−3.31)	−0.066 (−2.66)	−0.061 (−3.25)	−0.061 (−2.81)
ΔNOA_t	−0.055 (−5.92)			
ΔWC_t			−0.359 (−7.08)	−0.266 (−3.01)
ΔNCO_t			−0.212 (−10.53)	−0.174 (−4.91)
ΔFIN_t			−0.134 (−5.40)	−0.052 (−0.92)
AB Controls	Not Included	Included	Not Included	Included
Adjusted R^2	16.8%	17.5%	16.8%	19.8%

Panel B: Changes in DuPont Components

$$\Delta RNOA_{t+1} = \rho_0 + \rho_1 RNOA_t + \rho_2 \Delta PM_t + \rho_3 \Delta ATO_t + \rho_4 \Delta RNOA_t + \rho_5 \Delta NOA_t$$
$$+ \ RSST\ Controls + AB\ Controls + \upsilon_{t+1}$$

Independent Variables	Model 1	Model 2	Model 3	Model 4
Intercept	0.044 (5.45)	0.057 (4.88)	0.049 (5.47)	0.065 (5.80)
$RNOA_t$	−0.277 (−6.07)	−0.285 (−5.75)	−0.279 (−5.95)	−0.277 (−5.32)
ΔPM_t	0.074 (1.78)	0.155 (1.65)	0.069 (1.83)	0.338 (1.26)
ΔATO_t	0.017 (4.29)	0.016 (2.95)	0.019 (4.44)	0.011 (2.05)
$\Delta RNOA_t$	−0.078 (−2.85)	−0.090 (−3.51)	−0.076 (−2.93)	−0.094 (−3.31)
ΔNOA_t	−0.062 (−9.92)			

(continued on next page)

TABLE 3 (continued)

Independent Variables	Model 1	Model 2	Model 3	Model 4
ΔWC_t			−0.321 (−4.57)	−0.248 (−3.31)
ΔNCO_t			−0.176 (−8.29)	−0.149 (−4.93)
ΔFIN_t			−0.098 (−3.42)	−0.044 (−0.74)
AB Controls	Not Included	Included	Not Included	Included
Adjusted R^2	16.9%	17.5%	16.8%	21.3%

The sample consists of 38,716 firm-year observations from 1984–2002. Regression results are based on 19 annual regressions using the Fama-MacBeth approach of averaging coefficients and calculating the t-statistics as follows: $\hat{\rho} \Big/ \dfrac{StdDev\rho}{\sqrt{n}}$ where $\hat{\rho}$ is the simple average of the annual coefficients, n is the number of annual regressions and $StdDev\rho$ is the standard deviation of the annual coefficients.

NOA (Net Operating Assets) = Operating Assets minus Operating Liabilities; Operating Assets is calculated as total assets (item #6) less cash and short-term investments (item #32); Operating Liabilities is calculated as total assets less total debt (items #9 and #34), less book value of total common and preferred equity (items #60 and #130), less minority interest (item #38).

ΔNOA (Growth in Net Operating Assets) = $(NOA_t − NOA_{t−1})/NOA_{t−1}$;

PM_t = Operating Income$_t$ (item #178)/Total Sales$_t$ (item #12);

ATO_t = Sales$_t$/Average NOA_t $((NOA_t + NOA_{t−1})/2)$;

$RNOA_t$ = $PM_t × ATO_t$;

$\Delta RNOA_{t+1}$ = $RNOA_{t+1} − RNOA_t$;

$\Delta RNOA_t$ = $RNOA_t − RNOA_{t−1}$;

ΔPM_t = $PM_t − PM_{t−1}$;

ΔATO_t = $ATO_t − ATO_{t−1}$;

ΔWC_t = $WC_t − WC_{t−1}$; WC is calculated as Current Operating Assets (COA) − Current Operating Liabilities (COL), COA = current assets (Compustat Item #4) − cash and Short-Term Investments (STI) (Compustat Item #1), and COL = current liabilities (Compustat Item #5) − debt in current liabilities (Compustat Item #34);

ΔNCO_t = change in net noncurrent operating assets is defined as $NCO_t − NCO_{t−1}$; NCO is calculated as Noncurrent Operating Assets (NCOA) − Noncurrent Operating Liabilities (NCOL), $NCOA$ = total assets (Compustat Item #6) − current assets (Compustat Item #4) – investments and advances (Compustat Item #32), and $NCOL$ = total liabilities (Compustat Item #181) − current liabilities (Compustat Item #5) − long-term debt (Compustat Item #9); and

ΔFIN_t = change in net financial assets is defined as $FIN_t − FIN_{t−1}$ and FIN = Financial Assets (FINA) – Financial Liabilities (FINL), FINA = Short-Term Investments (STI) (Compustat Item #193) + Long-Term Investments (LTI) (Compustat Item #32), and FINL = long-term debt (Compustat Item #9) + debt in current liabilities (Compustat Item #34) + preferred stock (Compustat Item #130).

AB Controls are comprised of the following nine variables

AB_INV = ΔInventory (#3) − ΔSales;

AB_AR = ΔAccounts Receivable (#2) − ΔSales;

AB_CAPEX = ΔIndustry Capex − ΔFirm Capex (#30);

AB_GM = ΔSales − ΔGross Margin (#12-41);

AB_ETR = Effective Tax Rate $\left[\left(\dfrac{1}{3} \sum_{\tau=1}^{3} ETR_{t−\tau} \right) − ETR_t \right] × \Delta EARN_t$ where $ETR_t = \dfrac{TaxExpense(\#16)_t}{EBT(\#170 + \#65)_t}$;

AB_EQ = 0 for LIFO, 1 for FIFO or other;

AB_AQ = 0 for Unqualified, 1 for Qualified or other;

AB_SandA = ΔSelling and Admin Expenses (#189) − ΔSales; and

AB_LF = (Past Sales/Past Employees (#29) − Sales/Employees)/(Past Sales/Past Employees).

supports the prior literature findings and is consistent with the notion that changes in asset turnover bring new information in predicting future changes in profitability and is consistent with the economic intuition that innovations in *ATO* reflect increases in the efficiency of asset usage in generating revenues. This change in firm operational efficiency does not appear to be captured by any of the accounting signals from the prior literature included in the analysis.

Stock Return Tests

Table 4 presents the results from the long-window association tests of Equation (3). The first regression model shows that Δ*EARN* is significant in explaining returns, whereas

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TABLE 4
Time-Series Means and t-Statistics for Coefficients from Annual Cross-Sectional Regressions of Contemporaneous Returns on DuPont Components

OLS Regressions for Market-Adjusted Returns

$$R_t = \rho_0 + \rho_1 EARN_t + \rho_2 \Delta EARN_t + \rho_3 RNOA_t + \rho_4 RNOA_t + \rho_5 PM_t + \rho_6 ATO_t$$
$$+ \rho_7 \Delta PM_t + \rho_8 \Delta ATO_t + \varepsilon_t$$

	Intercept	*EARN*	Δ*EARN*	*RNOA_t*	Δ*RNOA_t*	*PM_t*	*ATO_t*	Δ*PM_t*	Δ*ATO_t*	Adj. R²
Model 1	0.0443	0.224	2.795							4.82%
	(1.85)	(1.43)	(2.44)							(2.65)
Model 2	−0.076	0.334	2.826	0.381	0.668					11.46%
	(−3.27)	(1.84)	(2.77)	(9.96)	(6.70)					(6.45)
Model 3	−0.129	0.308	2.885	0.284	0.067	0.496	0.006			12.48%
	(−4.73)	(1.70)	(2.76)	(6.84)	(6.69)	(2.99)	(2.36)			(7.17)
Model 4	−0.123	0.313	2.839	0.278	−0.003	0.495	0.004	0.122	0.089	14.00%
	(−4.78)	(1.63)	(2.68)	(7.04)	(−0.09)	(3.00)	(1.30)	(1.93)	(6.45)	(6.85)

The sample consists of 38,716 firm-year observations from 1984–2002. Regression results are based on 19 annual regressions using the Fama-MacBeth approach of averaging coefficients and calculating the t-statistics as follows: $\hat{\rho} \Big/ \dfrac{StdDev\rho}{\sqrt{n}}$ where $\hat{\rho}$ is the simple average of the annual coefficients, n is the number of annual regressions and $StdDev\rho$ is the standard deviation of the annual coefficients.

R_t = stock returns are measured using compounded buy-hold market-adjusted returns (raw return minus the corresponding value-weighted return), inclusive of dividends and other distributions computed over the 12 months beginning in the first month of the firm's fiscal year and ending at the end of the fiscal year *t*;

$EARN_t$ = EPS_t / P_{t-1}; the firm's earnings before extraordinary items per share in year *t* deflated by the market value of equity per share at the end of fiscal year *t*−1;

$\Delta EARN_t$ = $\Delta EPS_t / P_{t-1}$; the firm's earnings per share before extraordinary items per share in year *t* minus its annual earnings in year *t*−1 deflated by the market value of equity per share at the end of fiscal year *t*−1;

NOA (Net Operating Assets) = Operating Assets – Operating Liabilities; Operating Assets is calculated as total assets (item #6) less cash and short-term investments (item #1) and (item #32); Operating Liabilities is calculated as total assets less total debt (items #9 and #34), less book value of total common and preferred equity (items #60 and #130), less minority interest (item #38);

PM_t = Operating Income$_t$ (item #178)/Total Sales$_t$ (item #12);

ATO_t = Sales$_t$/Average NOA_t (($NOA_t + NOA_{t-1}$)/2);

$RNOA_t$ = $PM_t \times ATO_t$;

$\Delta RNOA_t$ = $RNOA_t - RNOA_{t-1}$;

ΔPM_t = $PM_t - PM_{t-1}$; and

ΔATO_t = $ATO_t - ATO_{t-1}$.

EARN is not. Adjusted R²s are at levels consistent with prior literature—about 4 percent.[31] Model 2 changes the analysis slightly to focus on different measures of profitability. Instead of just using *EARN* and Δ*EARN*, *RNOA* and Δ*RNOA* are added to the analysis. Many in the valuation literature are using *RNOA* as a better measure of economic performance (e.g., Penman and Zhang 2003; Fairfield and Yohn 2001; Nissim and Penman 2001; Richardson et al. 2006; Fairfield et al. 2003a). Model 2 bears out this choice. The results show that simply adding *RNOA* and Δ*RNOA* increases the adjusted R² from 4.8 percent to 11.5 percent. An (untabulated) Vuong (1989) test and F-test confirms that this increase is statistically significant. Thus, these variables are not only incrementally significant to *EARN*, but also dramatically increase the traditionally low R²s that come with this type of analysis (Lev 1989).

When *PM* and *ATO* are added to the regression in model 3, both components are significant and positive with t-statistics of 2.99 and 2.36, respectively. This is somewhat surprising given that the levels of these variables did not predict future changes in profitability in table 3.[32] Further, it is interesting that *RNOA* is still significant in models 3 and 4, especially given that it is simply *PM* × *ATO*, both of which are already in the regression equation. Thus, not only is *PM* and *ATO* incremental to *RNOA*, but *RNOA* appears to capture more information than is contained in its parts as well as in *EARN*. Finally, when DuPont component changes are added in the final specification (model 4), we again find that Δ*ATO* is significant and positive, consistent with the incremental explanatory power documented in Panel B of Table 3, but that Δ*RNOA* is not. Apparently, much of the strong predictive power of Δ*RNOA* in models 2 and 3 is driven by Δ*ATO* and not Δ*PM*. Table 4 highlights several findings. First, Δ*ATO* is the only change component that is significantly associated with contemporaneous returns consistent with the earnings prediction results. Second, the explanatory power of the return regression increases significantly with the addition of *RNOA* to *EARN*. And finally, despite the lack of earnings predictive ability, both *PM* and *ATO* are significant in explaining contemporaneous returns. This indicates that the DuPont components are incremental to earnings in capturing the information relevant to investors in pricing securities with explanatory power as high as 14 percent when examining *RNOA* and the DuPont components.

Table 5 presents the results of the tests of Equation (4)—whether future levels of *PM* and *ATO* in year $t+1$ are associated with contemporaneous returns in year t. The coefficient ρ_{11} on ATO_{t+1} is significant with t-statistic of 3.44. The results indicate that this future component is significant and incremental to current and future earnings. Once again, this points to the importance of asset turnover as a useful and informative ratio on the economics of the firm. Also note that, consistent with Table 4, *RNOA* remains significant even after adding the current and future levels of its components, *PM* and *ATO*. Not only are market returns associated with current changes in *ATO*, but market participants appear to positively price future changes in *ATO* and the efficient deployment of capital it signifies.

Table 6 provides the results of tests of Equation (5). Recall from Section II that only changes in the DuPont components are included in these return tests because of the nature of the short-window tests. In model 1, the coefficient on surprise (*SUR*) is positive and

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[31] Prior literature has found that in the same regression *EARN* is significant, whereas Δ*EARN* is not (e.g., Amir and Lev 1986). In unreported results, when I estimate this regression equation using the entire sample (including loss firms), I find that both components are statistically significant and positive. Once again, different sample composition and sample periods may explain this difference.

[32] In unreported rank regressions where the scale is consistent across both variables, *PM* has a larger coefficient than *ATO* indicating that *PM* has a somewhat larger relative importance than *ATO* in explaining contemporaneous returns.

TABLE 5
Time-Series Means and t-Statistics for Coefficients from Annual Cross-Sectional Regressions of Contemporaneous Returns on Future DuPont Components

OLS Regressions for Market-Adjusted Returns

$$R_t = \rho_0 + \rho_1 EARN_t + \rho_2 \Delta EARN_t + \rho_3 RNOA_t + \rho_4 \Delta RNOA_t + \rho_5 PM_t + \rho_6 ATO_t + \rho_7 \Delta PM_t + \rho_8 \Delta ATO_t$$

$$+ \rho_9 RNOA_{t+1} + \rho_{10} PM_{t+1} + \rho_{11} ATO_{t+1} + \varepsilon_t$$

	Intercept	EARN	ΔEARN	RNOA$_t$	ΔRNAO$_t$	PM$_t$	ATO$_t$	ΔPM$_t$	ΔATO$_t$	RNOA$_{t+1}$	PM$_{t+1}$	ATO$_{t+1}$	Adj. R^2
Mean Coef.	−0.123	0.314	2.890	0.217	0.001	0.472	0.004	0.117	0.088	0.080			14.61%
t-statistic	(−4.68)	(1.64)	(2.74)	(5.07)	(0.02)	(2.67)	(1.10)	(1.81)	(6.55)	(3.51)			(7.39)
Mean Coef.	−0.140	0.312	2.863	0.289	−0.005	−0.086	−0.008	0.125	0.087	−0.007	0.724	0.017	16.04%
t-statistic	(−5.42)	(1.64)	(2.79)	(7.58)	(−0.13)	(−0.32)	(−0.68)	(1.89)	(5.88)	(−0.43)	(1.83)	(3.44)	(7.95)

The sample consists of 38,716 firm-year observations from 1984–2002. Regression results are based on 19 annual regressions using the Fama-MacBeth approach of averaging coefficients and calculating the t-statistics as follows: $\hat{\rho} \bigg/ \dfrac{StdDev\rho}{\sqrt{n}}$ where $\hat{\rho}$ is the simple average of the annual coefficients, n is the number of annual regressions and $StdDev\rho$ is the standard deviation of the annual coefficients.

R_t = stock returns are measured using compounded buy-hold market-adjusted returns (raw return minus the corresponding value-weighted return), inclusive of dividends and other distributions computed over the 12 months beginning in the first month of the firm's fiscal year and ending at the end of the fiscal year t;

$EARN_t$ = EPS_t/P_{t-1}; the firm's earnings before extraordinary items per share in year t deflated by the market value of equity per share at the end of fiscal year $t-1$;

$\Delta EARN_t$ = $\Delta EPS_t/P_{t-1}$; the firm's earnings per share before extraordinary items per share in year t minus its annual earnings in year $t-1$ deflated by the market value of equity per share at the end of fiscal year $t-1$;

NOA (*Net Operating Assets*) = Operating Assets – Operating Liabilities; Operating Assets is calculated as total assets (item #6) less cash and short-term investments (item #1) and (item #32); Operating Liabilities is calculated as total assets less total debt (items #9 and #34), less book value of total common and preferred equity (items #60 and #130), less minority interest (item #38);

PM_t = Operating Income$_t$ (item #178)/Total Sales$_t$ (item # 12);

ATO_t = Sales$_t$/Average NOA_t (($NOA_t + NOA_{t-1}$)/2);

$RNOA_t$ = $PM_t \times ATO_t$;

$\Delta RNOA_t$ = $RNOA_t - RNOA_{t-1}$;

ΔPM_t = $PM_t - PM_{t-1}$; and

ΔATO_t = $ATO_t - ATO_{t-1}$.

TABLE 6
Time-Series Means and t-Statistics for Coefficients from Annual Cross-Sectional Regressions of Short-Window Unexpected Returns on the DuPont Components

$$UR_t = \rho_0 + \rho_1 SUR_t + \rho_2 \Delta PM_t + \rho_3 \Delta ATO_t + \rho_4 \Delta RNOA_t + \varepsilon_t$$

	Intercept	SUR_t	ΔPM_t	ΔATO_t	$\Delta RNOA_t$	Adj. R^2
Model 1	0.006	0.119				0.19%
	(5.07)	(4.32)				(2.54)
Model 2	0.007	0.145	−0.001	0.003		0.21%
	(5.17)	(4.53)	(−0.72)	(3.86)		(1.07)
Model 3	0.006	0.144	−0.004	0.002	0.003	0.24%
	(5.21)	(4.59)	(−1.55)	(2.01)	(1.40)	(1.08)

The sample consists of 38,716 firm-year observations from 1984–2002. Regression results are based on 19 annual regressions using the Fama-MacBeth approach of averaging coefficients and calculating the t-statistics as follows: $\hat{\rho} \Big/ \dfrac{StdDev\rho}{\sqrt{n}}$ where $\hat{\rho}$ is the simple average of the annual coefficients, n is the number of annual regressions and $StdDev\rho$ is the standard deviation of the annual coefficients.

UR_t = stock returns are measured using compounded buy-hold market-adjusted returns (raw return minus the corresponding value-weighted return), inclusive of dividends and other distributions computed over the five-day window surrounding the earnings announcement beginning two days before and ending two days after the annual earnings announcement for fiscal year t;

SUR_t (*Annual Earnings Surprise*) = annual I/B/E/S earnings – the most recent median forecast of annual earnings for year t;

NOA (*Net Operating Assets*) = Operating Assets – Operating Liabilities; Operating Assets is calculated as total assets (item #6) less cash and short-term investments (item #1) and (item #32); Operating Liabilities is calculated as total assets less total debt (items #9 and #34), less book value of total common and preferred equity (items #60 and #130), less minority interest (item #38);

PM_t = Operating Income$_t$ (item #178)/Total Sales$_t$ (item #12);

ATO_t = Sales$_t$/Average NOA_t (($NOA_t + NOA_{t-1}$)/2);

$RNOA_t$ = $PM_t \times ATO_t$;

$\Delta RNOA_t$ = $RNOA_t$ − $RNOA_{t-1}$;

ΔPM_t = PM_t − PM_{t-1}; and

ΔATO_t = ATO_t − ATO_{t-1}.

significant, as would be expected. In the second model, only ΔATO is significant and positive, which is consistent with its implications for future earnings from Panel B of Table 3. Positive changes in ATO are associated with positive abnormal returns around the earnings announcement, and the result holds even after controlling for the change of profitability ($\Delta RNOA$) above and beyond the surprise in the final regression.

In my final return test, a trading strategy is explored that exploits the information in these variables. Table 7 presents the results. Model 1 indicates that there is a correspondence between ΔATO and future abnormal stock returns. The abnormal future return on such a simple signal is surprising, but is consistent with the future forecast error tests presented below. Market participants do not appear to fully impound the future predictive power of ΔATO for future changes in profitability found in Table 3. Additionally, the chance that ΔATO is simply measuring risk is also minimized by the low increase in adjusted R^2 in Table 4 when adding the DuPont components. As mentioned earlier, the coefficients are decile-ranked in order to facilitate interpretation. The coefficient on ΔATO indicates that a trading strategy optimizing the information in ΔATO would result in a hedge return of

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TABLE 7
Time-Series Means and t-Statistics for Coefficients from Annual Cross-Sectional Regressions
of Future Abnormal Returns on the Ranks of DuPont Components

$$R_{t+1} = \rho_0 + \rho_1 \Delta RNOA_t + \rho_2 \Delta PM_t + \rho_3 \Delta ATO_t + \rho_4 RSST\ Controls + \rho_5 RNOA_t + \rho_6 PM_t$$
$$+ \rho_7 ATO_t + \rho_8 Fama\ French\ Risk\ Factors + \varepsilon_{t+1}$$

Independent Variables	Model 1	Model 2	Model 3
Intercept	−0.061 −2.15	−0.014 −0.49	−0.115 −2.83
$\Delta RNOA_t$	0.001 0.11	−0.001 −0.12	−0.000 −0.08
ΔPM_t	0.006 0.33	0.016 1.23	0.016 0.73
ΔATO_t	0.078 5.12	0.054 3.11	0.052 2.52
ΔWC_t		−0.513 −4.61	−0.557 −5.58
ΔNCO_t		−0.162 −3.96	−0.193 −5.26
ΔFIN_t		−0.041 −1.14	−0.108 −2.29
$RNOA_t$			0.070 1.41
PM_t			0.110 1.04
ATO_t			0.000 0.29
FF Risk Factors	Included	Included	Included
Adjusted R^2	1.6%	3.0%	3.8%

The sample consists of 38,716 firm-year observations from 1984–2002. Regression results are based on 19 annual regressions using the Fama-MacBeth approach of averaging coefficients and calculating the t-statistics as follows: $\hat{\rho} \Big/ \dfrac{StdDev\rho}{\sqrt{n}}$ where $\hat{\rho}$ is the simple average of the annual coefficients, n is the number of annual regressions and $StdDev\rho$ is the standard deviation of the annual coefficients.

R_{t+1} (*Future Abnormal Returns*) = compound buy-and-hold returns inclusive of all dividends and other distributions less the value-weighted market index beginning four months after the end of the fiscal year and continuing for one year; variables are ranked annually and assigned to deciles; the continuous value of the variables is replaced by decile-rank in the regressions and divided by 9;

NOA (*Net Operating Assets*) = Operating Assets – Operating Liabilities; Operating Assets is calculated as total assets (item #6) less cash and short-term investments (item #1) and (item #32); Operating Liabilities is calculated as total assets less total debt (items #9 and #34), less book value of total common and preferred equity (items #60 and #130), less minority interest (item #38);

PM_t = Operating Income$_t$ (item #178)/Total Sales$_t$ (item #12);
ATO_t = Sales$_t$/Average NOA_t $((NOA_t + NOA_{t-1})/2)$;
$RNOA_t$ = $PM_t \times ATO_t$;
ΔPM_t = $PM_t - PM_{t-1}$;
ΔATO_t = $ATO_t - ATO_{t-1}$;
$\Delta RNOA_t$ = $RNOA_t - RNOA_{t-1}$;

TABLE 7 (continued)

$\Delta WC_t = WC_t - WC_{t-1}$; *WC* is calculated as Current Operating Assets (COA) − Current Operating Liabilities (COL), and COA = Current Assets (Compustat Item #4) − Cash and Short-Term Investments (STI) (Compustat Item #1), and COL = Current Liabilities (Compustat Item #5) – Debt in Current Liabilities (Compustat Item #34).

ΔNCO_t = change in net noncurrent operating assets is defined as $NCO_t - NCO_{t-1}$. NCO is calculated as Non-Current Operating Assets (NCOA) − Non-Current Operating Liabilities (NCOL), and NCOA = Total Assets (Compustat item #6) − Current Assets (Compustat Item #4) − Investments and Advances (Compustat Item #32), and NCOL = Total Liabilities (Compustat Item #181) − Current Liabilities (Compustat Item #5) − Long-Term Debt (Compustat Item #9).

ΔFIN_t = change in net financial assets is defined as $FIN_t - FIN_{t-1}$, and FIN = Financial Assets (FINA) – Financial Liabilities (FINL). FINA = Short-Term Investments (STI) (Compustat Item #193) + Long-Term Investments (LTI) (Compustat Item #32), and FINL = Long-Term Debt (Compustat Item #9) + Debt in Current Liabilities (Compustat Item #34) + Preferred Stock (Compustat Item #130).

FF Risk Factors are comprised of book-to-market ratio, log (MVE), and Beta. *Book-to-Market Ratio* = Book value of equity (Compustat item #60)/Market Value of Equity (shares × price − item #25 × item #199). *MVE* = Log (Market Value of Equity). *BETA* (β) for firm *i* for fiscal year *t* is estimated by a market model regression. The regression is run using weekly returns for a period of two years ending at the end of the fiscal year from which I obtain the data to compute each of the financial ratios.

about 7.8 percent after controlling for $\Delta RNOA$ and the three Fama and French (1993) risk factors. The return drops to about 5.2 percent but remains statistically significant, even after controlling for the RSST accrual measures and the levels of the DuPont components. Thus, market participants do not appreciate the persistent nature of changes to asset efficiency as measured by *ATO*.

Analyst Forecast Revision Tests

Table 8 presents the first set of analyst tests that are used to ascertain whether analyst forecast revisions are associated with the DuPont components. In the first regression, the forecast surprise is positive and significant, consistent with analysts revising their forecasts of future earnings in the same direction as the earnings surprise. Model 2 adds the DuPont components. Once again, ΔATO is the only DuPont component that is positive and significant. Model 3 shows that the significance remains even after including the change of *RNOA*.[33] Recall that changes in *ATO* positively predict future changes in profitability. Thus, the association between analyst forecast revisions and changes in the DuPont components is consistent with their predictive ability of future profitability and indicates that analysts are revising their forecasts in a manner consistent with the predictive properties of ΔATO.

Table 9 presents the analysis of explaining future forecast errors from Equation (8). Model 1 presents the levels of the components. Both are insignificant, which is again consistent with the lack of power on predicting future profitability. Model 2 presents the changes specification. Surprisingly, both ΔPM and ΔATO are statistically significant. This is surprising because ΔPM (1) has no predictive power with respect to future changes in profitability and (2) generally has similar time-series properties to *RNOA* (Nissim and Penman 2001). Accordingly, one would expect analysts to properly impound the information in this variable.

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[33] In unreported portfolio tests, ΔPM also appeared to have some predictive power when the earnings surprise control was not included.

TABLE 8
Time-Series Means and t-Statistics for Coefficients from Annual Cross-Sectional Regressions of Analysts Forecast Revisions on the DuPont Components

$$Anal\_REV_t = \rho_0 + \rho_1 SUR_t + \rho_2 \Delta PM_t + \rho_3 \Delta ATO_t + \rho_4 \Delta RNOA_t + \varepsilon_t$$

	Intercept	SUR_t	ΔPM_t	ΔATO_t	$\Delta RNOA_t$	Adj. R^2
Model 1	−0.002	0.062				1.09%
	(−5.40)	(3.06)				(2.66)
Model 2	−0.002	0.066	0.001	0.001		1.4%
	(−4.44)	(3.26)	(1.09)	(3.63)		(2.88)
Model 3	−0.002	0.066	0.001	0.001	0.000	1.32%
	(−4.40)	(3.26)	(0.94)	(2.44)	(0.01)	(3.02)

The sample consists of 38,716 firm-year observations from 1984–2002. Regression results are based on 19 annual regressions using the Fama-MacBeth approach of averaging coefficients and calculating the t-statistics as follows: $\hat{\rho} \big/ \dfrac{StdDev\rho}{\sqrt{n}}$ where $\hat{\rho}$ is the simple average of the annual coefficients, n is the number of annual regressions and $StdDev\rho$ is the standard deviation of the annual coefficients.

$Anal\_REV_t$ (*Analyst Revision*) = one-year-ahead earnings forecasts measured as the revision to the consensus analyst forecast of year $t+1$ earnings made just after year t earnings are announced. Specifically, it is the first median I/B/E/S consensus one-year-ahead forecast of year $t+1$ earnings, minus the last median consensus of year $t+1$ earnings made directly before the announcement of year t earnings, all scaled by share price at the end of fiscal year $t-1$;

SUR_t (*Annual Earnings Surprise*) = annual I/B/E/S earnings – the most recent median forecast of annual earnings for year t;

NOA (*Net Operating Assets*) = Operating Assets − Operating Liabilities; Operating Assets is calculated as total assets (item #6) less cash and short-term investments (item #1) and (item #32); Operating liabilities is calculated as total assets less total debt (items #9 and #34), less book value of total common and preferred equity (items #60 and #130), less minority interest (item #38);

ΔNOA (*Growth in Net Operating Assets*) = $(NOA_t − NOA_{t-1})/NOA_{t-1}$;

PM_t = Operating Income$_t$ (item #178)/Total Sales$_t$ (item #12);

ATO_t = Sales$_t$/Average NOA_t $((NOA_t + NOA_{t-1})/2)$;

$RNOA_t$ = $PM_t \times ATO_t$;

ΔPM_t = $PM_t − PM_{t-1}$;

ΔATO_t = $ATO_t − ATO_{t-1}$; and

$\Delta RNOA_t$ = $RNOA_t − RNOA_{t-1}$.

But the analysis suggests that analysts do not appear to employ all the information in ΔATO when making forecasts. The positive sign of the coefficient is also important. Recall that ΔATO positively predicts future changes in profitability after controlling for the $\Delta RNOA$. The positive coefficient on this variable indicates that, on average, analysts' forecast errors seem to be predicted by ΔATO, consistent with the positive prediction of future profitability and is entirely consistent with the future abnormal return tests. Specifically, it gives support to the idea that analysts do not fully appreciate the information in this variable, and that (similar to Abarbanell and Bernard [1992]) market participants may be relying on analysts for information. Overall, the two tests seem to confirm that there is information contained in ΔATO that is not completely understood by market participants, and both point to the lack of appreciation of the predictive abilities of ΔATO.

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TABLE 9

Time-Series Means and t-Statistics for Coefficients from Annual Cross-Sectional Regressions of Future Forecast Errors on the DuPont Components

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$$FE_{t+1} = \rho_1 + \rho_2 \Delta RNOA_t + \rho_3 PM_t + \rho_4 ATO_t + \rho_5 \Delta PM_t + \rho_6 \Delta ATO_t + \varepsilon_{t+1}$$

	Intercept	**$\Delta RNOA_t$**	**PM_t**	**ATO_t**	**ΔPM_t**	**ΔATO_t**	**Adj. R^2**
Model 1	0.013	−0.001	−0.013	−0.000			1.74%
	(8.44)	(−1.35)	(−1.62)	(−0.09)			(1.46)
Model 2	0.015	0.001			0.002	0.002	2.78%
	(11.27)	(1.09)			(3.29)	(2.56)	(7.45)
Model 3	0.013	0.000	−0.013	−0.000	0.002	0.002	1.79%
	(8.57)	(0.48)	(−1.83)	(−0.30)	(3.27)	(2.54)	(8.32)

The sample consists of 38,716 firm-year observations from 1984–2002. Regression results are based on 19 annual regressions using the Fama-MacBeth approach of averaging coefficients and calculating the t-statistics as follows: $\hat{\rho} \Big/ \dfrac{StdDev\rho}{\sqrt{n}}$ where $\hat{\rho}$ is the simple average of the annual coefficients, n is the number of annual regressions, and $StdDev\rho$ is the standard deviation of the annual coefficients.

FE_{t+1} (*Forecast error*) = realized earnings for year $t+1$ less the median forecast earnings from the months prior to the announcement of $t+1$ earnings, scaled by the stock price in the month of the earnings announcement for year t;

NOA (*Net Operating Assets*) = Operating Assets – Operating Liabilities; Operating Assets is calculated as total assets (item #6) less cash and short-term investments (item #1) and (item #32); Operating liabilities is calculated as total assets less total debt (items #9 and #34), less book value of total common and preferred equity (items #60 and #130), less minority interest (item #38);

PM_t = Operating Income$_t$ (item #178)/Total Sales$_t$ (item #12);

ATO_t = Sales$_t$/Average NOA_t ((NOA_t + NOA_{t-1})/2);

$RNOA_t$ = $PM_t \times ATO_t$;

ΔPM_t = $PM_t - PM_{t-1}$;

ΔATO_t = $ATO_t - ATO_{t-1}$; and

$\Delta RNOA_t$ = $RNOA_t - RNOA_{t-1}$.

V. CONCLUSION

In this paper, the usefulness of DuPont analysis, a common form of financial statement analysis that decomposes return on net operating assets (*RNOA*) into two multiplicative components: profit margin and asset turnover, is comprehensively tested. This decomposition breaks down earnings into two meaningful ratios that are interpretable. Consistent with prior literature and the economic intuition that an increase in asset turnover represents an improvement in asset utilization that will generate future results, I find that changes in asset turnover have positive explanatory power for future changes in *RNOA* incremental to current changes in *RNOA*. This paper contributes to this growing literature by confirming that the information contained in changes in asset turnover is incremental to other documented predictors of profitability such as accruals and the fundamental signals used by experts in Lev and Thiagarajan (1993).

However, the primary focus of the paper is how market participants, such as equity analysts and stock market investors, use DuPont components in assessing the prospects of the firm. The paper examines the stock market's association with the information in the DuPont components variables through long- and short-window tests and finds that the market recognizes the future *RNOA* implications of these components. As would be expected, long-window stock returns are positively associated with changes in asset turnover. Additionally, short-window returns show that the market responds favorably to changes in asset

turnover. However, future return tests confirm that this favorable response is incomplete. Analyst forecast revision tests mirror the short-window return results. I find that there is positive revision to future earning forecasts associated with changes in asset turnover that is incremental to the earnings surprise as well as changes in total profitability. Thus, sell-side analysts appear to properly use the information in ΔATO in assessing the future prospects of the firm at least from a directional perspective. However, I find that although there is an association with this ratio and revisions of future earnings forecasts, there appears to be information in the DuPont components that goes unused by analysts as evidenced by the predictability of future forecast errors. The consistency of the future analyst forecast error tests with the future return tests is reassuring. In the spirit of Abarbanell and Bernard (1992), it points to the possibility that investors may be misled partially because analysts do not impound the differential time-series properties of these two components.

Overall, the study finds that the DuPont analysis is a useful tool of financial statement analysis. Unlike other analyses, the DuPont decomposition of *RNOA* has the nice feature of being derived from a theoretical and parsimonious framework of valuation and relates to the operational aspects of the firm. In particular, the analysis points to the value of focusing on changes in asset turnover.

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