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Conditional versus unconditional persistence of RNOA components: implications for valuation

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Abstract Financial analysis often involves decomposing variables into components, emphasizing the structured hierarchy among ratios. We distinguish between unconditional persistence (a variable's autocorrelation coefficient), and conditional persistence (the power of a variable's persistence to explain the persistence of a variable higher in the hierarchy). We argue that a variable's conditional persistence determines the magnitude of its market reaction, allowing us to predict the relative magnitude of the market reaction to a ratio depending on its hierarchal level in the analysis. We examine the market reaction to the DuPont ratios and find that, while the unconditional persistence of asset turnover (ATO) is larger than that of operating profit margin (OPM), the conditional persistence of OPM is larger than that of ATO. Thus, we predict and find that the market's reaction to OPM is stronger than that to ATO. We further decompose OPM and ATO into their second-order components and show that the market reaction depends on a component's conditional persistence.

Keywords Persistence · DuPont decomposition · Market reaction · Financial analysis · Ratios

JEL Classification G14 · M41

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1 Introduction

Ratio analysis plays a significant role in bankruptcy prediction (Ohlson 1980), credit rating (Kaplan and Urwitz 1979), prediction of takeovers (Palepu 1986), prediction of the sign of earnings changes (Ou and Penman 1989), prediction of stock returns (Penman and Zhang 2006), and valuation (Nissim and Penman 2001).[1] Recent studies have also looked at the market reaction to financial ratios, that is, the effects of various ratios on stock returns when financial statement information is released.[2] For instance, Soliman (2008) examines the effect of return on net operating assets (RNOA) and its DuPont components—operating profit margin (OPM) and asset turnover (ATO)—on current and subsequent stock returns.

Prior studies have also examined the persistence of earnings and earnings components. For example, Lipe (1986), Wilson (1987), Sloan (1996) and Ertimur et al. (2003) find that different components of earnings have different persistence and should therefore be priced differentially by equity investors. Penman and Zhang (2006) claim that financial analysts and investors care about the sustainable component of earnings because equity values are based on expected future earnings rather than current earnings. Thus, investors should pay more for sustainable (more persistent) earnings. In addition, Ertimur et al. (2003), Jegadeesh and Livnat (2006), and Kama (2009) find that revenues have greater persistence than earnings and expenses. Gu et al. (2006) argue that the persistence of earning surprises increases when it is driven by revenue surprises rather than by expense surprises. Surprisingly, although revenues have greater persistence than earnings, investors prefer an increase in earnings to an increase in revenues as documented by Ertimur et al. (2003), Jegadeesh and Livnat (2006), and Kama (2009) and prefer an increase in revenues to a decrease in expenses (Ertimur et al. 2003).

To reconcile the greater persistence of revenues than earnings with the weaker market reaction to revenues than earnings, we distinguish between two types of persistence measures—*conditional persistence* and *unconditional persistence*. Consistent with prior literature, unconditional persistence is defined as the autocorrelation coefficient obtained from a variable's time-series. In contrast, we define conditional persistence as the marginal contribution of a component variable's persistence to the persistence of a variable higher in the hierarchy. We argue that the persistence of earnings components (for example, revenues and expenses, cash and accruals) is important for valuation only to the extent that it provides information about the persistence of the primary variable of interest for equity valuation—earnings. Furthermore, since earnings is the primary variable of interest to equity investors, it should have the strongest market reaction, and the

[1] See also Cottle et al. (1988); Penman (2010); Palepu et al. (2004); White (2003).

[2] Most market reaction studies examine the effects of earnings (Lev and Ohlson 1982; Lev 1989; Kothari 2001; Holthausen and Watts 2001; Dechow and Schrand 2004) and revenues (Jegadeesh and Livnat 2006) on stock returns, but have virtually ignored the effects of financial ratios on short-window returns. This could be because prior databases did not enable researchers to identify the precise line items that were disclosed in the preliminary earnings release as compared with those that became public only through the 10Q/K filings with the Securities and Exchange Commission (SEC). Also, SEC filing dates were largely unavailable to researchers in databases.

magnitude of the market reaction to earnings components-revenues and expenses-should depend on their marginal contribution to earnings persistence.

This new concept of conditional persistence is particularly useful when accounting variables are decomposed into components, as is often the case for financial ratios in general and the DuPont decomposition of RNOA, in particular. As Nissim and Penman (2001) argue, the traditional DuPont decomposition ties ratios together in a structured way, emphasizing the established hierarchy among them. Financial ratios are building blocks in the construction of residual income, but certain ratios at a lower level of the hierarchy provide finer information about ratios at a higher level and hence may be more useful for investors than ratios with greater persistence that are at the same level in the hierarchy.

We contribute to the literature by introducing and investigating the valuation implications of conditional persistence. In particular, we begin with return on net operating assets (RNOA) as the primary variable and decompose it into two-first-order components—net operating asset turnover (ATO) and core operating profit margin (OPM). We measure the unconditional persistence of both components and find that ATO is unconditionally more persistent than OPM. Then, we examine how the persistence of ATO and OPM affect the persistence of RNOA and find that the persistence of core OPM is more powerful than the persistence of ATO in explaining the persistence of RNOA, namely the conditional persistence of core OPM (the marginal contribution of the persistence of OPM to the persistence of RNOA) is larger than that of ATO. Hence, we predict and find that the market reaction to unexpected changes in OPM is stronger than that to unexpected changes in ATO.

We further decompose core OPM into two-second-order components—gross profit margin (GPM) and other profit margin (OTPM). We find that the unconditional persistence of GPM is higher than that of OTPM. However, there is no difference between the conditional persistence of these components. Therefore, we predict and find that the market reaction to unexpected changes in these two components is similar. We also decompose ATO into working capital turnover (WCTO) and fixed assets turnover (FATO). We find that both the unconditional and conditional persistence of FATO are higher than those of WCTO. Therefore, we predict and find stronger market reaction to unexpected changes in FATO than to unexpected changes in WCTO.

We also use portfolio analysis to examine the market reaction to the DuPont components. A portfolio analysis enables a quantification of the tradeoff between RNOA components in terms of stock returns, which is less obvious in a regression analysis. Specifically, we double-sort companies according to their ratios and examine excess returns to portfolios "high" in one component and "low" in the other. We show that high (low) OPM yields positive (negative) excess returns, regardless of the level of ATO, while an increase in ATO does not lead to an increase in excess returns when OPM is low. This result highlights the dominance of operating profit margin over asset turnover in terms of market reaction. An examination of the second-order components of operating profit margin—gross profit margin and other profit margin—shows similar excess returns in extreme portfolios, consistent with the argument that the market reacts similarly to

unexpected changes in these components. Portfolio analysis of the second-order components of asset turnover shows that a portfolio of companies with high fixed assets turnover yields positive excess returns regardless of the level of working capital turnover, while a portfolio of companies with low fixed-asset turnover yields nonpositive excess returns regardless of the level of working capital turnover. This result suggests, as expected, that the market favors increases in fixed assets turnover over increases in working capital turnover, because the conditional persistence of fixed assets turnover is larger than that of working capital turnover.

Finally, we complement our analysis by investigating the association between financial ratios and subsequent stock returns, similar to Soliman (2008). This analysis provides insights as to whether investors fully and immediately react to these unexpected ratios when they are disclosed or whether there is a post-announcement drift similar to that documented with respect to earnings and revenue surprises. First, we find a significant post-announcement drift to unexpected changes in RNOA, incrementally to expected earnings and revenues. Decomposing RNOA into its first-order components—OPM and ATO—we find that only unexpected changes in asset turnover are associated with subsequent stock returns. In fact, we find that both earnings and revenues are no longer associated with subsequent stock returns incrementally to unexpected changes in asset turnover. This last result suggests that the main component driving the post-announcement drift is the market's inability to fully reflect information on unexpected changes in asset turnover.

Second-order decomposition of operating profit margin reveals that both gross profit margin and other profit margin exhibit no association with subsequent stock returns, incrementally to earnings and revenue surprises. A decomposition of asset turnover into working capital and fixed assets turnovers shows that both these second-order components exhibit significant associations with subsequent stock incrementally to earnings and revenue surprises.

The main contribution of this study is the new concept of conditional persistence—the marginal contribution of the persistence of a component lower in the hierarchy to that of a variable higher in the hierarchy. This new concept is particularly useful when analyzing a set of accounting variables (for example, financial ratios) with a clear hierarchy. We also contribute to the literature by relating a variable's conditional persistence to its market reactions. We show that the conditional persistence is more important than the unconditional persistence in determining the value relevance of accounting variables. Therefore, conditional persistence is an important factor in understanding the market reactions and valuation of accounting variables.

The remainder of the study is organized as follows: Section 2 reviews the literature and develops empirical predictions. Section 3 discusses the sample and variable definitions and provides descriptive statistics on the main variables. Section 4 provides the results, and Sect. 5 concludes.

2 Related literature

Return on net operating assets (RNOA) is normally decomposed into operating profit margin (OPM) and total asset turnover (ATO), RNOA = OPM × ATO.

OPM, measured as core earnings before interest and after tax divided by net sales, provides information on the sensitivity of operating income to product prices and changes in cost structure. Changes in OPM, thus, reflect changes in sales not accompanied by proportionally similar changes in costs; for instance, when demand unexpectedly falls and the firm chooses not to reduce its selling, general, and administrative (SG&A) expenses (Anderson et al. 2003) or changes in costs that cannot be passed onto customers (for example, rising fuel costs absorbed by airlines due to competition) by changing sales. RNOA also depends on the amount the company invests in generating profits. In particular, low profit margin does not necessarily indicate bad performance as firms with low OPM may also require relatively small investments in net operating assets, leading to a high residual income. ATO, measured as net sales divided by net operating assets (NOA), captures efficiency in utilizing the firm's net investment and the quality of asset management. Firms with low ATO may be compensated for their large investments in assets by generating high OPM, yielding a high RNOA and residual income. Changes in OPM and ATO provide information about the persistence of residual income and RNOA as both residual income and RNOA are sensitive to changes in product prices, input prices, and efficiency in utilizing the net operating assets. In addition, changes (and levels) of OPM and ATO provide value-relevant information about future residual income beyond unexpected earnings and revenues.

Several studies have focused on the role of financial ratios in predicting future ratios and valuation. Nissim and Penman (2001) use the residual income valuation model to develop a link between equity values on one side and RNOA and leverage on the other side. They track the behavior and persistence of these ratios over time. Fairfield and Yohn (2001), Penman and Zhang (2006), and Soliman (2008) show that decomposing changes in RNOA into changes in ATO and OPM improves the accuracy of forecasted RNOA. Specifically, they find that the change in ATO, but not the change in OPM, explains future RNOA after controlling for current RNOA. Fairfield et al. (2009) show that industry analysis has no incremental information in forecasting profitability but it is useful in predicting future sales growth. Soliman (2008) shows that RNOA and its components affect stock returns after controlling for earnings.

The persistence of RNOA and its components has been the focus of several studies (for example, Romer 1986, Nissim and Penman 2001, and Penman and Zhang 2006). These studies find that the persistence of ATO is higher than that of OPM. That is, the *unconditional* persistence of ATO is larger than that of OPM. This finding does not necessarily mean that ATO is more value-relevant than OPM or that ATO is a more important factor in explaining stock returns than OPM. Analogously, prior studies have shown that the persistence of revenues is higher than that of earnings but that the market reaction to earnings surprises is stronger than that to revenue surprises (Jegadeesh and Livnat 2006, and Kama 2009).

Our study is also related to Soliman (2008), who uses cross-sectional regressions with annual returns as the dependent variable and finds that RNOA and its two components, OPM and ATO, are value-relevant. He also finds that only the change in ATO is significant in explaining short-window (5 days) stock returns around earnings announcements, but changes in OPM and RNOA are not significant. He

argues that the market reacts to changes in ATO but not to changes in RNOA and OPM because only changes in ATO are significant in predicting future changes in return on net operating assets. Unlike Soliman (2008), we use firm-specific time-series regressions and show that the market reaction to changes in unexpected OPM is positive and significantly larger than that to unexpected changes in ATO (after controlling for revenue and earnings surprises). We explain these conflicting findings by introducing a new concept of persistence—conditional persistence—and showing that the conditional persistence of OPM is larger than that of ATO. By distinguishing between unconditional persistence and conditional persistence we extend the existing literature. A variable's unconditional persistence is its autocorrelation measured independently of other variables. A variable's conditional persistence is measured as its marginal contribution in explaining the persistence of a variable higher in the hierarchy. That is, the usefulness of each component in valuation should be related to its marginal contribution to earnings quality, as argued by Penman and Zhang (2006). If earnings quality is associated with the persistence of RNOA, the usefulness of each RNOA component should be related to its conditional persistence. In particular, if the conditional persistence of one RNOA component is higher than that of the other component, this should also be reflected in its higher association with excess stock returns. Applying this new concept to the DuPont components, we predict that, when the conditional persistence of a component variable is higher than another component variable with the same hierarchy rank, the market reaction to information disclosed about the variable with the higher conditional persistence will be stronger than for the other variable. This new concept is particularly useful when accounting variables are disaggregated into variables lower in the hierarchy, as is the case for the DuPont decomposition of financial ratios.

3 Sample, variables and descriptive statistics

We compute the market reaction to earnings as the buy-and-hold return on a security minus the average buy-and-hold return on a matched portfolio with similar size, momentum, and book-to-market (using two size, three momentum and three book-to-market portfolios) around the release of quarterly earnings. We use two return windows, depending on whether the firm reported all the necessary information in the preliminary earnings announcement. The main analysis is conducted for a return window from 1 day prior to the preliminary earnings announcement until 1 day after the SEC filing date. For those firms that released the required information in the preliminary earnings announcement, we also use a three-day window around the preliminary earnings announcement date. When the precise SEC filing date is unavailable, we use the last date of the period allowed under SEC regulation, since most firms file 1 or 2 days before the mandatory filing date (Griffin 2003).

Following Nissim and Penman (2001), we calculate RNOA as core operating income after-tax (COI) divided by net operating assets (NOA). OPM is calculated as COI divided by net revenues, and asset turnover (ATO) is calculated as net revenue

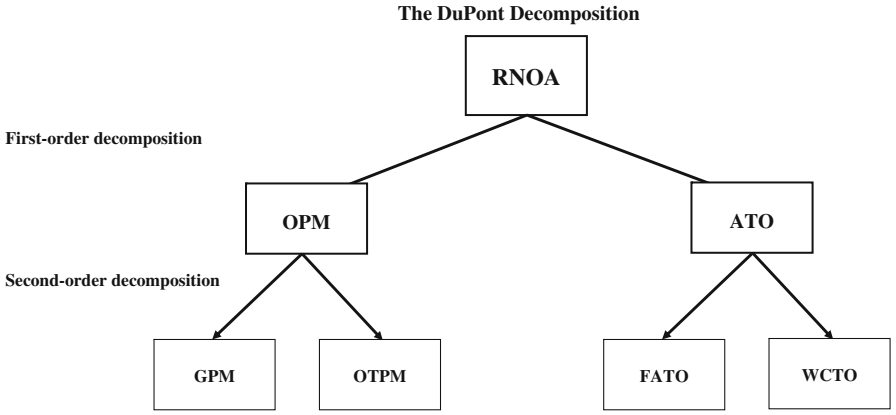

Fig. 1 The DuPont Decomposition. *RNOA* Return on net operating assets (quarterly operating income after-tax divided by net operating assets). *OPM* Core operating profit margin after tax. *ATO* Asset turnover (quarterly sales divided by net operating assets). *GPM* Gross profit margin after tax (quarterly gross profit after tax divided by sales). *OTPM* other profit margin after-tax (the difference between OPM and GPM). *WCTO* Working capital turnover (quarterly sales divided by net working capital). *FATO* Fixed assets turnover (quarterly sales divided by net PP&E)

divided by NOA.[3] We also decompose OPM into gross and other profit margins (GPM, OTPM) and ATO into working capital and fixed assets turnovers (WCTO, FATO). GPM is calculated as gross profit after tax divided by net revenues, and OTPM is calculated as the difference between OPM and GPM divided by net revenues. WCTO and FATO are calculated as net revenues divided by net working capital and fixed assets, respectively.[4] Fig. 1 depicts the decomposition of RNOA into its first and second-order components.

To compute earnings and revenue surprises, we calculate standardized unexpected earnings (SUE) as the standardized difference between EPS and expected EPS: $\mathrm{SUE}_{i,t}=\frac{\mathrm{EPS}_{i,t}-E(\mathrm{EPS}_{i,t})}{S_{i,t}}$. $E(\mathrm{EPS}_{it})$ is expected earnings per share for firm i in quarter t, measured as $E(\mathrm{EPS}_{i,t}) = \mathrm{EPS}_{i,t-4}+D_{i,t}$ where EPS_{it-4} is earnings in the same quarter last year and D_{it} is an average drift over the last 8 quarters: $D_{i,t}=\frac{1}{8}\sum_{j=1}^{8}(\mathrm{EPS}_{i,t-j}-\mathrm{EPS}_{i,t-j-4})$. S_{it} is the standard error of the unexpected part of EPS, $S_{i,t}=\frac{1}{7}\sqrt{\sum_{j=1}^{8}(\mathrm{EPS}_{i,t-j}-E(\mathrm{EPS})_{i,t-j})^2}$. Standardized unexpected revenue (SURG) is calculated in a similar manner.

[3] We repeated the entire analysis with pre-tax profit instead of after-tax profit and with total assets instead of net operating assets. The results are very similar to those reported here.

[4] In terms of Compustat quarterly item numbers: COI = (#69 + [(#22 − #31 − #32) × (1 − MTR)] − #26)/#2; NOA = #59 + #53 + #45 + #51 + #55 − #36; Net Revenues = #2. GPM = [(#2 − #30) × (1 − MTR)]/#2; WCTO = #2/(#37 + #38 + #39 − #46 − #48 − #47); FATO = #2/#42; MTR = is the annual federal and state tax rate.

Unexpected RNOA and its components (URNOA, UOPM, UATO, UGPM, UOTPM, UWCTO, and UFATO) are measured as raw ratios minus these ratios in the same quarter last year. Unconditional persistence of each ratio is measured each quarter as the first autocorrelation over the previous eight quarters and denoted as $P(X)$.

The initial sample includes all public companies covered by Compustat and CRSP during 1989 through 2008 with a market value of equity in excess of $10 million at quarter-end, total assets that exceed $1 million at quarter-end, quarterly sales of at least $1 million, and with at least 25 quarterly observations. We delete observations with missing data on RNOA, OPM, ATO, SUE, and SURG as well as buy-and-hold excess returns around earnings announcements. We exclude financial institutions and public utilities (4-digit SIC codes 6000–6999 and 4900–4999) because the structure of their financial statements is incompatible with those of other companies. To limit the effect of extreme observations, each quarter we rank the sample according to each of the RNOA components, SUE, SURG and buy-and-hold excess returns, and remove the extreme one percent of the observations on each side. In addition, we delete observations with OPM lower than −1 (i.e., negative 100%).

To ensure that we measure market reactions to the quarterly information that investors in fact were exposed to at the time of the earnings announcements, we rely on the Point-In-Time database of Charter Oak Investment Systems, now available through WRDS. This database allows us to determine what financial statement detail was available to market participants in the preliminary earnings release, as compared to the financial statement information that only became available through SEC filings. Further, it allows us to use the information actually present in the original earnings press release or immediately subsequent SEC filing as compared to the restated quarterly information available in the typical Compustat database.[5] Table 1 lists the number of observations each year in the main sample and the reduced sample—companies that provide all the information needed to compute RNOA, OPM and ATO in their preliminary earnings announcements. The main and the reduced samples include 81,049 and 5,847 firm-quarter observations for 1,878 and 181 different firms, respectively.

Table 2 contains descriptive statistics for the main sample (Panel A) and for the reduced sample (Panel B). In addition to the main research variables described above, we report statistics for book-to-market ratios (B/M), measured as book value of equity at quarter-end divided by market value of common equity, and firm size (MV), measured as market value of common equity at quarter-end. Generally, statistics are similar across the two samples. Median buy-and-hold excess returns (AR) are around zero, by construction, for the short and the long windows. Mean and median quarterly RNOA are 0.03, indicating that the distribution of RNOA is not skewed.

Looking at the components of operating profit margin, gross profit margin is generally positive, but other profit margin is generally negative. This is because the

[5] See related discussions and a description of the Charter Oak database in Jegadeesh and Livnat (2006).

Table 1 Sample selection

Year	Full sample	Reduced sample
1989	612	18
1990	3,443	44
1991	3,822	100
1992	4,019	113
1993	4,225	116
1994	4,450	116
1995	4,756	119
1996	5,081	169
1997	5,129	208
1998	5,088	305
1999	5,069	287
2000	4,890	424
2001	4,630	484
2002	4,547	554
2003	4,484	567
2004	4,153	549
2005	3,796	492
2006	3,432	474
2007	3,166	416
2008	2,257	292
Observations	81,049	5,847
Companies	1,878	181

The full sample includes all companies with complete stock returns and financial data available on Compustat and CRSP with market value of equity above $10 million at quarter-end and at least 25 quarterly observations. We exclude financial institutions (1-digit SIC = 6) and public utilities (2-digit SIC = 49). We also remove the extreme 1% of observations (on both sides) in terms of Return on Net Operating Assets (RNOA), components of RNOA, standardized unexpected earnings (SUE), standardized unexpected revenue (SURG) and abnormal returns (AR). The reduced sample includes those companies for which financial statement information needed to calculate RNOA and its components is available in the preliminary earnings announcement

main component of other profit margin is selling, general, and administrative expenses (SG&A). As for the components of asset turnover, working capital turnover is more volatile than fixed assets turnover simply because working capital can be negative while fixed assets are strictly positive.

The distribution of book-to-market ratios is skewed to the right as the means (0.60, 0.56) are larger than the medians (0.49, 0.46) in both samples, respectively. In the two samples, mean and median unexpected ratios are either zero or very close to zero, by design. As for firm size, companies are, on average, smaller in the full sample than in the reduced sample, because larger companies tend to provide more information in their preliminary earnings announcements (Amir and Livnat 2006).

Table 2 Descriptive statistics

Variable	*N*	Mean	Std. Dev.	5th Pctl.	25th Pctl.	Median	75th Pctl.	95th Pctl.
Panel A: Full sample								
AR (LW)	81,049	0.00	0.12	−0.18	−0.06	−0.00	0.07	0.21
RNOA	81,049	0.03	0.05	−0.02	0.01	0.03	0.04	0.10
OPM	81,049	0.05	0.09	−0.06	0.02	0.05	0.09	0.17
ATO	81,049	0.61	0.46	0.17	0.34	0.49	0.72	1.45
GPM	63,721	0.23	0.11	0.08	0.15	0.22	0.30	0.43
OTPM	63,721	−0.18	0.11	−0.37	−0.23	−0.16	−0.10	−0.04
WCTO	63,721	1.71	5.34	−4.07	0.89	1.43	2.44	7.29
FATO	63,721	1.83	2.10	0.26	0.71	1.23	2.11	5.49
URNOA	81,049	−0.00	0.40	−0.05	−0.01	0.00	0.01	0.05
UOPM	81,049	0.00	0.12	−0.08	−0.01	0.00	0.01	0.08
UATO	81,049	−0.01	2.55	−0.27	−0.05	0.00	0.05	0.22
UGPM	63,721	0.00	0.03	−0.04	−0.01	0.00	0.01	0.04
UOTPM	63,721	−0.00	0.06	−0.06	−0.01	0.00	0.01	0.06
UWCTO	63,721	0.02	6.92	−2.74	−0.23	0.01	0.26	2.88
UFATO	63,721	0.02	0.61	−0.68	−0.09	0.01	0.13	0.73
SUE	81,049	−0.09	1.62	−2.75	−0.69	0.02	0.70	2.32
SURG	81,049	0.08	1.43	−2.35	−0.84	0.22	0.98	2.28
B/M	81,049	0.60	0.47	0.14	0.31	0.49	0.76	1.42
MV	81,049	3,963.3	18,199.2	26.6	118.9	464.3	1,835.3	1,505.1

Variable	Mean	Std. Dev.	5th Pctl.	25th Pctl.	Median	75th Pctl.	95th Pctl.
Panel B: Reduced sample (short-window return; $N = 5{,}847$)							
AR (SW)	0.01	0.08	−0.11	−0.03	0.00	0.05	0.14
RNOA	0.04	0.07	−0.01	0.01	0.03	0.04	0.11
OPM	0.05	0.08	−0.03	0.03	0.05	0.09	0.16
ATO	0.65	0.49	0.19	0.34	0.51	0.83	1.54
URNOA	0.00	0.11	−0.05	−0.01	0.00	0.01	0.04
UOPM	0.00	0.10	−0.08	−0.01	0.00	0.01	0.07
UATO	0.01	0.75	−0.27	−0.05	0.00	0.05	0.23
SUE	−0.08	1.72	−2.63	−0.73	0.02	0.72	2.36
SURG	0.12	1.44	−2.27	−0.82	0.29	1.01	2.28
B/M	0.56	0.49	0.12	0.29	0.46	0.70	1.27
MV	5,080.6	21,088.1	64.5	320.4	939.9	2,830.8	18,097.1

The table presents descriptive statistics for the full sample (Panel A) and reduced sample (Panel B). Variables are defined as follows: *AR(SW)* is the 3-day excess buy-and-hold return around the preliminary earnings announcement date, calculated as the buy-and-hold return on the security minus the average buy-and-hold return on a portfolio of firms with similar size and B/M; *AR(LW)* is excess buy-and-hold return from 1 day before the preliminary earnings announcement until 1 day after the SEC filing; *RNOA* is return on net operating assets, measured as quarterly operating income, divided by net operating assets; *OPM* is core operating profit margin after tax, measured as quarterly core operating income after tax divided by sales; *ATO* denotes asset turnover; measured as quarterly sales divided by net operating assets; *GPM* is gross profit margin after tax, measured as quarterly gross profit after tax divided by sales; *OTPM* is other profit margin, measured as the difference between OPM and GPM; *WCTO* is working capital turnover, measured as quarterly sales divided by working capital; *FATO* is fixed assets turnover, measured as quarterly sales divided by fixed assets; *URNOA, UOPM, UATO, UGPM, UOTPM, UWCTO, UFATO* are unexpected variables, measured as the difference between the current variable and its level in the same quarter last year; *SUE* is standardized unexpected earnings, measured as quarterly earnings per share minus earnings per share in the same quarter last year minus a drift, scaled by the standard deviation of earnings in the prior eight quarters; *SURG* (standardized unexpected revenue) similar to SUE but with sales per share; *B/M* is the book-to-market ratio, measured as book value of common equity at quarter-end divided by market value of common equity; *MV* is market value of common equity at quarter-end (in millions of dollars)

Table 3 Unconditional persistence of RNOA and its components

Variable	Mean	Std. Dev.	5th Pctl.	25th Pctl.	Median	75th Pctl.	95th Pctl.
Panel A: Full sample (long-window return)							
P(URNOA)	0.28	0.18	−0.02	0.16	0.28	0.40	0.56
P(UOPM)	0.25	0.17	−0.04	0.13	0.25	0.37	0.53
P(UATO)	0.38	0.16	0.09	0.28	0.39	0.50	0.62
P(UGPM)	0.27	0.18	−0.02	0.16	0.28	0.40	0.55
P(UOTPM)	0.21	0.17	−0.07	0.08	0.21	0.33	0.48
P(UWCTO)	0.30	0.18	−0.02	0.19	0.31	0.42	0.57
P(UFATO)	0.44	0.16	0.15	0.34	0.46	0.56	0.68
Panel B: Reduced sample (short-window return)							
P(URNOA)	0.32	0.17	0.02	0.21	0.34	0.46	0.59
P(UOPM)	0.30	0.17	0.03	0.18	0.30	0.42	0.58
P(UATO)	0.40	0.17	0.11	0.28	0.41	0.53	0.63

Variable	High B/M	Low B/M	High MV	Low MV
Panel C: Mean persistence for book-to-market (B/M) and size (MV) sub-samples				
P(URNOA)	0.28	0.28	0.30	0.27
P(UOPM)	0.26	0.24	0.26	0.25
P(UATO)	0.38	0.39	0.39	0.37
P(UGPM)	0.28	0.27	0.29	0.26
P(UOTPM)	0.20	0.21	0.22	0.20
P(UWCTO)	0.30	0.30	0.29	0.30
P(UFATO)	0.44	0.45	0.46	0.44

The table presents descriptive statistics for the unconditional persistence, $P(X)$, of unexpected RNOA and its components for the full sample (Panel A), the reduced sample (Panel B) and sub-samples of high and low book-to-market and high and low size (Panel C). Unconditional persistence, $P(X)$, is measured for each firm as the first auto-correlation over the previous eight quarters. High/Low book-to-market (B/M) and High/Low firm size (market value of equity, MV) are defined relative to the quarterly median. See Table 2 for variable definitions

4 Results

4.1 Estimating unconditional persistence

Table 3 provides information on the distribution of unconditional persistence for each of the ratios. Panel A contains information on the main sample, Panel B presents information for the reduced sample, and Panel C provides information for the high and low book-to-market and size sub-samples.

First we examine the unconditional persistence of unexpected return on net operating assets, *P*(URNOA); unexpected operating profit margin, *P*(UOPM); and unexpected asset turnover, *P*(UATO). The unconditional persistence measures of these first-order ratios are larger, at the 0.05 level or better, in the reduced sample than the main sample, probably because the firms in the reduced sample are, on average, larger. We find that *P*(UATO) is larger, at the 0.01 level, than both

P(URNOA) and *P*(UOPM) in the main, reduced, book-to-market sub-samples, and size sub-samples. We also find that *P*(URNOA) is larger than *P*(UOPM), but the difference between them is significant at the 0.01 level only in the main sample.

We further decompose operating profit margin into gross profit margin and other profit margin and measure the unconditional persistence of these variables. We find that the unconditional persistence of unexpected gross profit margin, *P*(UGPM), is larger than that of unexpected other profit margin, *P*(UOTPM), at the 0.01 level, in the main sample and the sub-samples based on book-to-market and size. In addition, we decompose asset turnover into working capital turnover and fixed assets turnover and measure the unconditional persistence of these variables. We find that the unconditional persistence of unexpected fixed assets turnover, *P*(UFATO), is larger than that of unexpected working capital turnover, *P*(UWCTO), at the 0.01 level, in the main sample and the sub-samples based on book-to-market and size.[6]

If we use the results in Table 3 as a basis for predicting the magnitude of the market reaction to ratios, we will falsely expect the market reaction for unexpected asset turnover (UATO) to be stronger than that of unexpected operating profit margin (UOPM). However, unconditional persistence cannot serve as a basis for predicting the market reaction to ratios because it ignores the hierarchical level of each ratio in the decomposition. We argue that the market reaction depends on conditional, not unconditional, persistence, because conditional persistence takes into consideration the hierarchical level of the ratio in the analysis.

Table 4 presents univariate correlations for the unexpected ratios (Panel A) and unconditional persistence measures (Panel B). We present Spearman (Pearson) correlations above (below) the main diagonal for the main sample. Correlations for the reduced sample are similar and thus not tabulated. We compute cross-sectional correlations between unexpected RNOA (URNOA) and the unexpected components (UOPM, UGPM, UOTPM, UATO, UWCTO, and UFATO) each quarter and average these correlations over all quarters.

Focusing on the first-order decomposition of RNOA into OPM and ATO, the average Spearman correlation between URNOA and UOPM is 0.86, larger (at the 0.01 level) than the correlation between URNOA and UATO, which is 0.56. Also, the persistence of URNOA, *P*(URNOA), is more highly correlated with the persistence of UOPM, *P*(UOPM), than with the persistence of UATO, *P*(UATO), (0.75 vs. 0.34, significant at the 0.01 level). These results suggest that movements in URNOA are explained primarily by the firm's ability to generate operating profits from sales and less so by movements in asset turnover.

Turning to the second-order decomposition of OPM into its components (GPM and OTPM), the average Spearman correlation between UOPM and UOTPM is 0.62, larger (at the 0.01 level) than the correlation between UOPM and UGPM, which is 0.56. Also, the persistence of UOPM, *P*(UOPM), is more highly correlated with the persistence of UOTPM, *P*(UOTPM), than with the persistence of UGPM, *P*(UGPM), (0.40 vs. 0.34, larger at the 0.01 level). This suggests that movements in unexpected operating profit margins (UOPM) are more correlated with movements

[6] The unconditional persistence measures are larger for the high market value of equity sub-sample (significant at the 0.05 level for all variables except for P(UOPM) and P(UWCTO)).

Table 4 Univariate correlations (long-window return; 63,721 firm/quarter observations)

		1	2	3	4	5	6	7
Panel A: Unexpected RNOA and its components								
1.	URNOA		0.71	0.39	0.36	0.60	0.01	0.27
2.	UOPM	0.86		0.17	0.50	0.85	0.01	0.22
3.	UATO	0.56	0.28		0.08	0.15	0.05	0.33
4.	UGPM	0.47	0.56	0.11		−0.01	0.00	0.06
5.	UOTPM	0.58	0.62	0.28	−0.13		0.01	0.23
6.	UWCTO	0.26	0.14	0.46	0.09	0.10		0.02
7.	UFATO	0.43	0.31	0.54	0.08	0.34	0.18	
Panel B: Unconditional persistence of unexpected RNOA and its components								
1.	*P*(URNOA)		0.74	0.32	0.25	0.34	0.13	0.22
2.	*P*(UOPM)	0.75		0.13	0.33	0.39	0.07	0.15
3.	*P*(UATO)	0.34	0.14		0.09	0.11	0.33	0.41
4.	*P*(UGPM)	0.27	0.34	0.09		0.24	0.04	0.10
5.	*P*(UOTPM)	0.35	0.40	0.12	0.25		0.06	0.16
6.	*P*(UWCTO)	0.14	0.07	0.35	0.04	0.06		0.13
7.	*P*(UFATO)	0.24	0.16	0.43	0.10	0.17	0.14	

The table presents average quarterly Pearson (above diagonal) and Spearman (below diagonal) correlations for unexpected RNOA (URNOA) and its components (Panel A) and the persistence of URNOA and its components (Panel B). The sample includes all available observations with sufficient accounting and return data for at least 25 quarters. See Table 2 for variable definitions

in unexpected other profit margins (UOTPM), probably because gross margins tend to be less volatile over time than movements in SG&A expenses.

Decomposing ATO into its components (WCTO and FATO) shows that the average Spearman correlation between UATO and UFATO is 0.54, larger (at the 0.01 level) than the correlation between UATO and UWCTO, which is 0.46. Also, the persistence of UATO, *P*(UATO), is more highly correlated with the persistence of UFATO, *P*(UFATO), than with the persistence of UWCTO, *P*(UWCTO), (0.43 vs. 0.35, significant at the 0.01 level). This suggests that movements in unexpected asset turnover (UATO) are more correlated with movements in unexpected fixed assets turnover (UFATO), probably because fixed assets tend to be nonmonetary firm-specific assets with a larger component of fixed cost, while a substantial amount of working capital consists of monetary items (for instance, accounts receivable) that are "less" firm-specific. Also, fixed assets contain a larger component of fixed cost that is less controllable in the short run, while working capital is more controllable in the short run. As a result, changes in unexpected fixed assets turnover tend to reflect a shift in the investing policy of the company and are usually larger in magnitude than unexpected changes in working capital turnover.

4.2 Estimating conditional persistence

Next, we rank the components of RNOA by their conditional persistence. We estimate the association between the persistence of URNOA, *P*(URNOA), and the

persistence of its components, $P(\text{UOPM})$ and $P(\text{UATO})$, by using the following regression equation:

$$P(\text{URNOA})_{it} = \alpha_{0t} + \alpha_{1t}P(\text{UOPM})_{it} + \alpha_{2t}\text{Lag}[P(\text{UOPM})]_{it} + \alpha_{3t}P(\text{UATO})_{it} + \alpha_{4t}\text{Lag}[P(\text{UATO})]_{it} + \varepsilon_{it} \quad (1)$$

The dependent variable in Eq. 1 is $P(\text{URNOA})$. Independent variables include the current and lagged persistence of UOPM and UATO. To obtain a measure of the impact of each independent variable on the dependent variable we multiply the regression coefficient by the corresponding variable mean. This analysis is performed on a quarter-by-quarter basis, and we report regression coefficients and *t*-statistics as in Fama and MacBeth (1973).[7]

As shown in Panel A of Table 5, the coefficients on $P(\text{UOPM})$ and $P(\text{UATO})$ are both positive and significantly different from zero at the 0.01 level. However, the coefficient on $P(\text{UOPM})$ is significantly higher (at the 0.01 level) than that of $P(\text{UATO})$. Moreover, the average coefficient of $P(\text{UOPM})$ multiplied by the mean of $P(\text{UOPM})$ is 0.18, while the average coefficient of $P(\text{UATO})$ multiplied by its mean is 0.09 (the difference is significant at the 0.01 level). Using lagged instead of contemporaneous variables yields similar results. The conclusion from Panel A, Table 5, is that the *conditional* persistence of UOPM is larger than that of UATO, while the *unconditional* persistence of UATO is higher than that of UOPM (as show in Table 3). Thus, the persistence of UOPM is more important in explaining the persistence of URNOA, and hence we predict that changes in UOPM will have a larger impact on excess stock returns than changes in UATO.

We further decompose OPM into two components—gross profit margin and other profit margin—and estimate Eq. 2:

$$P(\text{UOPM})_{it} = \delta_{0t} + \delta_{1t}P(\text{UGPM})_{it} + \delta_{2t}P(\text{UOTPM})_{it} + \phi_{it} \quad (2)$$

The purpose of estimating Eq. 2 is to identify which component of operating profit margin has a larger conditional persistence. As Panel B of Table 5 shows, the persistence of both components is significant at the 0.01 level in explaining the persistence of UOPM. In addition, there is no significant difference between the conditional persistence of UGPM and the conditional persistence of UOTPM (the impact—average coefficient multiplied by the mean variable—is 0.07 for both variables). Based on this result we would expect the market reaction to unexpected gross profit margin (UGPM) to be similar to that of unexpected other profit margin (UOTPM). At first glance this result seems unintuitive, as many would expect unexpected changes in gross profit margin to have higher conditional persistence because other profit often includes transitory items. However, since our analysis focuses on core income, there is no a priori reason to expect the conditional persistence of other profit to be different than gross profit.[8]

[7] We repeated the analysis using firm-by-firm time series regressions. The results are qualitatively the same.

[8] This argument is similar to that raised by Ohlson and Penman (1992), although they argue that absent measurement error, each component of earnings should be valued the same.

Table 5 Conditional persistence of RNOA components

	P(UOPM)	Lag [*P*(UOPM)]	*P*(UATO)	Lag [*P*(UATO)]	Adj-R^2 *N*
Panel A: RNOA components—dependent variable is *P*(URNOA)					
Coefficient	0.71**		0.23**		0.58
t-Statistic	(192.6)		(68.0)		81,049
Coefficient × Mean	0.18**		0.09**		
Coefficient		0.56**		0.20**	0.38
t-Statistic		(138.0)		(52.9)	79,171
Coefficient × Mean		0.14**		0.08**	
Coefficient	0.69**	0.02**	0.20**	0.04**	0.59
t-Statistic	(136.4)	(5.4)	(47.9)	(9.7)	79,171
Coefficient × Mean	0.17**	0.01**	0.08**	0.01**	

	P(UGPM)	*P*(UOTPM)	Adj-R^2 *N*
Panel B: OPM components—dependent variable is *P*(UOPM)			
Coefficient	0.24**	0.32**	0.22
t-Statistic	63.33	34.67	63,721
Coefficient × Mean	0.07**	0.07**	

	P(UWCTO)	*P*(UFATO)	Adj-R^2 *N*
Panel C: ATO components—dependent variable is *P*(UATO)			
Coefficient	0.28**	0.38**	0.25
t-Statistic	39.41	88.38	63,721
Coefficient × Mean	0.08**	0.17**	

The table presents results of estimating the link between the persistence of URNOA and its components (Panel A), the link between the persistence of UOPM and its components (Panel B), and the link between the persistence of UATO and its components (Panel C). It presents mean coefficients, associated *t*-statistics and coefficients multiplied by the value of the variable's mean for the following quarter-by-quarter regressions

Panel A: $P(\text{URNOA})_{it} = \alpha_{0t} + \alpha_{1t}P(\text{UOPM})_{it} + \alpha_{2t}\text{Lag}[P(\text{UOPM})]_{it} + \alpha_{3t}P(\text{UATO})_{it} + \alpha_{4t}\text{Lag}[P(\text{UATO})]_{it} + \varepsilon_{it}$

Panel B: $P(\text{UOPM})_{it} = \delta_{0t} + \delta_{1t}P(\text{UGPM})_{it} + \delta_{2t}P(\text{UOTPM})_{it} + \phi_{it}$

Panel C: $P(\text{UATO})_{it} = \rho_{0t} + \rho_{1t}P(\text{UWCTO})_{it} + \rho_{2t}P(\text{UFATO})_{it} + \eta_{it}$

See Table 2 for definitions of variables

*, ** denote significance at the 0.05 and 0.01 levels, respectively

To complete this analysis, we decompose total asset turnover (ATO) into two components—working capital turnover (UWCTO) and fixed assets turnover (FATO)—and estimate Eq. 3:

$$P(\text{UATO})_{it} = \rho_{0t} + \rho_{1t}P(\text{UWCTO})_{it} + \rho_{2t}P(\text{UFATO})_{it} + \eta_{it} \quad (3)$$

As Panel C of Table 5 shows, the coefficient on *P*(UFATO) is larger than that on *P*(WCTO), and its impact is larger at the 0.01 level. This result suggests that the conditional persistence of FATO is larger than that of WCTO, and hence we expect the market reaction to unexpected changes in fixed assets turnover (UFATO) to be stronger than that to unexpected changes in working capital turnover (UWCTO).

4.3 Market reaction to RNOA and its components

We estimate the market reaction to unexpected RNOA and its first-order (UOPM and UATO) and second-order (UGPM, UOTPM, UWCTO, and UFATO) components using the following firm-by-firm time-series regressions:

$$AR_{it} = \beta_{0t} + \beta_{1t}\text{URNOA}_{it} + \beta_{2t}\text{UOPM}_{it} + \beta_{3t}\text{UATO}_{it} + \beta_{4t}\text{SUE}_{it} + \beta_{5t}\text{SURG}_{it} + \eta_{it} \quad (4)$$

$$AR_{it} = \beta_{0t} + \beta_{1t}\text{UGPM}_{it} + \beta_{2t}\text{UOTPM}_{it} + \beta_{3t}\text{SUE}_{it} + \beta_{4t}\text{SURG}_{it} + \eta_{it} \quad (5)$$

$$AR_{it} = \beta_{0t} + \beta_{1t}\text{UWCTO}_{it} + \beta_{2t}\text{UFATO}_{it} + \beta_{3t}\text{SUE}_{it} + \beta_{4t}\text{SURG}_{it} + \eta_{it} \quad (6)$$

The dependent variable in Eqs. 4–6 is buy-and-hold abnormal returns (AR). We use a short window of three trading days around the preliminary earnings announcement for firm-quarters that disclosed the required information in these announcements and a long window starting from one day prior to the preliminary earnings announcement until one day after the SEC filing. The independent variables include unexpected RNOA and its components; we also include standardized unexpected earnings (SUE) and standardized unexpected revenue (SURG) as control variables.

Table 6 presents the distribution of the firm-by-firm regression coefficients for the main sample (Panel A, Eq. 4), the reduced sample (Panel B, Eq. 4), the second-order decomposition of operating profit margin (Panel C, Eq. 5), and the second-order decomposition of asset turnover (Panel D, Eq. 6). The regressions include companies with at least 25 quarterly observations.

The results in Panels A and B resemble each other, so we will discuss only the results using the main sample results (long return window, 1,878 firms). We present regression results for five specifications, numbered Reg. 1 through Reg. 5. Starting with Reg. 1, the coefficients on SUE and SURG are positive, as expected, consistent with prior studies.[9] Consistent with Soliman (2008), results in Reg. 2 show that the average coefficient on URNOA is positive, as expected, and significant at the 0.01 level (0.39, $t = 7.73$), suggesting that unexpected changes in RNOA explain abnormal returns beyond unexpected earnings and revenues.

Results in Reg. 3 and Reg. 4 show that the average coefficients on the first-order components—UOPM and UATO—are positive, as expected, and significant at the 0.01 level. The economic significance of this result is that the market rewards firms that can convert a larger share of revenues into operating income and firms that are

[9] The average coefficient on SUE is significantly higher (at the 0.01 level) than that on SURG in the long window (Panel A) but the difference between the average coefficients is not significant in the short window.

Table 6 Market reaction to URNOA, UOPM, UATO, and their components

Variable	Mean	*t*-Value	25th Pctl	Med	75th Pctl	Std. Dev.
Panel A: Full sample (long-window return, 1,878 companies)						
Reg. 1						
SUE	7.06	18.59	−2.30	6.67	15.91	16.46
SURG	4.23	11.27	−5.40	3.32	12.53	16.28
Adj-R^2	0.02	12.36	−0.03	0.00	0.05	0.08
Reg. 2						
URNOA	0.39	7.73	−0.46	0.14	1.08	2.19
SUE	5.72	11.72	−5.45	4.66	15.75	21.16
SURG	4.08	10.49	−5.75	3.04	12.50	16.87
Adj-R^2	0.03	12.95	−0.03	0.01	0.07	0.09
Reg. 3						
UOPM	0.17	3.61	−0.32	0.07	0.58	2.04
SUE	6.14	12.27	−5.05	4.93	16.52	21.69
SURG	4.36	11.14	−5.63	3.54	13.03	16.95
Adj-R^2	0.03	14.04	−0.03	0.01	0.07	0.09
Reg. 4						
UATO	0.05	4.67	−0.07	0.03	0.17	0.48
SUE	6.46	16.08	−3.20	6.03	15.87	17.41
SURG	3.77	9.27	−6.39	2.65	12.71	17.61
Adj-R^2	0.02	11.28	−0.04	0.00	0.06	0.09
Reg. 5						
UOPM	0.16	3.36	−0.34	0.07	0.61	2.12
UATO	0.06	5.13	−0.07	0.03	0.19	0.50
SUE	5.68	10.97	−5.69	4.58	16.19	22.45
SURG	3.78	9.08	−6.68	2.91	13.18	18.04
Adj-R^2	0.03	13.30	−0.04	0.01	0.08	0.10
Panel B: Reduced sample (short-window return, 181 companies)						
Reg. 1						
SUE	4.88	4.99	−2.65	3.45	11.73	13.17
SURG	5.09	6.38	−2.50	4.39	11.64	10.72
Adj-R^2	0.03	4.71	−0.03	0.01	0.07	0.09
Reg. 2						
URNOA	0.40	3.22	−0.36	0.18	1.04	1.66
SUE	2.64	2.21	−5.08	3.09	12.08	16.06
SURG	4.79	5.85	−2.58	4.60	11.30	11.01
Adj-R^2	0.04	4.53	−0.04	0.01	0.08	0.11
Reg. 3						
UOPM	0.32	2.96	−0.20	0.14	0.81	1.46
SUE	1.94	1.44	−6.45	2.33	10.06	18.20
SURG	5.01	6.09	−2.15	3.84	11.01	11.06
Adj-R^2	0.04	4.64	−0.04	0.01	0.10	0.12

Table 6 continued

Variable	Mean	*t*-Value	25th Pctl	Med	75th Pctl	Std. Dev.
Reg. 4						
UATO	0.03	1.24	−0.06	−0.00	0.12	0.27
SUE	4.32	4.38	−2.78	4.66	11.52	13.27
SURG	4.64	4.99	−3.24	3.83	11.05	12.51
Adj-R^2	0.03	4.24	−0.04	0.01	0.09	0.11
Reg. 5						
UOPM	0.27	2.36	−0.21	0.07	0.85	1.55
UATO	0.03	1.11	−0.06	0.01	0.10	0.31
SUE	1.90	1.49	−7.07	2.91	10.04	17.11
SURG	4.69	5.07	−2.51	4.09	11.20	12.46
Adj-R^2	0.04	4.30	−0.05	0.02	0.11	0.13
Panel C: OPM components (long-window; 1,524 companies)						
UGPM	0.31	6.13	−0.56	0.22	1.06	1.95
UOTPM	0.25	4.85	−0.51	0.09	0.80	1.98
SUE	5.24	8.55	−4.32	3.11	14.59	23.94
SURG	3.54	7.43	−4.38	2.50	11.25	18.61
Adj-R^2	0.04	13.53	−0.04	0.02	0.09	0.11
Panel D: ATO components (long-window; 1,524 companies)						
UWCTO	0.02	5.66	−0.01	0.00	0.03	0.11
UFATO	0.03	3.86	−0.04	0.01	0.08	0.32
SUE	5.25	11.89	−2.77	3.84	13.43	17.25
SURG	2.98	6.33	−5.56	2.02	10.22	18.39
Adj-R^2	0.03	11.70	−0.04	0.01	0.08	0.11

The table presents distribution of coefficients for firm-by-firm regressions. The model is

Panel A: $AR_{it} = \beta_{0t} + \beta_{1t}\text{URNOA}_{it} + \beta_{2t}\text{UOPM}_{it} + \beta_{3t}\text{UATO}_{it} + \beta_{4t}\text{SUE}_{it} + \beta_{5t}\text{SURG}_{it} + \eta_{it}$

Panel B: $AR_{it} = \beta_{0t} + \beta_{1t}\text{UGPM}_{it} + \beta_{2t}\text{UOTPM}_{it} + \beta_{3t}\text{SUE}_{it} + \beta_{4t}\text{SURG}_{it} + \eta_{it}$

Panel C: $AR_{it} = \beta_{0t} + \beta_{1t}\text{UWCTO}_{it} + \beta_{2t}\text{UFATO}_{it} + \beta_{3t}\text{SUE}_{it} + \beta_{4t}\text{SURG}_{it} + \eta_{it}$

The model is estimated for firms with at least 25 quarterly observations. See Table 2 for definitions of variables

Coefficient estimates of SUE and SURG are multiplied by 1,000

more efficient in utilizing their assets in addition to increases in unexpected earnings and revenues. In addition, the average coefficient on UOPM (0.17, $t = 3.61$) is larger than the average coefficient on UATO (0.05, $t = 4.67$) at the 0.01 level. Results in the last specification, Reg. 5, also confirm that the average coefficient on UOPM is larger than that on UATO at the 0.01 level (0.16, vs. 0.06). These results suggest that the market reaction to unexpected changes in operating profit margin is larger than that to unexpected changes in asset turnover. The results in Panels A and B are consistent with our expectation that, because UOPM is more *conditionally*

persistent than UATO, the market reaction will be stronger for UOPM than for UATO.

In Panel C, we present results for estimating Eq. 5—market reaction to the components of operating profit margin (that is, UGPM and UOTPM). We find that the average component on UGPM (0.31, $t = 6.13$) is larger than the average component on UOTPM (0.25, $t = 4.85$), but the difference between the two is not significant. This result is consistent with our previous finding that the two components are similar in their conditional persistence.

To complete the market reaction analysis, we present the results of estimating Eq. 6 in Panel D. The average coefficient on UFATO (0.03, $t = 3.86$) is larger, at the 0.05 level, than the average coefficient on UWCTO (0.02, $t = 5.66$), which suggests that the market reaction to unexpected changes in fixed assets turnover is stronger than to unexpected changes in working capital turnover. This finding is consistent with our previous finding that the conditional persistence of fixed assets turnover is larger than that of working capital turnover.

Overall, results in Table 6 suggest that after controlling for earnings and revenues surprises, URNOA and its components have a significant incremental effect on abnormal stock returns. Furthermore, the magnitude of the market reaction to each component is associated with its conditional persistence. In particular, the conditional persistence of operating profit margin is larger than that of asset turnover, and hence the market reaction to unexpected changes in operating profit margins is stronger than that to unexpected changes in asset turnover. This holds for the second-order decomposition of profit margin and asset turnover into their components. Since the conditional persistence of gross profit margin and other profit margin were indistinguishable from each other, we expect and find similar magnitudes of market reaction. Finally, since the conditional persistence of fixed assets turnover is larger than that of working capital turnover, we expect and find a stronger market reaction to unexpected changes in fixed assets turnover than to unexpected changes in working capital turnover.

We complement the regression analysis with a portfolio analysis of the interaction between RNOA components. Since the methodology employed here is based on portfolio analysis, we relax the restriction of 25 quarterly observations per firm, so the total number of observation here is higher than in the regression analysis. Specifically, we form variable-sized portfolios of firm-quarters that are both in quintile i of one component and quintile j of a second component and examine whether the market's reaction to each RNOA component depends on the level of the other component.

Table 7, Panel A, presents results for short window returns using *raw ratios*. Results and conclusions are very similar for the long window. For each quarter, we rank all available companies according to OPM and ATO and divide them into quintiles. When companies are in the lowest quintile of OPM and also in the lowest quintile of ATO (OPM1, ATO1), mean abnormal return (AR) is −1.22% during a three-day period around quarterly earnings announcement. In contrast, when companies are in the upper quintile of OPM and in the upper quintile of ATO (OPM5, ATO5), mean AR is 2.37%, a difference of 3.59% (significantly different from zero at the 0.01 level). Furthermore, when OPM is in the upper quintile and ATO is in the lower quintile (OPM5, ATO1), mean AR is 0.75%, compared with a

negative mean AR of −0.97% when ATO is in the upper quintile and OPM is in the lower quintile (OPM1, ATO5). This result suggests that in the case of a tradeoff between OPM and ATO the market prefers OPM. Consistent with this finding, the differences in AR between the upper and the lower quintiles of OPM are positive (significant at the 0.01 level) regardless of the level of ATO. However, conditional on the lower quintile of OPM, the difference in AR between the upper and the lower quintiles of ATO is 0.25% (not significantly different from zero). In contrast, conditional on the upper quintile of OPM, the difference in AR between the upper and the lower quintiles of ATO is 1.62% (significant at the 0.01 level).

Panel B of Table 7 demonstrates the dominance of unexpected operating profit margin (UOPM) over unexpected asset turnover (UATO) as reflected in abnormal stock returns. When UOPM is in its highest quintile and UATO is in its lowest quintile (that is, a positive change in profitability followed by a decrease in assets efficiency), abnormal stock returns are, on average, positive and significant at the 0.01 level. However, when UATO is in its highest quintile and UOPM is in its lowest quintile (that is, a positive change in assets efficiency followed by a decrease in profitability) abnormal returns are, on average, negative (but not significant).

Results in Panels A and B of Table 7 show that the market reacts more strongly to OPM than to ATO. An increase in raw or unexpected OPM leads to an increase in excess returns regardless of the level of raw or unexpected ATO. Moreover, when raw or unexpected OPM is low (high), mean AR is negative (positive) regardless of the level of raw or unexpected ATO. These results imply that the market regards improvements in OPM more positively than improvements in ATO. We conclude that an increase in profitability is more important for the market than an increase in efficiency in utilizing the assets because profitability is more conditionally persistent than an increase in efficiency.

In Panel C of Table 7, we examine the interaction between the second-order components of operating profit margin (GPM and OTPM). Consistent with our previous findings, there is no dominant component. Specifically, excess returns are similar when gross profit margin is high and other profit margin is low (GPM5, OTPM1) and when gross profit margin is low and other profit margin is high (GPM1, OTPM5). The results in this panel are also consistent with our earlier results that gross profit margin and other profit margin were indistinguishable from each other in their conditional persistence.

Panel D of Table 7 presents the interaction between the second-order components of asset turnover (WCTO and FATO). High FATO yields positive excess returns regardless of the level of WCTO, while low FATO yields nonpositive excess returns regardless of the level of WCTO. This result suggests that the market favors increases in fixed assets turnover over increases in working capital turnover. The results in this panel are once again consistent with our earlier results showing that the conditional persistence of fixed assets turnover was larger than that of working capital turnover.

4.4 Analyzing subsequent stock returns

Numerous studies have documented an association between current earnings and revenue surprises on one side and subsequent stock returns on the other side,

Table 7 Interaction between the components of RNOA, OPM, and ATO

	OPM1	OPM5	OPM5—OPM1
Panel A: Raw components of URNOA ($N = 21{,}022$)			
ATO 1	−1.22**	0.75**	1.97**
ATO 5	−0.97**	2.37**	3.34**
ATO5—ATO1	0.25	1.62**	
	UOPM 1	UOPM 5	UOPM5—UOPM1
Panel B: Unexpected components of URNOA ($N = 21{,}022$)			
UATO 1	−1.58**	1.72**	3.30**
UATO 5	−0.78	2.11**	2.89**
UATO5—UATO1	0.80**	0.39	

	Raw data			Unexpected ratios	
	OTPM1	OTPM5		UOTPM1	UOTPM5
Panel C: OPM components ($N = 34{,}417$)					
GPM1	−2.28**	0.49**	UGPM1	−1.86**	0.37**
GPM5	0.37**	1.65	UGPM5	0.27	1.51**
	Raw data			Unexpected ratios	
	WCTO1	WCTO5		UWCTO1	UWCTO5
Panel D: ATO components ($N = 37{,}666$)					
FATO 1	−0.41*	0.19	UFATO 1	−0.82**	−0.42
FATO 5	0.88**	0.84**	UFATO 5	1.01**	1.64**

Panel A presents the market reaction to a combination of OPM and ATO. First, we rank all companies each quarter according to their OPM and ATO and assign them into quintiles. Then, we construct variable-sized portfolios of observations that fall into the extreme quintiles of OPM and ATO. For example, a combination of OPM1/ATO1 includes observations in the lowest quintile of both OPM and ATO. We report average excess returns for a 3-day buy-and-hold window around the preliminary earnings announcement

Panel B presents the market reaction to a combination of UOPM and UATO

Panel C presents the market reaction to a combination of OPM and UOPM components: [GPM, UGPM] and [OTPM, UOTPM]

Panel D presents the market reaction to a combination of ATO and UATO components: [WCTO, UWCTO] and [FATO, UFATO]

The data set includes all available observations (relaxing the restriction of 25 quarterly observations per company)

See Table 2 for definitions of variables

*, ** Denote significance from zero at the 0.05 and 0.01 levels, respectively

suggesting that both earnings and revenue surprises are not fully and immediately reflected in stock prices (Jegadeesh and Livnat 2006, and Kama 2009). In addition, Soliman (2008) shows that subsequent stock returns are associated with current asset turnover (ATO), but not with current return on net operating assets (RNOA) or operating profit margin (OPM), and that current stock returns are associated with

future RNOA and ATO. Penman and Zhang (2006) find that changes in operating profit margins and asset turnover are not associated with stock returns 1 year ahead after controlling for growth in net operating assets.

Following these studies, we augment our analysis by investigating whether investors fully react to URNOA and its components. In addition, we examine whether the post-announcement drift differs across unexpected RNOA components. While higher conditional persistence should lead to a stronger contemporaneous market reaction, we cannot predict whether one component will be associated with a stronger post-announcement drift.

To estimate the association between current ratios and subsequent stock returns, we estimate the following Eqs. 7–9:

$$\begin{aligned}\text{DRIFTAR}_{it} = {} & \gamma_{0t} + \gamma_{1t}\text{URNOA}_{it} + \gamma_{2t}\text{UOPM}_{it} + \gamma_{3t}\text{UATO}_{it} + \gamma_{4t}\text{SUE}_{it} \\ & + \gamma_{5t}\text{SURG}_{it} + \psi_{it} \end{aligned} \tag{7}$$

$$\text{DRIFTAR}_{it} = \gamma_{0t} + \gamma_{1t}\text{UGPM}_{it} + \gamma_{2t}\text{UOTPM}_{it} + \gamma_{3t}\text{SUE}_{it} + \gamma_{4t}\text{SURG}_{it} + \psi_{it} \tag{8}$$

$$\text{DRIFTAR}_{it} = \gamma_{0t} + \gamma_{1t}\text{UWCTO}_{it} + \gamma_{2t}\text{UFATO}_{it} + \gamma_{3t}\text{SUE}_{it} + \gamma_{4t}\text{SURG}_{it} + \psi_{it} \tag{9}$$

The dependent variable in Eqs. 7–9, $DRIFTAR_{it}$, is buy-and-hold post-announcement excess returns for a window of 180 days starting from 2 days after the current SEC filing date.[10] All independent variables are identical to those used earlier. Table 8 presents regression results in a format similar to that used in Table 6.

The first specification in Panel A of Table 8 (Reg. 1) includes only earnings and revenue surprises. Consistent with prior studies, we find a post-announcement drift for both earnings and revenue surprises. The second specification (Reg. 2) shows that URNOA (unexpected return on net operating assets) is associated with subsequent stock returns (at the 0.05 level) after controlling for both earnings and revenue surprises (SUE and SURG). In fact, when URNOA is included in the model, earnings surprises no longer exhibit a drift at the 0.10 level.

In the next two specifications (Reg. 3 and Reg. 4), URNOA is replaced by its first-order components (UOPM and UATO), respectively. According to Reg. 3, UOPM is not associated (at the 0.10 level) with subsequent stock returns. In contrast, UATO is significantly associated (at the 0.01 level) with subsequent stock returns. In fact, SUE and SURG are not associated with subsequent stock returns incrementally to UATO. This last result, which is confirmed by Reg. 5, suggests that the main component driving the post-announcement drift is UATO; the market fails to fully reflect information on unexpected changes in asset turnover.

We decompose operating profit margin into gross profit margin and other profit margin and estimate Eq. 8. The results of this decomposition, which are reported in Panel B of Table 8, show that both UGPM and UOTPM exhibit no association with subsequent stock returns, incrementally to earnings and revenue surprises, as is the case with their parent ratio. Furthermore, we decompose asset turnover into working

[10] We also used a window starting 2 days after the current *SEC* filing date until 1 day after the next preliminary earnings announcement date (if the next preliminary earnings announcement date was unavailable, we used a window of 90 days after the current preliminary announcement date) obtaining very similar results.

Table 8 Post-announcement stock returns to URNOA and its components

Variable	Mean	*t*-value	25th Pctl	Med	75th Pctl	Std. Dev.
Panel A: RNOA components ($N = 73{,}712$; 1,722 companies)						
Reg. 1						
SUE	1.94	2.33	−15.59	2.01	19.20	34.57
SURG	2.73	3.01	−18.92	1.59	24.00	37.55
Adj-R^2	0.02	9.68	−0.03	−0.00	0.04	0.07
Reg. 2						
URNOA	0.27	2.37	−1.33	0.16	1.89	4.79
SUE	−0.38	−0.36	−21.13	0.42	21.90	43.37
SURG	2.70	2.88	−19.33	1.36	24.25	38.96
Adj-R^2	0.03	11.93	−0.04	0.01	0.07	0.09
Reg. 3						
UOPM	−0.15	−1.44	−1.06	0.01	0.97	4.34
SUE	1.74	1.65	−18.38	0.95	23.11	43.67
SURG	2.39	2.52	−19.65	1.59	23.71	39.44
Adj-R^2	0.02	11.58	−0.04	0.01	0.07	0.09
Reg. 4						
UATO	0.13	5.93	−0.18	0.08	0.42	0.93
SUE	−0.02	−0.02	−17.86	−0.48	18.75	35.71
SURG	0.88	0.89	−21.46	0.24	23.44	40.99
Adj-R^2	0.03	13.96	−0.03	0.01	0.08	0.09
Reg. 5						
UOPM	−0.23	−2.21	−1.10	−0.01	0.91	4.29
UATO	0.14	6.16	−0.17	0.08	0.46	0.96
SUE	0.42	0.38	−20.70	−0.14	21.79	45.56
SURG	0.57	0.56	−21.93	−0.20	23.12	42.30
Adj-R^2	0.04	15.13	−0.04	0.02	0.09	0.10
Panel B: OPM components ($N = 57{,}504$; 1,382 companies)						
UGPM	−0.10	−0.84	−1.72	0.02	1.69	4.47
UOTPM	0.03	0.28	−1.47	0.02	1.66	4.52
SUE	−0.34	−0.28	−17.11	−0.36	16.76	45.59
SURG	2.87	2.88	−15.34	0.60	18.48	37.13
Adj-R^2	0.04	12.06	−0.04	0.02	0.08	0.11
Panel C: ATO components ($N = 57{,}504$; 1,382 companies)						
UWCTO	0.04	5.84	−0.02	0.00	0.07	0.27
UFATO	0.05	2.60	−0.12	0.01	0.15	0.66
SUE	−1.86	−2.02	−16.20	−1.01	12.55	34.30
SURG	1.33	1.27	−17.19	0.35	18.49	38.94
Adj-R^2	0.04	12.68	−0.04	0.01	0.09	0.11

The table presents the distribution of coefficients for firm-by-firm regressions. The model is

Panel A: $\text{DRIFTAR}_{it} = \gamma_{0t} + \gamma_{1t}\text{URNOA}_{it} + \gamma_{2t}\text{UOPM}_{it} + \gamma_{3t}\text{UATO}_{it} + \gamma_{4t}\text{SUE}_{it} + \gamma_{5t}\text{SURG}_{it} + \psi_{it}$

Panel B: $\text{DRIFTAR}_{it} = \gamma_{0t} + \gamma_{1t}\text{UGPM}_{it} + \gamma_{2t}\text{UOTPM}_{it} + \gamma_{3t}\text{SUE}_{it} + \gamma_{4t}\text{SURG}_{it} + \psi_{it}$

Panel C: $\text{DRIFTAR}_{it} = \gamma_{0t} + \gamma_{1t}\text{UWCTO}_{it} + \gamma_{2t}\text{UFATO}_{it} + \gamma_{3t}\text{SUE}_{it} + \gamma_{4t}\text{SURG}_{it} + \psi_{it}$

where DRIFTAR denotes post-announcement excess buy-and-hold return for a window of 180 days starting 2 days after the current SEC filing date

The model is estimated for firms with at least 25 quarterly observations. See Table 2 for definitions of variables

Coefficient estimates of SUE and SURG are multiplied by 1,000

capital and fixed assets turnovers and estimate Eq. 9. The results of this decomposition, which are reported in Panel C of Table 8, show that both UWCTO and UFATO exhibit significant (at the 0.01 level) association with subsequent stock returns incrementally to earnings and revenue surprises, as is the case with their parent ratio.

The results in Table 8 are consistent with those in Soliman (2008) in finding a significant association between future abnormal returns and current UATO but not between future returns and current UOPM. We further decompose ATO and OPM into their second order components and find that while those of OPM exhibit no association with future stock returns, those of ATO exhibit significant association with future stock returns after controlling for earnings and revenue surprises.

The similarities between the findings in Soliman (2008) and the findings reported here occur despite differences in research methodologies. Specifically, while Soliman (2008) uses cross-sectional regressions to estimate the association between current ratios and future stock returns, we use firm-by-firm time-series regressions. In addition, Soliman (2008) uses a window of 1 year beginning 4 months after the end of the fiscal year, while we utilize data on SEC filing dates to measure a window of 180 days starting 2 days after SEC filings. Finally, unlike our model, Soliman (2008) does not control for earnings and revenue surprises.[11]

5 Concluding remarks

Financial analysis is about using current accounting information in predicting future residual income. This is often done by decomposing variables into components in a structured manner, as in the DuPont decomposition of return on net operating assets (RNOA). Consequently, the hierarchal level of the variable in the decomposition is important in the analysis and hence in valuation.

This study investigates the role of RNOA and its components in equity valuation. In particular, we examine which RNOA component has a larger impact on excess stock returns and why. Prior studies argue that the usefulness of an accounting variable in explaining stock returns depends on its persistence. The higher the persistence, the larger is the stock market reaction to that item. However, the traditional measure of persistence—the autocorrelation obtained from a variable's time series—may not be comparable across financial variables at different hierarchal levels.

To link persistence with market reaction to accounting variables in the context of a hierarchical system, we introduce a new measure of persistence—conditional persistence—and define it as the marginal contribution of a variable's persistence to the persistence of a variable higher in the hierarchy. We show that the market reaction to a variable depends on its conditional persistence. Specifically, we decompose RNOA into its first-order components—core operating profit margin and

[11] The importance of unexpected changes in asset turnover in predicting stock returns is related to the finding that changes in NOA predict stock returns (Fairfield et al. 2003; Hirshleifer et al. 2004; Penman and Zhang 2006).

net operating asset turnover—and find that ATO is unconditionally more persistent than OPM. We also find that both OPM and ATO are relevant in explaining excess stock returns, but given the higher persistence of ATO, one would expect the market reaction to ATO to be stronger than to OPM. In fact, market reaction to OPM is stronger than to ATO.

Next, we measure the conditional persistence of OPM and ATO and find that OPM contributes more than ATO to the persistence of RNOA, hence OPM is more conditionally persistent than ATO and the market reaction to it should be stronger than that to ATO. Using firm-specific time-series regressions and portfolio analysis, we show that the incremental explanatory power of OPM in explaining contemporaneous stock returns is indeed higher than that of ATO (after controlling for revenue and earnings surprises). We further decompose OPM and ATO into second-order components and show that the market reaction to each component depends on its conditional persistence.

Following prior studies, we also investigate the association between subsequent stock returns and current unexpected RNOA and its components. We find that only ATO and its components are associated with subsequent stock returns. This result suggests that market participants fail to fully react to unexpected changes in asset utilization but not to unexpected changes in profit margins.

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