Profitability Analysis

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March 23, 2022
[***Preliminary***; ***comments are welcome***: dn75@columbia.edu;
current version is available at https://papers.ssrn.com/abstract_id=4064824]

Abstract

This study describes a comprehensive profitability analysis that introduces several novel ratios and decompositions. Key innovations relate to the separation and analysis of activities other than operating and financing, and, most importantly, to the decomposition of operating profitability. Three drivers of operating profitability are analyzed: profit margin, asset turnover, and a funding ratio that measures the proportion of operating assets funded by capital. The empirical analysis demonstrates the informativeness of the various decompositions as well as that of the underlying reformulated financial statements constructed in a companion study (Nissim 2022b).

JEL Classification: G12, G17, G31, G32, M41
Keywords: Profitability; financial statement analysis; DuPont analysis; earnings persistence; special items; recurring earnings; core earnings; earnings quality; free cash flow; forecasting; valuation
Data availability: All data are available from sources identified in the text

* The author gratefully acknowledges the helpful comments and suggestions made by Marc Badia, Matthias Breuer, John Hand, Trevor Harris, Moritz Hiemann, Urooj Khan, Sehwa Kim, Tim Koller, Fernando Penalva, Petya Platikanova, Shivaram Rajgopal, Robert Stoumbos, and seminar participants at Columbia University and IESE.

1. Introduction

Profitability analysis involves decomposing the book rate of return on common equity (*ROCE*) into components representing the contributions of different business activities. This study describes a comprehensive profitability analysis that introduces several novel ratios and decompositions, and it explains the insights that can be obtained from each part of the analysis. The empirical analysis, which utilizes and informs on the reformulated financial statements constructed in a companion study (Nissim 2022b), demonstrates the usefulness of the decompositions.

Key innovations of the profitability decomposition proposed by the study relate to the separation and analysis of activities other than operating and financing and, most importantly, to the decomposition of operating profitability. Unlike common shareholders' profitability, which is universally defined as the ratio of net income attributable to common shareholders to average common equity, operating profitability is measured using alternative metrics. Perhaps the most common measure of operating profitability is return on assets (*ROA*)—operating income divided by average total assets. Another commonly used measure of operating profitability—referred to either as return on net operating assets (*RNOA*) or return on invested capital (*ROIC*)—removes from the denominator of *ROA* nonoperating assets (e.g., excess cash and nonoperating investments) and also subtracts operating liabilities (e.g., accounts payable, accrued expenses, and deferred revenue).[1] A less common approach is to measure the investment in operations (i.e., the denominator of the operating profitability metric) using operating assets, and add to the numerator

[1] As shown below, if all assets and liabilities are either operating or financing, net operating assets is equal to net capital, and return on net operating assets is equal to return on invested capital (*ROIC*). *ROIC* is also referred to as return on capital employed or return on net capital.

an estimate of the cost of operating liabilities; the resulting measure is referred to as return on operating assets or *ROOA* (e.g., Nissim and Penman 2003).

The rationale for the denominator (*RNOA* or *ROIC*) and numerator (*ROOA*) adjustments is that the cost of operating credit reduces reported operating income. When suppliers or other vendors provide credit, they often increase the net price of the goods or services provided, resulting in an increase in the firm's cost of goods sold or operating expenses. For example, when extending credit, a supplier may not offer the same discount that it would otherwise provide, increasing cost of goods sold. Customers that pay in advance of receiving the goods or services are another source of operating credit, with its cost generally reflected in reported revenue (paying cash in advance of receiving the goods or services often yields substantial discounts). Employees provide credit to the company by receiving payments after they provide services (resulting in accrued compensation liabilities) as well as through unfunded pension and other postretirement benefit plans.[2] Several other operating liabilities, such as asset retirement obligations and some restructuring liabilities, are measured at present value with the accretion expense included in operating expenses. Therefore, to obtain a meaningful measure of operating profitability one should either compare operating profit to the net investment in operations (i.e., after subtracting the credit provided by operating creditors) or "undo" the cost of operating credit from reported operating profit.[3]

[2] Until 2017, the interest cost component of pension and other postretirement benefits was included in cost of goods produced (and therefore in COGS and inventory) and in operating expenses. In March 2017 the FASB issued Accounting Standards Update No. 2017-07, which changed the reporting of pension and other postretirement benefits expenses. Under the new standard (effective 2018), only the service cost component of postretirement benefits is included in operating costs and expenses.

[3] Operating credit is also provided by governments, primarily through tax incentives that create deferred tax liabilities. The difference between accelerated tax depreciation and straight-line book depreciation, as well as other temporary book-tax differences that create a net deferred tax liability, are effectively interest free credit from the government. In making investment decisions companies consider this benefit and are willing to accept low profitability projects if the tax benefit is sufficiently large. Thus, for instance, companies with large deferred tax liabilities may have a low ratio of operating profit to operating assets, but they may still be economically profitable because a significant portion of the assets is effectively funded by the government. Therefore, adjusting measures of operating profitability to reflect the tax benefit of deferrals, similar to the adjustments with respect to other operating

Each of the two alternative approaches for adjusting operating profitability measures for the cost of operating credit has its advantages and disadvantages. The primary shortcoming of *RNOA* is that some companies obtain substantial operating credit relative to reported operating assets, which makes net operating assets small or even negative.[4] When net operating assets is small compared to the scale of operations, the impact of any measurement error in the numerator or denominator of *RNOA* is magnified and *RNOA* becomes a "noisy" measure of operating profitability. And when net operating assets is negative, *RNOA* is meaningless.

Unlike *RNOA*, *ROOA* is measured relative to total operating assets, which typically provides a reasonable measure of scale and is never negative. However, *ROOA* suffers from its own shortcomings. Most importantly, measuring *ROOA* requires one to estimate the cost of operating credit, which is at least partially unobservable. In addition, even when measured properly, *ROOA* does not reflect the *net* profitability of operations because the amount of capital invested in operations is smaller than operating assets (the difference is operating credit). In practice, the net approach for measuring operating profitability (*RNOA* or *ROIC*) is more commonly used than the gross approach (*ROOA*), probably due to the unobservability of the cost of most operating liabilities.

The small denominator issue that undermines *RNOA* also affects net operating asset turnover (sales divided by average net operating assets), which together with the operating profit margin (operating profit divided by sales), determines *RNOA*. Thus, when net operating assets is small or negative one cannot meaningfully decompose operating profitability into the effects of

liabilities discusses above (i.e., either subtract it from the denominator or add imputed interest to the numerator), may result in more correct profitability measures.

[4] Koller et al. (2020, Chapter 24) suggest several approaches to mitigating this issue, including capitalizing R&D costs. See also Iqbal et al. (2021), and Sections 2.11.5 and 5.5 in Nissim (2021a).

margin and (net) turnover. Moreover, even when net operating assets is "reasonable," measuring turnover relative to net operating assets is problematic. Sales are generated by operating assets, and whether the assets are funded by operating credit or capital has no direct implications for their sales-generating potential. Accordingly, turnover should be measured relative to operating assets.

This study develops a novel approach for decomposing operating profitability, which incorporates the advantages of both the net and gross approaches. Specifically, turnover is measured relative to operating assets, and a new driver of operating profitability is introduced: the ratio of net operating assets to operating assets. This ratio—referred to as the *Operations Funding Ratio*—measures the proportion of the investment in operating assets that is funded with capital (as opposed to operating credit), and thus provides insight regarding the impact of operating credit on profitability. As will be shown, because it involves only balance sheet information, the *Operations Funding Ratio* is typically highly stable over time and therefore easy to forecast. The three drivers of operating profitability—*Operating Profit Margin*, *Operating Asset turnover*, and *Operations Funding Ratio* (*RNOA = Operating Profit Margin × Operating Asset turnover / Operations Funding Ratio*)—are always meaningful and have robust statistical properties. Thus, these drivers facilitate the analysis and forecasting of operating profitability in essentially all cases.

The empirical analysis starts by describing the distributions of and correlations among the various ratios, to evaluate the significance of the different determinants of shareholders' profitability. To the extent that the ratios differ in their persistence or stability over time, or exhibit cross-correlations or lead-lag relationships, profitability decompositions may help in forecasting profitability. Like prior studies (e.g., Nissim and Penman 2001), the paper documents substantial differences in persistence across the ratios. Unlike prior work, the study also shows that there are large differences in the stability of the ratios over times, and that these differences are not the same

as the differences in persistence. While difficult to demonstrate in a large sample non-contextual analysis, differences in stability across ratios are relevant for forecasting and valuation as they help (1) identify the components that require high attention, (2) decide the weight to assign to past ratios versus other information, and (3) gauge the likely accuracy of the forecasts. Despite the limitations of a non-contextual analysis, the study shows that its innovative approach for decomposing operating profitability, and the method developed in a companion study for estimating transitory items (Nissim 2022b), provide considerable improvement in the accuracy of profitability forecasts. It also provides direct evidence on the two premises underlying the novel decomposition: sales are more strongly related to operating assets than to net operating assets, and operating liabilities are more strongly related to operating assets than to sales.

The paper proceeds as follows. Section 2 describes the motivations for conducting profitability analysis. Section 3 reviews the reformulated financial statements used in calculating profitability ratios. Section 4 explains each step in the profitability analysis and the insights it may provide, except the analysis of operating profitability. Section 5 develops a novel decomposition of operating profitability and compares it to alternative approaches. Section 6 presents the empirical evidence, and Section 7 concludes.

2. Motivations for profitability analysis

Profitability decompositions provide relevant information in several ways.[5] First, the component ratios that interact to generate *ROCE* ***inform on different aspects of profitability and related activities***. For example, some ratios are used to evaluate operating profitability, while others are

[5] Given the important insights that profitability analysis may provide, many text books on financial analysis and valuation devote significant space to describing profitability decompositions and linking them to relative and fundamental valuation models. Examples include Easton et al. (2018), Koller et al. (2020), Lundholm and Sloan (2019), Palepu et al. (2020), and Wahlen et al. (2017).

used to analyze the effects of borrowing. In addition, some components of operating profitability inform on the link between investment and revenue, while others focus on the relationship between revenue and operating profit. Analyzing component ratios of operating profitability is important because they evolve differently over time, and they drive free cash flow. Thus, profitability analysis ***helps in forecasting free cash flow, estimating value, and predicting stock returns*** (e.g., Nissim and Penman 2001, Binz et al. 2022).[6] Similarly, understanding the leverage effect on profitability is critical to ***understanding financial risks and other borrowing effects*** (e.g., Nissim and Penman 2003).

Second, because business activities are reflected in different ways in *ROCE* components, *ROCE* decompositions ***help in understanding and evaluating the underlying activities***. For example, outsourcing of manufacturing increases asset turnover (by reducing the investment in fixed assets) but reduces profit margin (cost of goods sold includes the manufacturer's profit); outsourcing of services may increase profit margin but heighten operating risks and potentially reduce sales growth;[7] "just-in-time inventory" improves asset turnover but may reduce sales growth (e.g., Baños-Caballero et al. 2014); operating credit increases net asset turnover but lowers profit margin (the cost of operating credit is embedded in costs and operating expenses); business combinations increase revenue but reduce asset turnover (acquired intangibles are recognized and tangible assets are marked up); and organic growth increases revenue but reduces profit margin,

[6] In his letter to Berkshire Hathaway Shareholders, included in the 2020 10-K, Warren Buffett explains the importance of evaluating components of operating profitability: "Our leadership in fixed-asset ownership, I should add, does not, in itself, signal an investment triumph. The best results occur at companies that require minimal assets to conduct high-margin businesses – and offer goods or services that will expand their sales volume with only minor needs for additional capital. We, in fact, own a few of these exceptional businesses, but they are relatively small and, at best, grow slowly."

[7] Outsourcing of services may also have offsetting effects within components of the profit margin. For example, it may reduce SG&A expenses but also reduce the gross margin due to a reduction in overall customer experience and pricing power.

at least in the short-term (e.g., Fairfield et al. 2002). Therefore, examining the levels of and changes in profitability ratios is useful for understanding management's decisions and the company's success in implementing the decisions. Moreover, comparing the ratios to those of other firms in the industry (e.g., Schröder and Yim 2018, Jackson et al. 2018), and evaluating the ratios in the context of the company's business environment (e.g., Selling and Stickney 1989), ***helps in assessing the likelihood of success of alternative strategies***. For example, the extent to which a firm is subject to competition or capacity constraints affects its ability to improve profitability by increasing profit margin via product differentiation strategies, or by increasing asset turnover via cost leadership strategies.

Third, the decomposition of operating profitability ***informs on operating risks***. Each of the three main components of operating profitability analyzed in this study capture an important risk dimension. Operating profit margin is an important determinant of the degree of operating leverage (i.e., the sensitivity of the percentage change in operating profit to a given percentage change in sales), and asset turnover is correlated with operating leverage (the proportion of fixed cost), the other determinant of the degree of operating leverage (Li et al. 2014). In addition, the operations funding ratio (i.e., the proportion of operating assets funded by capital) is negatively related to the firm's power over its operating counterparts, which is an important determinant of operating flexibility (e.g., Nissim and Penman 2003).

Fourth, the firm's profile—as reflected in the levels of and trends in its financial ratios—helps in ***evaluating the average life-cycle stage*** of the company's products as well as its ***growth prospects*** (e.g., Klepper 1996, Dickinson 2011). For example, as firms progress through the growth stage, their operating margin, asset turnover and financial leverage all tend to increase. Relatedly, profitability analysis applied at the aggregate level provides insight relevant for forecasting real

economic activity (Konchitchki and Patatoukas 2014), essentially by ***informing on the economy's stage in the business cycle***. Similarly, aggregating profitability ratios at the industry level helps in ***understanding the stage of the industry's life cycle and the industry's characteristics***. For example, industries with significant operating leverage and high entry barriers tend to have low asset turnover and high profit margin, while industries with low capital intensity and commodity-like products tend to have high asset turnover and low profit margin (e.g., Selling and Stickney 1989).

Fifth, *ROCE* decomposition helps in ***predicting profitability and evaluating its sustainability*** (e.g., Fairfield and Yohn 2001, Esplin et al. 2014). This follows because the different *ROCE* components vary in their persistence and cross-correlations. For example, "special items" are less persistent than other income statement items (e.g., Dechow and Ge 2006); operating profitability is more persistent than the financial leverage effect (e.g., Nissim and Penman 2001); asset turnover is more persistent than profit margin (e.g., Soliman 2008, Amir at al. 2011); negative special items predict earnings increases (e.g., Burgstahler et al. 2002, Cready et al. 2012) but lower profit margin for high profitability firms (e.g., Fairfield at el. 2009); and increases in operating liabilities (debt) are often associated with subsequent increases (decreases) in operating profitability (e.g., Nissim and Penman 2003, Chen at al. 2019). Evaluating the persistence or sustainability of earnings is at the core of earnings quality analysis, and it is relevant for both relative and fundamental valuation as well as for various risk-related analyses (e.g., when evaluating debt capacity). In addition, some patterns of and relationships among component ratios are indicative of earnings management (e.g., Jansen et al., 2012).[8]

[8] Profitability analysis may inform on earnings management or earnings quality for additional reasons (see Section 2.8 in Nissim 2021a). For example, executives of firms with deteriorating operating profitability may have stronger than average incentives to overstate earnings (e.g., Donelson et al. 2021). Profitability decomposition may also

Finally, ***in many cases ratios higher in the hierarchy are problematic or even meaningless, while component ratios still provide useful information***. For example, if common equity is negative, *ROCE* cannot be interpreted but profit margin and asset turnover are still informative. This is an important benefit of profitability decompositions, as negative book values are quite common and are due to different reasons, including substantial share repurchases by successful companies. As another example, some companies obtain more operating credit than they invest in operating assets, resulting in negative net operating assets and thus inability to measure the rate of return earned in operations. In such cases, component ratios of operating profitability (e.g., profit margin) are still meaningful.

3. Reformulated financial statements

Conducting informative profitability and valuation analyses requires reformulating the financial statements to separate operating activities—the core of value creation—from financing and other nonoperating activities. It also requires distinguishing between recurring and transitory items in the income statement. Nissim (2022b) provides a step-by-step explanation of the reformulation process, and it describes how the reformulated financial statements can be measured using Compustat data items. The analysis in this paper uses the reformulated financial statements constructed in Nissim (2022b). The following is a short description.

Reformulating the balance sheet involves classifying assets and liabilities as either operating, financing, or other nonoperating, as shown in Exhibit A. Appendix A lists the items comprising the different categories.

inform on the source of earnings sustainability—persistent profitability versus additional investments—which is another aspect of earnings quality (e.g., Estridge et al. 2009).

Exhibit A. Reformulated Balance Sheet

	Operating assets		Operating liabilities
+	Financial assets	+	Debt
+	Other nonoperating assets	+	Other nonoperating liabilities
			Total liabilities
		+	Equity
	Total assets		Total liabilities and equity

The reformulated balance sheet can also be presented in a net format, derived by subtracting financial assets, operating liabilities, and other nonoperating liabilities from both sides of the balance sheet:

Exhibit B. Reformulated Balance Sheet (net presentation)

	Operating assets		Debt
-	Operating liabilities	-	Financial assets
	Net operating assets		Net debt
+	Net other nonoperating assets	+	Equity
	Net assets funded by net capital		Net capital

Net operating assets—that is, the difference between operating assets and operating liabilities—measures the amount of net capital invested in operations. Net capital is also used to fund investments in net other nonoperating assets (i.e., other nonoperating assets, such as equity method investments, minus other nonoperating liabilities, such as reserves for unusual litigation). Net capital is also referred to as invested capital or capital employed.

Like the reformulated balance sheet, the reformulated income statement distinguishes between operating, financing, and other nonoperating items. However, unlike the balance sheet, another layer of analysis is required. Because recurring earnings have greater impact on value than transitory items, and they help predict future profits, it is important to identify and separate out transitory components before classifying items by the nature of activity. Once transitory items are

separated out, the classification is (mostly) straightforward. Revenue generated in operations is classified as operating, while income earned on financial assets (e.g., interest income on long-term marketable securities) is classified as financing, and income earned from other nonoperating activities (e.g., equity method income) is classified as other nonoperating. Similarly, expenses representing consumption of operating assets (e.g., depreciation of fixed assets or cost of inventory sold) or incurrence of operating liabilities (e.g., accrued expenses) are classified as operating, while interest on debt is classified as financing. Income taxes are allocated to transitory, operating, financing, and other nonoperating activities based on the related income and tax rates. Exhibit C presents the reformulated income statement and Appendix B lists the items comprising each category.

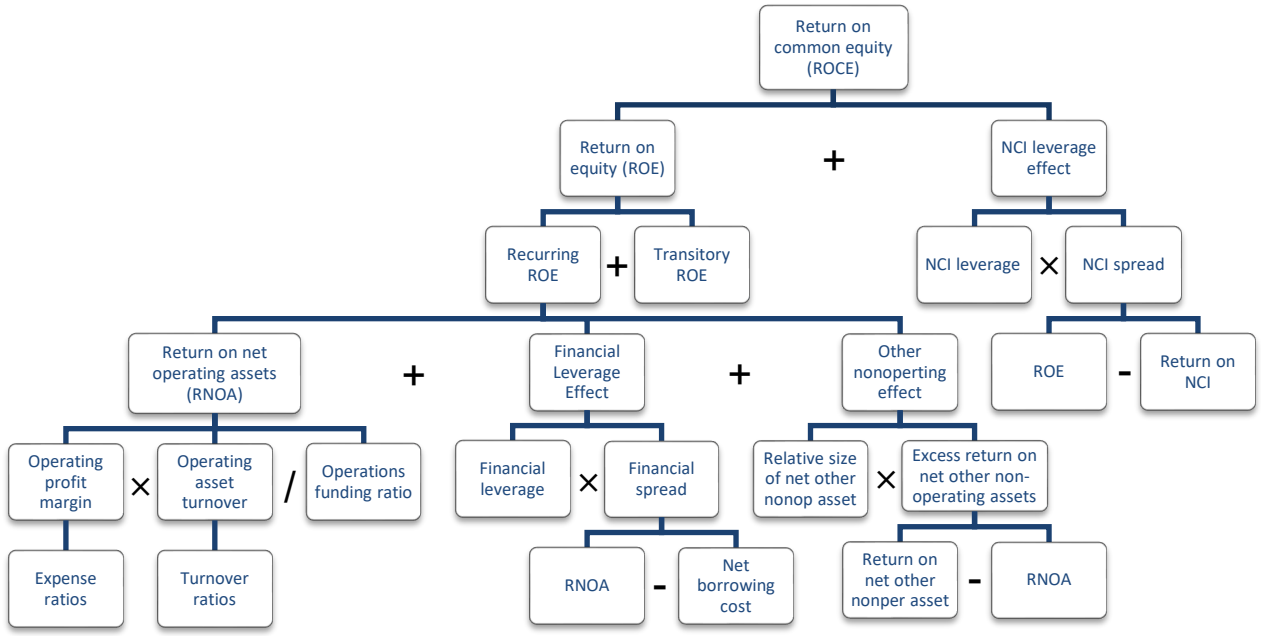
Exhibit C. Reformulated Income Statement

	Operating revenue
-	Operating expenses (COGS, recurring operating expenses, tax)
	Net Operating Profit After Tax (NOPAT)
-	Net Financial Expense (NFE)
+	Income from other nonoperating activities
	Recurring income
+	Transitory income
	Net income after preferred dividend
-	Net income attributable to noncontrolling interest
	Net income attributable to common equity

4. Profitability decomposition

Given the reformulated balance sheet and income statement, conducting profitability analysis is straightforward. Exhibit D presents the profitability ratios and the relationships among them.

Exhibit D. Profitability Analysis



The key ratios in this decomposition are defined as follows:

Ratio	Reform. balance sheet		Reformulated Income Statement
Operating asset turnover	Operating assets	⇦	Operating revenue
			Operating expenses (COGS, SG&A, tax)
RNOA	Net operating assets	⇦	Net operating profit after tax (NOPAT)
Net borrowing costs	Net debt	⇦	Net financial expense (NFE)
Return on net other nonoper. assets	Net other nonop. assets	⇦	Earnings from net other nonoperating assets
Recurring ROE	Total equity	⇦	Recurring income
Transitory ROE	Total equity	⇦	Transitory income
Return on equity (ROE)	Total equity	⇦	Net income after preferred dividend
Return on noncontrolling interest	Noncontrolling interests	⇦	Net income attributable to noncon. interest
Return on common equity	Common equity	⇦	Net income attributable to common equity

The starting point when evaluating profitability is the return on common equity:[9]

$$ROCE = \frac{Net\ income\ attributable\ to\ common\ equity}{Average\ common\ equity}$$

[9] Theoretically, if there are no incremental investments during the year, profitability ratios should be measured relative to the beginning-of-period investment that generated the profits, not relative to the average balance. To see why, consider a $100 investment in a savings account made at the beginning of the year. Assuming a 10% interest rate, at the end of the year the balance in the account is $110. The rate of return is 10/100, not 10/110 or 10/105. But what if additional investments or withdrawals are made during the year? For example, what would be the impact on the profitability measure if another $100 is deposited in the savings account at the middle of the year? If profitability

ROCE measures the return from all activities (recurring and transitory; operating, financing, and other nonoperating) per dollar of common equity investment. Profitability analysis decomposes *ROCE* into components representing the contributions of the different business activities. Subsection 4.1 distinguishes between the profitability of common equity and that of noncontrolling interests, while Subsection 4.2 decomposes *ROE* into recurring and transitory components. Subsection 4.3 describes the components of recurring profitability. Subsections 4.4 and 4.5 elaborate on two of the components of recurring profitability: the financial leverage effect, and the impact of other nonoperating activities. The analysis of the core component of recurring profitability—operating activities—is provided in a separate section, Section 5.

4.1 Profitability of common equity versus noncontrolling interests

As explained in Nissim (2022b), equity consists of common equity and noncontrolling interests (in the reformulated balance sheet temporary equity and preferred stock are included in debt). Accordingly, the dollar return earned on total equity is divided between common equity and non-controlling interests (NCI). To the extent that the profitability of NCI (*RONCI*) is different from that of common equity, return on common equity (*ROCE*) will be different from return on equity (*ROE*). This is often the case because NCI represents ownership in partially owned subsidiaries, while common equity represents interests in the parent company and all its subsidiaries. The extent to which *ROCE* differs from *ROE* in any given year (*NCI Leverage Effect*) depends on the significance of NCI relative to common equity (*NCI Leverage*) and the difference in profitability between that of overall equity (*ROE*) and the noncontrolling interests (*RONCI*). Specifically,

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is measured using the beginning of year balance, the rate of return is 15% (=15/100). In this case, a more correct calculation would be to use the average of the beginning and end of year balances, which gives a rate of return of 9.5% (=15/([100+215]/2)). That is, using the average balance effectively assumes that changes in the investment occur at the middle of the year. Because firms often add or withdraw capital or assets during the period, profitability ratios should generally be measured relative to the average balance of the investment during the year.

$$NCI\ Leverage\ Effect = ROCE - ROE = NCI\ Leverage \times NCI\ Spread$$

Where

$$ROE = \frac{Net\ income\ after\ preferred\ dividends}{Average\ equity}$$

$$NCI\ Leverage = \frac{Average\ NCI}{Average\ common\ equity}$$

$$NCI\ Spread = ROE - RONCI$$

And

$$RONCI = \frac{Noncontrolling\ interest\ in\ income}{Average\ noncontrolling\ interests}$$

For most companies, NCI is relatively small or nonexistent, so *ROCE* is close to or equal to *ROE*. However, for some companies NCI is significant (e.g., Nissim 2021b). In such cases, it is important to understand the impact of NCI on *ROCE*. The above analysis provides relevant insight by evaluating the significance of NCI and the extent to which it earns a different return than that on overall equity.

4.2 Recurring versus Transitory ROE

When evaluating profitability, it is important to distinguish recurring profitability from transitory effects, both because recurring earnings have greater impact on value than transitory items and they help predict future profits. Accordingly, *ROE* should be decomposed as follows:

$$ROE = Recurring\ ROE + Transitory\ ROE$$

Where

$$Recurring\ ROE = \frac{Recurring\ income}{Average\ equity}$$

$$Transitory\ ROE = \frac{Transitory\ income}{Average\ equity}$$

Recurring ROE is a summary measure of recurring profitability from all business activities. It is measured by excluding from net income after preferred dividends (the numerator of *ROE*) items that are deemed transitory. *Transitory ROE* measures the impact of transitory items on shareholders' profitability. Perhaps the most difficult part of profitability analysis is identifying and measuring transitory items. Nissim (2022b) develops an algorithm for measuring transitory income, which is used in the empirical analysis below.

4.3 Decomposition of Recurring ROE

The next step in the profitability analysis is to decompose *Recurring ROE* into the effects of operating, financing, and other nonoperating activities:

$$Recurring\ ROE = RNOA + Financial\ Leverage\ Effect + Other\ Nonoperating\ Effect$$

Where *RNOA* measures the rate of return earned in operations; *Financial Leverage Effect* measures the impact of financing activities on shareholders' profitability (i.e., the additional return to shareholders from earning a spread on borrowed funds); and *Other Nonoperating Effect* measures the impact on shareholders' profitability of investments other than operating or financing (e.g., equity method investments, real estate not used in operations). I next define the last two components, and then discuss *RNOA* in a separate section.

4.4 Financial Leverage Effect

The *Financial Leverage Effect* is calculated as follows:

$$Financial\ Leverage\ Effect = Financial\ Leverage \times Financial\ Spread$$

Where

$$Financial\ Leverage = \frac{Average\ net\ debt}{Average\ equity}$$

$$Financial\ Spread = RNOA - Net\ Borrowing\ Cost$$

$$Net\ Borrowing\ Cost = \frac{Net\ financial\ expense}{Average\ net\ debt}$$

Financial Leverage measures the amount of net borrowing per dollar of equity; *Net Borrowing Cost* measures the after-tax cost of each dollar borrowed (net of amounts invested in financial assets); and *Financial Spread* measures the additional return that accrues to shareholders per dollar of borrowing.

The decomposition of the financial leverage effect informs on the trade-off between risk and return that financial leverage entails. Shareholders earn the difference between *RNOA* and *Net Borrowing Cost* (i.e., *Financial Spread*) on each dollar of debt, but they also absorb the volatility of the excess return, as lenders generally receive a constant return independent of the profitability of operations. In other words, holding net operating assets constant, leverage reduces the amount of equity but does not reduce the variability of net income (because debtholders' claims are fixed), thereby by increasing the volatility of *ROE*. Moreover, when *RNOA* is lower than *Net Borrowing Cost*, leverage has a negative effect on shareholders' profitability. *RNOA* is typically higher than *Net Borrowing Cost*, leading to a positive leverage effect on shareholders' profitability. However, this does not necessarily imply that leverage adds value because of its impact on volatility and the related negative effects.[10] Evaluating the components of the financial leverage effect—including the amount of leverage, the cost of borrowing, and the spread—shed light on the benefits and costs of leverage, as explained next.

[10] In his letter to Berkshire Hathaway Shareholders, included in the 2018 10-K, Warren Buffett notes: "We use debt sparingly. Many managers, it should be noted, will disagree with this policy, arguing that significant debt juices the returns for equity owners. And these more venturesome CEOs will be right most of the time. At rare and unpredictable intervals, however, credit vanishes and debt becomes financially fatal. A Russian-roulette equation – usually win, occasionally die – may make financial sense for someone who gets a piece of a company's upside but does not share in its downside. But that strategy would be madness for Berkshire. Rational people don't risk what they have and need for what they don't have and don't need."

The costs of leverage

- ***Increased volatility of shareholders profitability*** by a factor equal to the *Financial Leverage*. For example, if *Financial Leverage* is equal to 2 (i.e., two dollars of net debt per dollar of equity), shareholders' profitability is 200% more volatile than *RNOA*. Importantly, this effect applies to both systematic and idiosyncratic volatility.[11]
- ***Increased probability of bankruptcy and related costs***. *Financial Leverage* measures the relative magnitude of claims that the firm is required to repay (debt). Therefore, high financial leverage indicates that a relatively small equity cushion is available to absorb losses, which in turn implies high solvency risk. Bankruptcy results in significant costs (e.g., lawyer fees) as well as losses from distressed asset sales and low exit values of intangible assets (e.g., assembled work force).
- ***Refinancing risk***. High-debt firms are dependent on capital markets for continued refinancing and so are more sensitive to changes in interest rates, credit spreads, or funds availability.
- ***Lower growth***. Because debt capacity is constrained, high-debt firms have limited ability to borrow additional funds when growth opportunities arise. Moreover, lack of financial flexibility may lead to contraction when the firm is faced with negative operating shocks. In addition, "debt overhang" may cause managers to forgo profitable projects that require new capital if that capital inflow primarily benefits existing debtholders by making their claims less risky (e.g., Lang et al. 1996).

[11] When evaluating systematic risk or when measuring WACC, leverage is typically calculated using market rather than book values. However, for evaluating the volatility of book rates of return, leverage should be measured using book values. Book value leverage is relevant also because (1) most contracts that use leverage ratios (e.g., debt covenants) measure leverage using book values; (2) the difference between the market and book values of equity reflects primarily intangible assets, which typically have little value in bankruptcy; and (3) book leverage may help in estimating future market leverage ratios because it is less volatile than market leverage, which may be temporarily low or high due to price fluctuations.

- ***Lower operating profitability***. High leverage may deter current and potential suppliers, employees, customers, or other operating counterparts from transacting with the firm, or it may induce them to demand better terms to the detriment of the firm, especially at times of industry downturns (e.g., Opler and Titman 1994, Cen et al. 2018).
- ***Lower credit ratings*** and higher *Net Borrowing Costs*. Financial leverage is a primary factor considered by credit rating agencies (lenders) in determining credit ratings (credit spreads).
- ***Agency costs between owners and debtholders***. Managers may take actions that destroy overall firm value but increase shareholders' value (the "wealth redistribution" hypothesis). For example, managers/shareholders may take on high risk projects ("asset substitution" hypothesis) or increase dividend payout. Debtholders anticipate and price this possibility.
- ***Personal tax costs***. The corporate tax benefits of interest deductibility are generally reflected in the *Financial Spread* (lower aftertax *Net Borrowing Cost*), but the personal tax disadvantage of debt relative to equity financing is not captured by the profitability ratios. For many investors, the tax rate on interest income is substantially higher than the effective tax rate on dividend income and capital gains (including the benefits of deferral and cost basis step-up in death). High leverage implies that a large percentage of the firm's overall return is subject to a relatively high personal tax rate.

In addition to the costs of leverage discussed above, financial leverage may inform on operating profitability (negative relationship) because the generation of internal funds in operations (i.e., operating profitability) leads to lower net debt and higher equity (e.g., Fama and French 2002).

<u>The benefits of leverage</u>

- ***The debt tax shield*** (e.g., Kemsley and Nissim 2002). Interest expense is generally deductible in the firm's tax return, but dividends cannot be deducted. The corporate tax benefits of

leverage are related to the amount of leverage, the level and stability of operating profitability, the cost of borrowing, and other factors.

- ***Larger size***. Borrowing allows firms to increase the size of operations and obtain the related benefits (e.g., economies of scale and scope, diversification). While firms may also be able to increase their size by issuing equity, the costs of equity financing may be excessive (e.g., dilution, information asymmetry, issuance costs, issuance at time of depressed market valuation).
- ***Lower agency costs between management and owners***. Having to service debt and the monitoring activities of debtholders make management more discipline and less likely to waste cash flows (the "free cash flow" or overinvestment hypothesis). In addition, debt increases managers relative ownership in the company and thus better align their interests with those of other shareholders (corporate control benefits).
- ***Higher average profitability***. Given that *RNOA* typically exceeds *Net Borrowing Cost*, leverage increases measures of shareholders' profitability (*ROE*, EPS), which may lead to higher valuation if the associated increase in risk is not fully priced.

4.5 Other nonoperating effect

This effect is calculated as follows:

$$\begin{aligned} &Other\ Nonoperating\ Effect \\ &\quad = Relative\ Size\ of\ Net\ Other\ Nonoperating\ Assets \\ &\quad \times Excess\ Return\ on\ Net\ Other\ Nonoperating\ Assets \end{aligned}$$

Where

$$Relative\ Size\ of\ Net\ Other\ Nonoperating\ Assets = \frac{Average\ net\ other\ nonoperating\ assets}{Average\ equity}$$

$$Excess\ Return\ on\ Net\ Other\ Nonoperating\ Assets = Return\ on\ Net\ Other\ Nonoperating\ Assets - RNOA$$

$$Return\ on\ Net\ Other\ Nonoperating\ Assets = \frac{Income\ from\ other\ nonoperating\ activities}{Average\ net\ other\ nonoperating\ assets}$$

Return on Net Other Nonoperating Assets measures the profitability of activities other than operating or financing. For example, if net other nonoperating assets consists solely of equity method investments, then *Return on Net Other Nonoperating Assets* = equity method income / average equity method investments.

5. Analysis of operating profitability

Measuring operating profitability (*RNOA*) for a given period involves comparing net operating profit after tax (NOPAT) to the net investment in operations that generated it:

$$RNOA = \frac{Net\ operating\ profit\ after\ tax\ (NOPAT)}{Average\ net\ operating\ assets}$$

Where NOPAT is calculated by removing transitory, financing, and other nonoperating items from net income (including the related income taxes), as described in Nissim (2022b). Accordingly, *RNOA* is a summary measure of recurring profitability from operating activities.

RNOA is measured relative to net operating assets (i.e., operating assets minus operating liabilities), rather than relative to operating assets, because NOPAT is the dollar return from operations after deducting the cost of operating credit, which is included in operating expenses (see Section 1). For example, suppliers and other vendors often charge higher prices (or do not offer discounts) when they extend credit, resulting in higher cost of sales and SG&A expenses. Moreover, some operating liabilities are reported discounted, with the interest cost included in operating expenses (e.g., the accretion expense on asset retirement obligations). In other words,

operating creditors have no claim on NOPAT; NOPAT measures the dollar return on net operating assets, which in turn flows or accrues to shareholders and debtholders.

RNOA is generally less volatile than *Recurring ROE*. Unlike *Recurring ROE*, *RNOA* is not directly affected by financial leverage as it excludes the impact of financial activities. As explained in Section 4.4 above, financial leverage magnifies the impact of operating shocks on shareholders' profitability by reducing the amount of equity (the denominator of *Recurring ROE*) without reducing the variability of recurring income (the numerator of *Recurring ROE*). That is, compared to *RNOA*, *Recurring ROE* has the same variability of the numerator (recurring income versus NOPAT), spread over a smaller denominator (equity versus net operating assets). Financial leverage does not affect the variability of recurring income since debt holders' claims on NOPAT are fixed (after-tax interest expense).

5.1 The standard decomposition of operating profitability

To obtain insights into the drivers of operating profitability, *RNOA* can be decomposed into margin and turnover, which are defined as follows:[12]

$$Operating\ Profit\ Margin = \frac{Net\ operating\ profit\ after\ tax\ (NOPAT)}{Operating\ revenue}$$

$$Net\ Operating\ Assets\ Turnover = \frac{Operating\ revenue}{Average\ net\ operating\ assets}$$

Multiplying the two drivers together yields *RNOA*:

$$RNOA = Operating\ Profit\ Margin \times Net\ Operating\ Assets\ Turnover$$

This disaggregation of *RNOA* is useful because, as discussed below, business strategies and activities are reflected in different ways in profit margin and net asset turnover. *Net Operating*

[12] This decomposition is different from the traditional DuPont decomposition which does not distinguish between operating and financing activities but rather measures profitability and turnover relative to total assets.

Asset turnover measures the average amount of sales generated per each dollar invested in operations, while *Operating Profit Margin* gages the portion of each dollar of sales that flows or accrues to the providers of capital.

Net Operating Asset Turnover should generally be less volatile and more persistent over time than the profit margin. This follows because, percentagewise, changes in income are more volatile than changes in sales due to (1) fixed costs, which reduce earnings without offsetting the variability in revenue (i.e., the impact of operating leverage), and (2) the inclusion of volatile expenses, gains, and losses in earnings. Excluding transitory items from NOPAT increases the persistence of profit margin and so reduces the difference in persistence between profit margin and asset turnover. In addition, as discussed below, when net operating assets is relatively small, *Net Operating Asset Turnover* is quite volatile. Still, in most cases, net asset turnover is more persistent than profit margin (e.g., Nissim and Penman 2001).

Determinants of profit margin and net asset turnover

One benefit from decomposing *RNOA* into *Operating Profit Margin* and *Net Operating Asset Turnover* is that it helps in understanding and evaluating operating activities and accounting effects. This follows because the two *RNOA* components are affected differently by these factors. For example, a high or improving profit margin may reflect or indicate:

- ***Efficiency in controlling costs*** or other activities that may reduce costs (e.g., outsourcing of services).
- ***Product differentiation***, branding, or other activities that allow companies to charge high markups.

- Same period ***decreases in discretionary spending*** such as R&D expenditures, brand-development activities, or other economic investments that are expensed as incurred (e.g., Baber et al. 1991).
- ***Accounting choices and estimates that reduce current expenses*** (e.g., Jansen et al. 2012). Examples include excess capitalization of expenditures, understated provisions for bad debt and warranty, and some accounting choices (e.g., operating instead of finance leases). (In contrast, accounting choices and estimates that accelerate revenue recognition may or may not increase the margin, depending on the incremental expenses.)
- ***Past impairment, restructuring or other accounting charges***, which reduce current depreciation or other operating expenses (e.g., Burgstahler et al. 2002, Fairfield et al. 2009, Cready et al. 2012).
- ***Low or reduced reliance on operating credit***, whose cost is typically implicit in cost of revenue and operating expenses.
- ***Low operating risk***. Operating profit margin is an important determinant of the degree of operating leverage (i.e., the sensitivity of the percentage change in operating profit to a given percentage change in sales), with high margins implying lower sensitivity to negative shocks (Li et al. 2014).

In contrast, a high or improving net asset turnover may reflect:

- ***Efficiency in utilizing assets***, including activities that allow companies to reduce investments in operating assets, such as outsourcing of manufacturing, factoring or sale of receivables, just-in-time inventory, and reliance on lines of credit instead of holding cash.
- ***Economies of scale*** (i.e., focusing on sales volume).

- ***Accounting choices and estimates that accelerated expense recognition***, resulting in understated net assets (e.g., Barton and Simko 2002, Richardson et al. 2005). Examples include overstated impairment charges (e.g., as part of a "big bath"), understated useful lives or salvage value of PP&E, and some accounting choices (e.g., accelerated instead of straight-line depreciation, LIFO instead of FIFO).
- ***Organic instead of acquired growth.*** Business combinations tend to reduce turnover due to the recognition of intangible asset and the mark-up of tangible assets, while organic growth reduces margins due to the expensing of internal costs.
- ***Operating credit***, which reduces the net investment in operations.
- ***Low operating risk***. Asset turnover generally decreases with asset tangibility, which in turn is correlated with operating leverage (i.e., the proportion of fixed costs; Li et al. 2014).

The joint distribution of profit margin and turnover

Considering the levels of and changes in *both* profit margin and net asset turnover can be particularly informative (e.g., Selling and Stickney 1989, Fairfield and Yohn 2001, Estridge et al. 2009, Dickinson 2011, Jansen et al. 2012). There is a strong trade-off between profit margin and net asset turnover—firms with relatively high net asset turnover usually have low profit margin, and high profit margin firms tend to have low net asset turnover (e.g., Nissim and Penman 2001). Similarly, strategy-driven, long-term changes in profit margin and net asset turnover are often negatively correlated. For example, product differentiation efforts lead to a higher profit margin but lower turnover, and outsourcing of production increases net asset turnover but reduces margin. In contrast, short-term changes in net asset turnover and profit margins are typically positively correlated. For example, an increase in the demand for the firm's products leads to an increase in

both net asset turnover and profit margin, and investments reduce both net asset turnover and profit margin, at least in the short-term.

An increase in the demand for a firm's products leads to increases in price per unit and/or quantity sold, and therefore to increases in sales revenue and net asset turnover. In addition, profit margin—which is equal to one minus the ratio of cost per unit to price per unit—increases due to a price increase and/or to a reduction in cost per unit that results from spreading fixed costs on a larger number of units. This latter effect is particularly strong for firms with high proportion of fixed costs (i.e., high operating leverage). For negative demand shocks, the reduction in profit margin is exacerbated by cost stickiness (Anderson et al. 2003).

Investments reduce net asset turnover and profit margin for the following reasons. Net asset turnover declines because there is typically a substantial gap between investments (which increase assets) and the resulting sales revenue (Fairfield et al. 2003). In addition, assets of acquired businesses are initially reported at fair value (including intangible assets), resulting in a lower revenue-to-assets ratio compared to the pre-acquisition ratio. Profit margin decreases because some investments—such as hiring, training, R&D, advertising—are expensed prior to the recognition of related revenues (e.g., Baber et al. 1991).

The levels of and changes in profit margin and net asset turnover may also inform on the likelihood of success of different business activities (Selling and Stickney 1989, Dickinson 2011). The notion of flexibility in trading off profit margin and net asset turnover is important when a firm considers strategic alternatives (e.g., product differentiation versus cost leadership). To increase *RNOA* by X percentage points, *Operating Profit Margin* or *Net Operating Asset Turnover* (or a combination of the two) should be increased by that percentage points. Thus, when *Operating Profit Margin* (*Net Operating Asset Turnover*) is relatively high, increasing *RNOA* by increasing

Operating Profit Margin (*Net Operating Asset Turnover*) requires a relatively large change. Moreover, when *Operating Profit Margin* or *Net Operating Asset Turnover* are relatively high, further increasing them becomes difficult. Therefore, when *Net Operating Asset Turnover* (*Operating Profit Margin*) is relatively high, companies are more likely to be able to increase *RNOA* by taking actions that increase *Operating Profit Margin* (*Net Operating Asset Turnover*).

Finally, changes in net asset turnover and profit margin can also be used to identify earnings management (Jansen et al 2012). For example, accruals management related to operating expenses affects operating income and net operating assets in the same direction, and thus causes turnover and margin to move in opposite directions. For example, for a given level of sales, if a firm manages earnings upward by understating the bad debt expense, both operating income relative to sales and the net realizable value of accounts receivable relative to sales will be overstated. The increase in operating income relative to sales will lead to an increase in margin, while the increase in net accounts receivable relative to sales will lead to a decrease in turnover.

Firm-specific effects

Some changes in profit margin and net asset turnover are due to events that are not under the company's control. For example, changes in the demand for the firm's products or its costs may be due to fluctuations in economy-wide factors (e.g., GDP, inflation, commodities, foreign exchange, employment), industry effects, or other factors relevant to the environment in which the company operates (see Section 4.10 in Nissim 2021a). Thus, to obtain insight into the company's activities it is important to evaluate changes in profit margin and net asset turnover relative to (i.e., controlling for) macro and industry effects, for example by comparing changes in the company's ratios with those for its peers.

5.2 An alternative decomposition of operating profitability

The above decomposition of *RNOA* has several shortcomings. When *Net Operating Assets* is small, *Net Operating Asset Turnover* is "noisy," and when *Net Operating Assets* is negative, *Net Operating Asset Turnover* is meaningless. In addition, *Net Operating Asset Turnover* is based on an inaccurate rationale, because sales are generated by all operating assets, not just by the portion funded by capital (which is equal to net operating assets). Thus, a more informative turnover ratio is:

$$Operating\ Assets\ Turnover = \frac{Operating\ revenue}{Average\ operating\ assets}$$

To relate this turnover measure to *RNOA*, I define

$$Operations\ Funding\ Ratio = \frac{Average\ net\ operating\ assets}{Average\ operating\ assets}$$

This latter ratio measures the proportion of operating assets that is funded by the providers of capital (equity and debt holders). Because net operating assets is equal to operating assets minus operating liabilities, a low *Operations Funding Ratio* indicates that a high proportion of operating assets is funded by operating creditors (accounts payable, deferred revenue, accrued expenses, other working capital liabilities, deferred taxes, and other long-term operating liabilities). Accordingly, a low *Operations Funding Ratio* (i.e., relatively large operating liabilities) may reflect or indicate:

- ***Market power***. Bargaining power over suppliers, employees, customers, and other operating creditors may enable the firm to fund much of its operations using operating credit.
- ***Financial stability***. Operating creditors (e.g., suppliers and customers), which often have superior information about the firm, are not likely to extend substantial credit to companies in financial difficulties.

- ***Earnings increases***. A low ratio may be due to overstated estimated liabilities that are likely to reverse (thereby increasing earnings), such as restructuring charges, deferred revenues, and warranty reserves (e.g., Nissim and Penman 2003).
- ***Little or no M&A***. M&A activities substantially increase operating assets (intangibles are recognized and tangible assets are market to fair value), while the marking-to-market effect on operating liabilities is typically small.

Note that

$$Net\ Operating\ Assets\ Turnover = \frac{Operating\ Assets\ Turnover}{Operations\ Funding\ Ratio}$$

And so

$$RNOA = \frac{Operating\ Profit\ Margin \times Operating\ Assets\ Turnover}{Operations\ Funding\ Ratio}$$

Unlike *RNOA* and *Net Operating Assets Turnover*—which are meaningless when net operating assets is negative and noisy when net operating assets is small—all three ratios in the above *RNOA* decomposition are always meaningful and have robust statistical properties.

6. Empirical analysis

6.1 Sample and data

I start with the Compustat North America Fundamental Annual file and select all observations with consolidated data (CONSOL = "C"), industry format (INDFMJ = "INDL"), standardized data format (DATAFMJ = "STD"), domestic company (POPSRC = "D;" including U.S., Canada, and ADR), and USD currency (CURCD = "USD"). I then obtain and merge data on pension and other postretirement benefits from the Compustat Pension Annual file, and data on operating lease assets and obligations from the Compustat Snapshot Annual file. I supplement the operating lease data

with information from XBRL files (https://www.sec.gov/dera/data/financial-statement-and-notes-data-set.html).[13]

I identify industry membership using MSCI's Global Industry Classification (GIC). I then exclude financial firms (GIC sector 40) utilities (GIC sector 55) and REITs (GIG sector 60 since 2017, previously included in GIC 40).[14] I next construct the reformulated financial statement as described in Nissim (2022b), and I measure the ratios as described in Sections 4 and 5 and summarized in Appendix C of this paper. Finally, I apply the following filters:

- I delete observations with fiscal years outside the 20 years 2001 through 2020. (Like Compustat, I assign observations to fiscal year *t* if the fiscal year ended between June/*t* and May/*t*+1.) I delete pre-2001 observations because detailed information on special items, which is used in measuring transitory income, is consistently available only starting 2001 (see Nissim 2022d).[15] I delete post 2020 observations because full year coverage for 2021 is not yet available, and the companies for which 2021 data are available do not constitute a random sample.[16]

[13] Starting 2019 (ASC 842), public companies report the present value of future operating lease payments as a liability, and Compustat includes it in their debt variables (DLC and DLTT). For reasons explained in Nissim (2022b), I classify this liability as operating and therefore undo Compustat's adjustment. Unfortunately, the Compustat Fundamental Annual file does not provide the operating lease liability. However, it is available (with a significant delay, unlike the Fundamental Annual file) in the Compustat Snapshot Annual file (data items OLNPV or LLC+LLLT). Due to the data delay, I obtain recent values of the obligation from XBRL files.

[14] Financial firms are excluded because for these firms operating and financing activities are intertwined, and financing activities are essential for value creation. Utilities are excluded because rate regulation affects the time-series of profitability ratios (e.g., a negative profitability shock may enable regulated utilities to charge higher rates and thus increase subsequent profitability).

[15] In addition, lease commitment information, which is needed for the measurement of operating assets, is fully available on Compustat only starting 2000 (see Nissim 2022c). Also, combined statutory tax rates, which are used in the measurement of transitory, financial, and other nonoperating items, are available from the OECD starting 2000 (see Nissim 2022a).

[16] Fiscal year end varies across industries, and both SEC filing requirements and the pace of data collection by Computstat are affected by the firm's size.

- I delete observations relating to small firms (annual revenue less than 100 million USD in December 2020 prices), because the distributions of financial ratios are often poorly behaved for these firms.[17]

Starting the sample period in 2001 implies that there is no overlap with the samples used in Nissim and Penman (2001, 2003), which is an advantage because some of the analyses in this study are related to those in the Nissim and Penman studies.

6.2 Distribution statistics

Table 1 provides summary statistics for the ratios described in Sections 4 and 5, and Table 2 presents time-series means (over the twenty years, 2001-2020) of cross-sectional correlation coefficients (Spearman above the diagonal, Pearson below). In Table 1, the statistics are presented in seven panels, corresponding to the decompositions in Exhibit D. To facilitate meaningful comparisons across the variables, in each panel only observations with non-missing values for all the variables in that panel are used.

Panel A of Table 1 presents statistics for *ROCE* and its two components: *ROE* and *NCI Leverage Effect*. The distributions of *ROCE* and *ROE* are almost identical, and the two profitability measures have very high correlation (Table 2) as most companies have little if any NCI equity.[18] Still, for some observations *NCI Leverage Effect* is quite significant (Panel B of Table 1), due to either substantial *NCI Leverage* or large *NCI Spread*. The significant dispersion in the distribution

[17] To further mitigate the effects of outliers, I identify and trim extreme values of ratio variables using the following procedure. For each variable, I calculate the 5th and 95th percentiles of the empirical distribution (P5 and P95 respectively) and trim observations outside the following range: P5 – 1 × (P95 – P5) to P95 + 1 × (P95 – P5). For normally distributed variables, this range covers approximately 5 standard deviations from the mean in each direction (= 1.65 + 1 × (1.65 – (-1.65)), which includes more than 99.99% of the observations. However, for poorly behaved variables a relatively large proportion of the observations is deleted.

[18] These statistics understate the economic significance of NCI for three reasons. Nissim (2021b) shows that (1) the relative magnitude of NCI is strongly correlated with size, and (2) the relative frequency of NCI has increased substantially over time. The equal-weight pooled statistics in Table 1 do not reflect these effects. In addition, in many countries NCI are much more significant compared to the U.S.

of *NCI Spread* indicates that for many firms the profitability of NCI is very different from that of common equity. This is due to differences between the profitability of partially owned subsidiaries (as reflected in *RONCI*) and that of the parent and its fully owned subsidiaries (*ROE* reflects the profitability of the parent and all subsidiaries).

Panel C of Table 1 presents statistics for the recurring and transitory components of *ROE*. *Transitory ROE* has a mean and median that are both close to zero, and its distribution is quite symmetric. These distributional characteristics are different from those of special items, which have negative mean and negative skewness (e.g., Dechow and Ge 2006); they are due to the "smoothing" approach used in measuring transitory items (see Nissim 2022b). Importantly, excluding transitory items significantly reduces the dispersion of profitability across firms and over time (the standard deviation of *Recurring ROE* is 21.5% compared to 24.1% for *ROE*). It also significantly reduces the negative skewness of profitability—for *Recurring ROE* the difference between the mean and median is substantially smaller than it is for *ROE*. The significant reduction in the dispersion and skewness of *Recurring ROE* compared to *ROE* suggests that the algorithm developed in Nissim (2022b) to estimate transitory items performs well. I conduct more direct tests below.

Statistics for the decomposition of *Recurring ROE* are presented in Panel D of Table 1. The distribution of *RNOA* is less dispersed and more symmetric than that of *Recurring ROE*. Yet *Recurring ROE* is driven primarily by *RNOA*—it has a much stronger correlation with *RNOA* (Pearson .74, Spearman .91; Table 2) than it has with either of its other two components, *Financial Leverage Effect* (Pearson .47, Spearman .42) and *Other Nonoperating Effect* (Pearson .09, Spearman .12). Still, the standard deviation of *Financial Leverage Effect* is not negligible relative to that of *RNOA* (12.3% compared to 17.2%, respectively), indicating that financial leverage has

large (positive or negative) effect on shareholder profitability for many firm-year observations. In contrast, *Other Nonoperating Effect* is small both on average and in the cross section (mean .1%, standard deviation 1.2%).

The distribution statistics for the drivers of *RNOA* (Panel E of Table 1), and the correlation coefficients between the drivers and *RNOA* (Table 2), suggest that each of the three drivers of operating profitability—*Operating Profit Margin*, *Operating Asset Turnover*, and *Operations Funding Ratio*—has significant effect on operating profitability. They each exhibit substantial variability and have the expected directional Pearson and Spearman correlations with *RNOA*. Still, the cross-sectional correlations between RNOA and its drivers are substantially larger for *Operating Profit Margin* compared to *Operating Asset Turnover* and *Operations Funding Ratio*; the time-series mean cross-section Pearson (Spearman) correlation is .70 (.79) for *Operating Profit Margin*, compared to .18 (.25) for *Operating Asset Turnover* and -.08 (-.13) for *Operations Funding Ratio*. In addition, the correlations among the three drivers are consistent with expectations—profit margin is negatively correlated with asset turnover (e.g., Nissim and Penman 2001) and positively correlated with the operations funding ratio (operating liabilities reduce the operations funding ratio, and their cost reduces the profit margin; Nissim and Penman 2003).[19]

Operating liabilities are on average very significant; for the average (median) firm, net capital funds 63.9% (67.4%) of operating assets, with operating liabilities funding the rest (recall that *Operations Funding Ratio* measures the proportion of operating assets funded by net capital). However, this effect varies significantly across firms, with standard deviation (inter-quartile range) of 16.8% (21.4% = 76.1%-54.7%). Given that *RNOA* is inversely proportional to the *Operations*

[19] Note that there is no overlap with the samples used in Nissim and Penman (2001 and 2003), so the above statistics provide evidence of out-of-sample validity.

Funding Ratio, these statistics imply that increasing *Operations Funding Ratio* by one standard deviation from its mean would reduce mean *RNOA* from 8.2% to 6.5% (=[.639/(.639+.168)]×.082). These statistics highlight the importance of evaluating the effect of operating credit on operating profitability, which is a novel aspect of the profitability decomposition developed in this study.

Panel F presents statistics for the decomposition of *Financial Leverage Effect*. At the center of the distribution, *Financial Leverage* is quite significant (mean of .529, median of .308). In addition, for most firms *Net Borrowing Cost* is significantly lower than *RNOA*, resulting in substantial *Financial Spread* (mean 4.2%, median 3.7%). Yet, for the median firm, *Financial Leverage Effect* is close to zero (-.1%), and it is significantly negative on average (-1.2%). The reason for this apparent contradiction becomes clear when considering the correlation coefficients among the ratios. As shown in Table 2, there is a strong negative correlation between *Financial Leverage* and *Financial Spread* (Pearson -.16, Spearman -.28). *Financial Leverage* is low or even negative for companies with high profitability and low cost of borrowing, and it is large for companies with low or negative *Financial Spread*. This result is consistent with the pecking order theory of capital structure and is well documented in the literature (e.g., Fama and French 2002).

The final panel of Table 1 (Panel G) presents statistics for the decomposition of *Other Nonoperating Effect*. Net other nonoperating assets that can be identified using Compustat data include equity method investments, assets of discontinued operations, and net-of-tax pension and OPB assets and liabilities (Nissim 2022b). Many firms either do not report these items or report relatively small amounts. Accordingly, *Other Nonoperating Effect* is zero or close to zero for most observations (see Panel D). Moreover, even for firms that report these items (Panel G), the effect on *Recurring ROE* is small (mean .15%, standard deviation 1.5%). Therefore, in the remaining

sections I provide limited analysis of this decomposition as well as that of common versus NCI equity (for the same reason—relatively small effect on *ROCE* for most firms).

6.3 Incremental information

As noted earlier, a primary motivation for conducting profitability analysis is to help in forecasting future profitability (e.g., Fairfield and Yohn 2001). To the extent that different *ROCE* components vary in their persistence or volatility over time, one may obtain more precise forecasts of *ROCE* by generating separate forecasts for the drivers of *ROCE* and then combine them to build an *ROCE* forecast (e.g., Esplin et al. 2014). Prior studies have focused on the persistence of profitability ratios and evaluated it using either (1) the slope coefficient from a cross-sectional regression of the ratio on its lagged value (e.g., Fama and French 2000); or (2) the time-series patterns of average profitability ratios calculated for portfolios sorted based on the values of the ratios in a base year (e.g., Nissim and Penman 2001). However, another characteristic of the time-series behavior of profitability ratios that affects their forecasting ability is volatility over time, as explained next.

Consider the following time-series model:

$$y_{t+1} = \alpha + \beta \times y_t + \varepsilon_{t+1}$$

where y is a component of shareholders profitability (e.g., *RNOA*) and β is its persistence coefficient. Unlike β, the variance of ε does not affect the expected value of predicted profitability, but it does affect the accuracy of the forecast. Information about the absolute and relative accuracy of forecasts of profitability components is particularly relevant in contextual settings where additional information besides the past behavior of profitability ratios is incorporated in the analysis. In essence, the volatility of the ratio over time affects the weight given to its past values relative to other information in predicting future values. Therefore, when evaluating the

information content of profitability components about future profitability, it is important to examine their time-series volatility in addition to their persistence.

In the empirical analysis that follows, I evaluate both determinants of the predictability of profitability components. Specifically, in Table 3 I examine the persistence coefficients from regressions of profitability ratios in future years $t + j$, for $j = 1, 2, \ldots 7$, on their value in year t. In Table 4, I evaluate the stability of the profitability ratios by examining the distributions of their coefficient of variation. I calculate each coefficient of variation by dividing the firm-specific standard deviation of the profitability ratio over the last seven years by the absolute value of the mean over the last seven years (a minimum of five non-missing values is required). For ratios that tend to be stable over time, the pooled distribution (across firms and years) of the coefficient of variation should have low mean and low median. In contrast, for ratios that tend to be volatile over time, the mean and median should be relatively high.

Consistent with prior studies, Table 3 shows considerable differences in persistence across the profitability ratios. In general, ratios that are based only on balance sheet numbers (*NCI Leverage*, *Operations Funding Ratio*, *Financial Leverage*, and *Relative Size of Net Other Nonoperating Assets*) are more persistent than other ratios, consistent with the stock (as opposed to flow) nature of these measures (e.g., Lemmon et al. 2008). Another expected result is the significant initial persistence of most profitability ratios (the coefficient relating profitability in year $t + 1$ to profitability in year t), which is followed by a gradual decline as j increases.[20]

[20] Numerous studies (e.g., Freeman et al. 1982, Fama and French 2000, Nissim and Penman 2001) provide evidence on the partial persistence and mean-reversion tendency of profitability ratios. The mean reversion is due to both economic forces (competition, more "normal" profitability of new investments, sales volatility, transitory items, operating and financing leverage, cost stickiness, and real options) and accounting effects (fair value accounting, conservatism, and "big bath" charges). See Section 2.8.4 in Nissim (2021a) for a comprehensive discussion.

The potential contribution of profitability analysis to the prediction of future profitability is clear in several of the decompositions. *Transitory ROE* has very little persistence, and *Recurring ROE* is substantially more persistent than overall *ROE* (Panel C). The very low persistence of *Transitory ROE* and the higher persistence of *Recurring ROE* compared to *ROE* indicate that the algorithm developed in Nissim (2022b) to estimate transitory items performs well. In addition, *Operating Profit Margin* is substantially less persistent than the other two component ratios of operating profitability, *Operating Asset Turnover* and *Operations Funding Ratio* (Panel E). As expected, *RNOA* is more persistent than *Financial Leverage Effect* and *Other Nonoperating Effect*; however, it is not more persistent than *Recurring ROE*.

The distribution statistics for the coefficients of variation, presented in Table 4, are mostly consistent with the persistence coefficients. There are several significant exceptions, however. First, unlike the persistence coefficients in Table 3, Panel D of Table 4 shows that *RNOA* is substantially less volatile over time than *Recurring ROE*. Thus, although on average *RNOA* and *Recurring ROE* have similar persistence (Panel D of Table 3), one may extrapolate from past *RNOA* with greater confidence than from *Recurring ROE* or its other components (*Financial Leverage Effect* and *Other Nonoperating Effect*). Another important difference between the persistence and variability results relate to the decomposition of operating profitability. The *Operations Funding Ratio* has, by far, the lowest levels of time-series variation. Yet, its persistence coefficients (Panel E of Table 3) are smaller than those of *Operating Asset Turnover*.

The results of Tables 3 and 4 suggest that profitability decompositions may help improve the forecasts of ratios higher in the hierarchy, as component ratios vary in their persistence and stability over time. Table 5 evaluates this conjecture, focusing on the persistence effect.[21]

[21] While evaluating the persistence effect on the forecast accuracy of ratios higher in the hierarchy is relatively straightforward (discussed below), demonstrating the variability effect using non-contextual analysis is difficult.

Specifically, it reports results of regressing profitability ratios on lag values of components from their decomposition. If a decomposition adds information, the component ratios should have significantly different coefficients. This can occur either because the component ratios have different persistence (as reported in Table 3), or if one component is correlated with the next year value of another component.[22] Conversely, a correlation structure may offset the effect of differential persistence, resulting in insignificant differences across the coefficients and implying that the decomposition does not help in forecasting.

Panel A of Table 5 reports the times-series means and HAC t-statistics of coefficients estimated using cross-sectional (annual) regressions of the following model:

$$ROE_{t+j} = \beta_0 + \beta_1 Recurring\ ROE_t + \beta_2 Transitory\ ROE_t + \varepsilon$$

For j = 1, 3, 5, and 7. If decomposing *ROE* into recurring and transitory components provides useful information for predicting *ROE* (because of differential persistence or a correlation structure), then the difference between the two coefficients should be significant. Indeed, the regression estimates in Panel A of Table 5 demonstrate that the coefficient of *Recurring ROE* is positive and highly significant in each of the four regressions, while that on *Transitory ROE* is insignificantly different from zero in three of the four regressions. In addition, the difference between the two coefficients is large and highly significant in each of the four regressions. These results suggest that *Transitory ROE* provides little if any information about future *ROE* incremental to *Recurring ROE*, and thus show that the algorithm developed in Nissim (2022b) to estimate transitory items performs well.

However, as discussed in the conclusion section, information on the differential variability of component ratios is relevant for contextual forecasting and valuation.

[22] Amir et al. (2011) refers to this effect as a determinant of "conditional persistence."

Panel B of Table 5 reports the results one level down in the hierarchy, focusing on the decomposition of *Recurring ROE*. As expected, the *RNOA* coefficient is significantly higher than the coefficient on *Financial Leverage Effect* in each of the four regressions. Strangely, the coefficient on *Other Nonoperating Effect* is larger than the other two coefficients, although the differences are statistically insignificant after $j = 1$. Considering the very low standard deviation of *Other Nonoperating Effect* (Panel D of Table 1), and the high standard errors of its estimated coefficient (as indicated by the low t-statistics in Panel B of Table 5), this result is not noteworthy.

Evaluating the incremental information in the decomposition of *RNOA* is more difficult due to the non-additive nature of this decomposition. To address this issue, I apply the natural log function to $RNOA_{t+j}$ and to the three component ratios, *Operating Profit Margin*$_t$, *Operating Asset Turnover*$_t$, and *Operations Funding Ratio*$_t$. To make the results easier to interpret, I use the negative of the log *Operations Funding Ratio*. These transformations convert the decomposition of *RNOA* into an additive one. Panel C of Table 5 reports the results. The coefficients on all component ratios are positive and highly significant in each of the four regressions. However, the coefficient on *Operating Profit Margin* is significantly smaller than the other two, consistent with its lower persistence (see Table 3). Interestingly, the coefficient on *Operations Funding Ratio* is significantly larger—both economically and statistically—than that of *Operating Asset Turnover*, despite the higher persistence of turnover (see Table 3). This result is consistent with the positive correlation between operating liabilities leverage and future operating profitability documented by Nissim and Penman (2003).

6.4 Evaluating Out-of-sample Predictions

The results in Table 5 suggest that the three decompositions examined here—recurring verses transitory, operating versus nonoperating, and profit margin versus asset turnover and funding—

provide useful information for predicting future profitability. However, these in-sample findings may not apply out of sample due to estimation error or instability of the coefficients. Therefore, I next compare out-of-sample forecasts generated using the models of Table 5, which use component ratios, with models that include only their total. Each year I estimate the models using all firm-year observations in the five years period that ended in that year, and I apply the estimated coefficients to the current values of the ratios to generate forecasts of future profitability. These forecasts are then used to calculate forecast errors, which in turn are compared across the forecasting models.

Table 6 compares the mean squared errors of the forecasting models. Decomposing *ROE* into recurring and transitory components provides a substantial improvement in the accuracy of out-of-sample forecasts of *ROE* (Panel A). Similarly, decomposing operating profitability into margin, turnover, and funding ratios provides considerable improvement (Panel C). However, while the decomposition of *Recurring ROE* provides statistically significant improvement (Panel B), the magnitude of the improvement is small (less than one percentage point). This later result is likely due to the relatively small difference in persistence between *RNOA* and *Financial leverage Effect* (Table 3). For reasons discussed in the conclusion section, the forecasts generated here understate the usefulness of profitability decompositions in contextual analyses. Still, even in the simple, non-contextual analysis conducted here, profitability decompositions provide useful information for forecasting.

6.5 Evaluating the assumptions underlying the decomposition of operating profitability

Section 5 motivates the proposed decomposition of operating profitability on three grounds: (1) the decomposition is feasible and informative even when net operating assets is negative; (2) sales are likely to be more strongly related to operating assets than to net operating assets; and (3)

operating liabilities are likely to be more strongly related to operating assets than to sales. The first advantage is straightforward. While only 2.2% of the observations that satisfy the sample selection criteria have negative net operating assets, the proportion increases to 10% when the size threshold is removed. I next evaluate the other two premises.

Table 7 reports the mean absolute percentage error when estimating sales based on operating assets (that is, as the product of operating assets and the mean ratio of sales to operating assets). It also reports the mean absolute percentage error when estimating sales based on net operating assets, and it compares the two metrics. The mean ratios of sales to operating assets and to net operating assets are calculated using either firms from the industry-year (first row) or using the time-series of the firm (second row). The percentage error is calculated as the ratio of the difference between actual and estimated sales to actual sales. To evaluate the improvement from using operating assets instead of net operating assets, I compare the corresponding mean absolute percentage errors. As shown in Table 7, the improvement is statistically and economically significant, both when evaluating the relationship within industry-year or over time for each firm. Figure 1 visualizes the improvement. Panel A (Panel B) of Figure 1 presents density curves for percentage errors derived using the industry-year (firm-specific) analysis. A tight distribution around zero implies that most errors are small, which in turn implies a strong relationship between sales and operating assets (or sales and net operating assets). In both panels the error distribution associated with operating assets has a much tighter distribution around zero compared to that associated with net operating assets.

I next turn to evaluating the third motivation for the decomposition—namely, that operating liabilities are more strongly related to operating assets than to sales. Table 8 reports the mean absolute sales-deflated error when estimating operating liabilities based on operating assets

(that is, as the product of operating assets and the mean ratio of operating liabilities to operating assets). It also reports the mean absolute percentage error when estimating operating liabilities based on sales (that is, as the product of sales and the mean ratio of operating liabilities to sales), and it compares the two metrics. The mean ratios of operating liabilities to operating assets and to sales are calculated using either firms from the industry-year (first row) or using the time-series of the firm (second row). The deflated error is the ratio of the difference between actual and estimated operating liabilities to sales. As shown, the improvement from using operating assets instead of sales to estimate operating liabilities is statistically and economically significant, both when evaluating the relationship within industry-year and over time for each firm. Panels A and B of Figure 2, which present density curves for the sales-deflated errors, visually demonstrate the improvement.

7. Conclusion

This study suggests several modifications to the specification and implementation of profitability analysis. While some parts of the revised analysis are relevant only for a subset of firms (e.g., the analysis of noncontrolling interests or of equity method investments), two innovations are relevant for most firms: the method used to distinguish between recurring and transitory items (which is developed in Nissim 2022b and tested here), and the decomposition of operating profitability.

Removing transitory items from shareholders profitability (*ROE*) reduces the dispersion and skewness of the resulting profitability measure (*Recurring ROE*). In addition, *Recurring ROE* is substantially more persistent and less volatile than *ROE*, and decomposing *ROE* into its recurring and transitory components yields significant improvement in out-of-sample forecasts of *ROE*.

Finally, *Transitory ROE* provides little if any information about future *ROE* incremental to *Recurring ROE*.

The study also describes a new approach for decomposing operating profitability. Like the standard operating profitability decomposition, the method suggested here distinguishes between profit margin and turnover. However, unlike the standard approach, turnover is measured relative to operating assets, and a new driver is introduced: net operating assets (i.e., operating assets minus operating liabilities) divided by operating assets. The empirical analysis shows that this ratio is remarkably stable over time, implying that when forecasting balance sheets one should first predict operating assets (generally based on revenue forecasts) and then predict operating liabilities in relation to operating assets. Indeed, decomposing operating profitability into the three drivers results in substantial improvement in forecasting accuracy. In addition, the study provides direct evidence on the two premises underlying the decomposition: sales are more strongly related to operating assets than to net operating assets, and operating liabilities are more strongly related to operating assets than to sales.

While the empirical analysis demonstrates the usefulness of profitability decompositions for predicting future profitability, it likely understates their usefulness in contextual implementations. For one reason, it uses linear regressions, while more sophisticated statistical analysis or machine learning methods may yield larger improvements (e.g., Binz et al. 2022). Secondly, as Bernard and Stober (1989) noted: "it is possible that the links between detailed earnings components and valuation are so highly contextual that no parsimonious model would ever capture more than a small portion of the story" (p. 648). When implementing valuation, analysts incorporate additional information besides past ratios. To the extent that such information can be incorporated without losing the insights from the behavior of past ratios, more precise

forecasts and valuation can be obtained. An important contribution of this study is to demonstrate differences in variability (or stability) across ratios. Such information is relevant for (1) identifying the components that require more attention, (2) deciding the weight to assign to past ratios versus other information, and (3) gauging the likely accuracy of the forecasts. Unfortunately, demonstrating these benefits in a large-sample non-contextual analysis is difficult. Future research may use specific settings to provide more direct evidence.

Appendix A. Reformulated Balance Sheet (detailed version)

Assets	Liabilities and Equity
Operating assets *Assets related to operating revenue and/or operating expenses* Required liquid funds Accounts receivable Inventory Other working capital assets (e.g., prepaid expenses, deferred costs) PP&E Right-of-use operating lease assets Intangible assets Net pension assets (if included in operations) Other long-term operating assets	**Operating liabilities** *Liabilities related to operating revenue and/or operating expenses* Accounts payable Accrued liabilities Deferred revenue Other working capital liabilities (e.g., income taxes payable) Deferred taxes Operating lease liabilities Pension and OPB net obligations (if included in Operations, which is uncommon) Other long-term operating liabilities
Financial assets *Financial instruments that are not needed for operations and are relatively liquid and/or represent fixed (rather than residual) claims* Cash, cash equiv. & ST invest. in excess of amounts needed for operations Long-term investments in marketable securities Illiquid fixed income instruments (other than operating receivables)	**Debt** *Borrowings from financial institutions & capital markets (including preferred stock and temporary equity)* Interest and dividends payable Short-term debt & current maturities of long-term debt Long-term debt (excluding conversion features) Temporary equity & preferred stock (excluding conversion features)
Other nonoperating assets *Illiquid assets that neither contribute to operating profit nor represent fixed claims* Equity method investments (investments in associates) Investments in unlisted equity securities Real estate not used in operations Assets of discontinued operations Tax loss carryforwards (if excluded from operations) Net pension assets (if excluded from operations, which is the preferred approach) Litigation assets (if excluded from operations)	**Other nonoperating liabilities** *Non-debt liabilities that do not affect operating profit* Liabilities of discontinued operations Litigation liabilities (if excluded from operations) Pension and OPB net obligations (if excluded from Operations, which is the preferred approach)
	Equity Common stock Noncontrolling interest Contingent claims (options & warrants, conversion features)

Appendix B. Reformulated Income Statement (detailed version)

Operating revenue
Sales and other recurring revenue generated by activities whose costs are recognized in cost of revenue and operating expenses

Cost of revenue
The cost of products and services delivered in generating operating revenue

Operating expenses
Recurring operating expenses other than cost of revenue and income taxes
- Selling, general and administrative expenses
- R&D
- Operating expenses that are reported separately from SG&A and R&D (e.g., amortization is often reported separately)

Other recurring operating income (expense)
- Normalized volatile quasi-recurring operating income (expense) (e.g., recurring portion of restructuring charges)
- Interest and dividend income on required liquid funds
- Other (e.g., rental income derived from properties classified as operating assets)

Pretax operating profit

Tax on operating profit

Net operating profit after tax (NOPAT)

Net financial expense
- Interest expense
- Interest and dividend income (excluding interest income on required liquid funds)
- Income taxes on net interest expense (difference between the above two items)
- Preferred dividends

Income from other nonoperating activities
- Recurring Income (expense) from other nonoperating activities (e.g., equity method income, operating income from discontinued operations), net of tax

Recurring income

Transitory items
- Volatile nonoperating income (expense) (e.g., gain or loss from selling investments)
- Transitory operating income (expense) (e.g., losses from natural disasters or expropriation of assets)
- Abnormal portion of volatile quasi-recurring operating income (expense) (e.g., abnormal portion of restructuring charges)
- Income taxes on transitory pretax income (transitory pretax income = sum of above three components)
- Abnormal income taxes (e.g., impact of TCJA tax reform on the 2017 income tax expense)
- Income from discontinued operations (excluding operating income from discontinued operations if disclosed)

Net income after preferred dividends

Net income attributable to noncontrolling interest

Net income attributable to common equity

Appendix C. Summary of ratios

The following is a summary of the ratios used in the decomposition:

$$Return\ on\ Common\ Equity\ (ROCE) = \frac{Net\ income\ attributable\ to\ common\ equity}{Average\ common\ equity}$$

$$Return\ on\ Equity\ (ROE) = \frac{Net\ income\ after\ preferred\ dividends}{Average\ equity}$$

$$NonControlling\ Interests\ (NCI)\ Leverage\ Effect = ROCE - ROE = NCI\ Leverage \times NCI\ Spread$$

$$NCI\ Leverage = \frac{Average\ NCI}{Average\ common\ equity}$$

$$NCI\ Spread = ROE - RONCI$$

$$Return\ on\ NCI\ (RONCI) = \frac{Noncontrolling\ interest\ in\ income}{Average\ noncontrolling\ interests}$$

$$Recurring\ ROE = \frac{Recurring\ income}{Average\ equity}$$

$$Transitory\ ROE = \frac{Transitory\ income}{Average\ equity}$$

$$Return\ on\ Net\ Operating\ Assets\ (RNOA) = \frac{NOPAT}{Average\ net\ operating\ assets}$$

$$Operating\ Profit\ Margin = \frac{NOPAT}{Operating\ revenue}$$

$$Operating\ Assets\ Turnover = \frac{Operating\ revenue}{Average\ operating\ assets}$$

$$Operations\ Funding\ Ratio = \frac{Average\ net\ operating\ assets}{Average\ operating\ assets}$$

$$Financial\ Leverage\ Effect = Financial\ Leverage \times Financial\ Spread$$

If any of its components is missing, *Financial Leverage Effect* is calculated as the difference between *Recurring ROE* and the total of *RNOA* and *Other Nonoperating Effect*.

$$Financial\ Leverage = \frac{Average\ net\ debt}{Average\ equity}$$

$$Financial\ Spread = RNOA - Net\ Borrowing\ Cost$$

$$Net\ Borrowing\ Cost = \frac{Net\ financial\ expense}{Average\ net\ debt}$$

$$Other\ Nonoperating\ effect = Relative\ Size\ of\ Net\ Other\ Nonoperating\ Assets \times Excess\ Retrun\ on\ Net\ Other\ Nonoperating\ Assets$$

If any of its components is missing, *Other Nonoperating Effect* is calculated as the difference between *Recurring ROE* and the total of *RNOA* and *Financial Leverage Effect*.

$$Relative\ Size\ of\ Net\ Other\ Nonoperating\ Assets = \frac{Average\ net\ other\ nonoperating\ assets}{Average\ equity}$$

$$Excess\ Return\ on\ Net\ Other\ Nonoperating\ Assets = Return\ on\ Net\ Other\ Nonopertaing\ Assets - RNOA$$

$$Return\ on\ Net\ Other\ Nonoperating\ Assets = \frac{Income\ from\ other\ nonoperating\ activities}{Average\ net\ other\ nonoperating\ assets}$$

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Table 1
Distribution statistics

Panel A: Decomposition of *ROCE* (observations = 47,754)

	Mean	StdDev	P5	Q1	Median	Q3	P95
ROCE	6.65%	25.97%	-38.30%	0.60%	9.53%	17.49%	37.94%
ROE	6.68%	25.92%	-38.22%	0.65%	9.55%	17.46%	37.92%
NCI Leverage Effect	-0.02%	0.39%	-0.54%	0.00%	0.00%	0.00%	0.33%

Panel B: Decomposition of *NCI Leverage Effect* (observations = 14,478)

	Mean	StdDev	P5	Q1	Median	Q3	P95
NCI Leverage Effect	-0.07%	0.64%	-1.31%	-0.21%	0.00%	0.11%	0.99%
NCI Leverage	0.0335	0.0500	0.0004	0.0036	0.0127	0.0405	0.1464
NCI Spread	-3.76%	37.43%	-66.46%	-14.40%	-0.43%	11.46%	44.55%
ROE	9.49%	20.18%	-21.45%	3.52%	10.68%	17.70%	34.92%
RONCI	13.24%	34.79%	-27.48%	0.00%	8.62%	22.32%	68.75%

Panel C: Decomposition of *ROE* (observations = 49,010)

	Mean	StdDev	P5	Q1	Median	Q3	P95
ROE	7.12%	24.08%	-36.01%	0.68%	9.64%	17.68%	37.97%
Recurring ROE	7.35%	21.49%	-28.48%	0.43%	9.00%	16.73%	35.66%
Transitory ROE	-0.23%	10.02%	-14.94%	-1.47%	0.01%	1.54%	13.12%

Panel D: Decomposition of *Recurring ROE* (observations = 47,126)

	Mean	StdDev	P5	Q1	Median	Q3	P95
Recurring ROE	6.87%	19.76%	-27.37%	0.34%	8.77%	16.21%	32.83%
RNOA	8.13%	17.19%	-17.69%	2.29%	7.95%	14.50%	33.89%
Financial Leverage Effect	-1.35%	12.32%	-21.65%	-3.35%	-0.18%	2.63%	12.88%
Other Nonoperating effect	0.09%	1.21%	-1.38%	-0.02%	0.00%	0.09%	2.00%

Panel E: Decomposition of *RNOA* (observations = 51,192)

	Mean	StdDev	P5	Q1	Median	Q3	P95
RNOA	8.20%	18.08%	-19.31%	1.94%	7.93%	14.83%	35.77%
Operating Profit Margin	4.97%	11.45%	-13.24%	1.08%	4.92%	9.96%	22.17%
Operating Asset Turnover	1.1649	0.7236	0.3261	0.6758	1.0198	1.4491	2.5823
Operations Funding Ratio	63.86%	16.79%	29.98%	54.65%	67.35%	76.13%	85.50%

Panel F: Decomposition of *Financial Leverage Effect* (observations = 46,502)

	Mean	StdDev	P5	Q1	Median	Q3	P95
Financial Leverage Effect	-1.19%	12.60%	-21.99%	-3.36%	-0.08%	2.84%	13.85%
Financial Leverage	0.5289	0.9922	-0.5087	-0.0806	0.3079	0.8047	2.4322
Financial Spread	4.19%	18.91%	-24.58%	-3.28%	3.66%	11.43%	34.60%
RNOA	8.25%	17.39%	-17.70%	2.30%	7.99%	14.59%	34.55%
Net Borrowing Cost	4.06%	6.17%	-3.50%	0.92%	3.95%	6.18%	13.50%

Panel G: Decomposition of *Other Nonoperating Effect* (observations = 25,835)

	Mean	StdDev	P5	Q1	Median	Q3	P95
Other Nonoperating effect	0.15%	1.51%	-2.10%	-0.27%	0.02%	0.49%	2.73%
Relative size of Net Other Nonop. Assets	0.0004	0.1125	-0.1835	-0.0346	-0.0008	0.0359	0.1924
Excess prof. of Net Other Nonop. Assets	-3.93%	32.89%	-51.83%	-14.51%	-4.24%	6.87%	44.09%
Return on Net Other Nonoper. Assets	4.77%	30.93%	-36.83%	-1.35%	3.40%	11.81%	49.12%
RNOA	8.70%	13.54%	-10.71%	3.48%	8.23%	13.97%	28.72%

The sample consists of annual observations for non-financial/REIT/utility firms during the period 2001 through 2020, with sales of at least $100MM in December 2020 prices. Data for each panel includes only observations with non-missing values for each of the variables in the panel. All ratios are defined in Appendix C and are calculated using reformulated financial statements constructed as described in Nissim (2022b).

Table 2
Correlation coefficients

		V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20
V1	*ROCE*		1.00	.17	.06	.45	.19	.88	.29	.81	.35	.11	.67	.19	-.08	.01	.70	-.09	-.05	-.36	.07
V2	*ROE*	.99		.16	.07	.42	.24	.89	.29	.81	.35	.11	.67	.19	-.08	.01	.70	-.09	-.05	-.36	.07
V3	*NCI Leverage Effect*	.13	.11		-.04	.83	-.53	.12	.08	.10	.08	.01	.09	.03	-.01	.00	.09	-.02	-.02	-.07	.00
V4	*NCI leverage*	.03	.04	-.10		-.05	.09	.08	-.02	.04	.10	.06	.11	-.13	.04	.17	.01	.12	.10	.01	.03
V5	*NCI spread*	.40	.41	.44	-.01		-.64	.32	.20	.28	.24	.02	.24	.06	-.03	.01	.25	-.06	-.02	-.15	.01
V6	*Return on NCI*	.12	.15	-.31	-.01	-.71		.25	.02	.24	.13	.07	.19	.08	-.05	-.02	.21	-.03	-.02	-.05	.07
V7	*Recurring ROE*	.83	.83	.08	.04	.30	.16		.01	.91	.42	.12	.76	.19	-.06	.00	.79	-.10	-.05	-.41	.09
V8	*Transitory ROE*	.40	.40	.08	-.01	.19	.02	.03		.02	.00	.01	.01	.03	-.01	-.02	.02	.00	-.01	-.01	.00
V9	*RNOA*	.62	.62	.05	.01	.21	.17	.74	.03		.15	.05	.79	.25	-.13	-.19	.87	-.18	-.03	-.49	.06
V10	*Financial Leverage Effect*	.37	.37	.06	.04	.21	.07	.47	.02	-.10		.07	.22	-.04	.09	.29	.12	.02	-.04	-.11	.05
V11	*Other Nonoperating effect*	.08	.08	.02	.02	.03	.04	.09	.02	.00	.04		.03	.03	.00	.05	.04	.01	-.22	.05	.07
V12	*Operating Profit Margin*	.55	.55	.04	.05	.15	.16	.64	.03	.70	.09	.00		-.21	.22	-.01	.69	-.09	.01	-.38	.06
V13	*Operating Asset Turnover*	.13	.13	.03	-.09	.03	.06	.13	.04	.18	-.04	.00	-.09		-.38	-.24	.24	-.15	-.09	-.11	.02
V14	*Operations Funding Ratio*	-.02	-.02	-.01	.03	-.03	-.02	.00	.00	-.08	.10	.01	.16	-.31		.27	-.10	.10	.00	.09	.01
V15	*Financial leverage*	-.03	-.03	.00	.10	-.01	-.02	-.04	-.02	-.12	.07	.04	.00	-.15	.23		-.28	.55	-.02	.11	.01
V16	*Financial spread*	.53	.53	.04	.00	.17	.14	.62	.03	.85	-.10	.00	.59	.17	-.08	-.16		-.47	-.03	-.43	.06
V17	*Net Borrowing Cost*	-.07	-.07	-.02	.05	-.04	-.01	-.08	-.01	-.10	-.04	.00	-.05	-.07	.06	.25	-.37		.01	.10	.01
V18	*Relative size of Net Other Nonoperating Assets*	-.04	-.04	-.03	.07	-.02	-.01	-.04	-.01	-.01	-.03	-.15	.02	-.05	-.01	-.01	-.01	.01		.08	.04
V19	*Excess profit. of Net Other Nonop. Assets*	-.19	-.19	-.03	.01	-.08	-.01	-.23	.00	-.34	-.01	.07	-.24	-.06	.06	.06	-.30	.04	.03		.73
V20	*Return on Net Other Nonoperating Assets*	.06	.06	.01	.02	.01	.05	.06	.01	.05	.02	.07	.05	.02	.01	.01	.04	.00	.03	.84	

The table presents time-series means of cross-sectional correlation coefficients (Spearman above the diagonal, Pearson below). The sample consists of annual observations for non-financial/REIT/utility firms during the period 2001 through 2020, with sales of at least $100MM in December 2020 prices. All ratios are defined in Appendix C and are calculated using reformulated financial statements constructed as described in Nissim (2022b).

Table 3
Persistence coefficients from regressions of X_{t+j} on X_t

Panel A: Decomposition of *ROCE*

	j = 1	j = 2	j = 3	j = 4	j = 5	j = 6	j = 7
ROCE	0.554	0.385	0.302	0.265	0.224	0.218	0.200
ROE	0.554	0.385	0.302	0.265	0.224	0.218	0.200
NCI Leverage Effect	0.506	0.342	0.273	0.193	0.172	0.143	0.105
Observations	41,165	36,250	32,062	28,380	25,161	22,255	19,703

Panel B: Decomposition of *NCI Leverage Effect*

	j = 1	j = 2	j = 3	j = 4	j = 5	j = 6	j = 7
NCI Leverage Effect	0.525	0.377	0.305	0.220	0.173	0.151	0.120
NCI Leverage	0.923	0.823	0.762	0.709	0.692	0.655	0.618
NCI Spread	0.489	0.344	0.270	0.245	0.200	0.181	0.149
ROE	0.560	0.420	0.352	0.316	0.252	0.257	0.221
RONCI	0.502	0.357	0.282	0.249	0.210	0.176	0.158
Observations	11,550	9,705	8,281	7,157	6,211	5,421	4,741

Panel C: Decomposition of *ROE*

	j = 1	j = 2	j = 3	j = 4	j = 5	j = 6	j = 7
ROE	0.621	0.449	0.355	0.329	0.277	0.265	0.255
Recurring ROE	0.773	0.612	0.518	0.465	0.401	0.367	0.345
Transitory ROE	0.133	0.060	0.009	0.006	-0.017	0.012	-0.001
Observations	42,479	37,526	33,256	29,471	26,134	23,162	20,489

Panel D: Decomposition of *Recurring ROE*

	j = 1	j = 2	j = 3	j = 4	j = 5	j = 6	j = 7
Recurring ROE	0.773	0.601	0.499	0.438	0.377	0.340	0.310
RNOA	0.767	0.606	0.507	0.433	0.374	0.335	0.316
Financial Leverage Effect	0.694	0.510	0.410	0.346	0.291	0.260	0.234
Other Nonoperating effect	0.563	0.382	0.283	0.232	0.189	0.187	0.178
Observations	40,640	35,707	31,597	27,961	24,759	21,916	19,384

Panel E: Decomposition of *RNOA*

	j = 1	j = 2	j = 3	j = 4	j = 5	j = 6	j = 7
RNOA	0.765	0.616	0.518	0.451	0.384	0.353	0.324
Operating Profit Margin	0.753	0.601	0.537	0.480	0.412	0.390	0.364
Operating Asset Turnover	0.948	0.901	0.868	0.837	0.807	0.782	0.761
Operations Funding Ratio	0.955	0.894	0.849	0.814	0.781	0.755	0.734
Observations	44,848	39,751	35,331	31,358	27,852	24,719	21,906

Panel F: Decomposition of *Financial Leverage Effect*

	j = 1	j = 2	j = 3	j = 4	j = 5	j = 6	j = 7
Financial Leverage Effect	0.713	0.520	0.424	0.364	0.304	0.278	0.252
Financial Leverage	0.921	0.818	0.739	0.683	0.640	0.601	0.569
Financial Spread	0.751	0.593	0.497	0.431	0.374	0.339	0.317
RNOA	0.766	0.608	0.511	0.440	0.379	0.343	0.319
Net Borrowing Cost	0.481	0.300	0.231	0.199	0.182	0.166	0.154
Observations	39,522	34,732	30,697	27,166	24,087	21,334	18,900

Panel G: Decomposition of *Other Nonoperating Effect*

	j = 1	j = 2	j = 3	j = 4	j = 5	j = 6	j = 7
Other Nonoperating effect	0.584	0.409	0.300	0.233	0.187	0.193	0.191
Relative size of Net Other Nonop. Assets	0.917	0.797	0.720	0.650	0.585	0.529	0.493
Excess prof. of Net Other Nonop. Assets	0.371	0.205	0.157	0.127	0.105	0.102	0.095
Return on Net Other Nonoper. Assets	0.321	0.161	0.115	0.090	0.071	0.069	0.062
RNOA	0.781	0.607	0.491	0.408	0.339	0.296	0.284
Observations	21,432	18,546	16,324	14,453	12,857	11,432	10,151

The table presents slope coefficients from regressions of each variable on its value t years ago, for j = 1, …, 7. The sample consists of annual observations for non-financial/REIT/utility firms during the period 2001 through 2020, with sales of at least $100MM in December 2020 prices. All ratios are defined in Appendix C and are calculated using reformulated financial statements constructed as described in Nissim (2022b).

Table 4
Coefficients of variation

Panel A: Decomposition of *ROCE* (observations = 13,069)

	Mean	StdDev	P5	Q1	Median	Q3	P95
ROCE	1.777	2.996	0.138	0.335	0.681	1.776	7.494
ROE	1.748	2.940	0.137	0.330	0.674	1.753	7.453
NCI Leverage Effect	2.738	3.295	0.451	1.100	1.844	2.828	9.079

Panel B: Decomposition of *NCI Leverage Effect* (observations = 6,428)

	Mean	StdDev	P5	Q1	Median	Q3	P95
NCI Leverage Effect	2.540	3.406	0.352	0.839	1.425	2.612	9.186
NCI Leverage	0.554	0.432	0.081	0.233	0.442	0.771	1.382
NCI Spread	2.797	4.208	0.357	0.774	1.375	2.807	10.925
ROE	1.555	2.814	0.130	0.306	0.583	1.405	6.717
RONCI	1.530	2.242	0.173	0.409	0.794	1.618	5.659

Panel C: Decomposition of *ROE* (observations = 27,678)

	Mean	StdDev	P5	Q1	Median	Q3	P95
ROE	1.800	3.018	0.138	0.342	0.733	1.829	7.385
Recurring ROE	1.245	1.981	0.111	0.268	0.552	1.285	4.939
Transitory ROE	5.690	8.119	0.868	1.764	2.872	5.673	21.143

Panel D: Decomposition of *Recurring ROE* (observations = 25,567)

	Mean	StdDev	P5	Q1	Median	Q3	P95
Recurring ROE	1.231	1.974	0.111	0.265	0.550	1.263	4.926
RNOA	1.001	1.544	0.111	0.250	0.478	1.016	3.837
Financial Leverage Effect	1.900	2.645	0.253	0.590	1.045	1.958	6.845
Other Nonoperating effect	3.278	4.388	0.382	1.067	1.882	3.333	11.854

Panel E: Decomposition of *RNOA* (observations = 30,002)

	Mean	StdDev	P5	Q1	Median	Q3	P95
RNOA	1.002	1.481	0.112	0.258	0.497	1.067	3.731
Operating Profit Margin	0.993	1.597	0.079	0.196	0.423	1.047	3.930
Operating Asset Turnover	0.146	0.097	0.040	0.078	0.120	0.188	0.340
Operations Funding Ratio	0.078	0.084	0.013	0.029	0.051	0.092	0.237

Panel F: Decomposition of *Financial Leverage Effect* (observations = 24,065)

	Mean	StdDev	P5	Q1	Median	Q3	P95
Financial Leverage Effect	1.822	2.529	0.247	0.573	1.021	1.910	6.387
Financial Leverage	0.786	1.075	0.111	0.253	0.447	0.823	2.757
Financial Spread	1.772	2.692	0.158	0.420	0.859	1.854	6.893
RNOA	1.036	1.607	0.110	0.248	0.478	1.041	4.103
Net Borrowing Cost	1.093	1.726	0.105	0.219	0.429	1.191	4.377

Panel G: Decomposition of *Other Nonoperating Effect* (observations = 12,856)

	Mean	StdDev	P5	Q1	Median	Q3	P95
Other Nonoperating effect	2.635	3.923	0.298	0.742	1.386	2.692	9.779
Relative size of Net Other Nonop. Assets	0.916	1.166	0.129	0.282	0.516	1.030	3.271
Excess prof. of Net Other Nonop. Assets	2.919	4.442	0.279	0.716	1.420	2.996	11.569
Return on Net Other Nonoper. Assets	2.832	4.325	0.247	0.712	1.422	2.842	11.067
RNOA	0.895	1.452	0.101	0.222	0.418	0.877	3.393

The table presents statistics from the pooled distribution (across firms and years) of the coefficients of variation of each of the profitability ratios. The coefficient of variation is calculated by dividing the firm-specific standard deviation of the profitability ratio over the last seven years by the absolute value of the mean over the last seven years (a minimum of five non-missing values is required). The sample consists of annual observations for non-financial/REIT/utility firms during the period 2001 through 2020, with sales of at least $100MM in December 2020 prices. Data for each panel includes only observations with non-missing values for each of the variables in the panel. All ratios are defined in Appendix C and are calculated using reformulated financial statements constructed as described in Nissim (2022b).

Table 5
Regressions evaluating potential information in profitability decomposition due to differences in persistence

Panel A: Shareholders' profitability (ROE_{t+j})

	j = 1	j = 3	j = 5	j = 7
Intercept	0.006	0.036	0.047	0.051
	0.7	3.9	5.1	5.7
Recurring ROE_t (1)	0.734	0.464	0.358	0.305
	28.9	13.8	14.1	12.2
Transitory ROE_t (2)	0.245	0.043	0.045	0.054
	9.6	0.9	1.8	1.7
(1)-(2)	0.489	0.421	0.314	0.251
	13.8	8.5	7.9	7.3
Average R-squared	0.345	0.124	0.070	0.050
Average observations	2,265	1,984	1,769	1,600

Panel B: Recurring profitability ($Recurring\ ROE_{t+j}$)

	j = 1	j = 3	j = 5	j = 7
Intercept	0.001	0.021	0.033	0.039
	0.1	3.6	6.0	8.1
$RNOA_t$ (1)	0.826	0.579	0.454	0.369
	56.6	24.2	19.0	24.8
Financial Leverage $Effect_t$ (2)	0.737	0.440	0.316	0.262
	36.0	21.9	12.7	11.8
Other Nonoperating $effect_t$ (3)	1.013	0.716	0.476	0.601
	11.2	3.8	2.2	2.0
(1)-(2)	0.089	0.139	0.139	0.107
	8.9	11.0	9.8	5.3
(1)-(3)	-0.188	-0.137	-0.022	-0.232
	-2.2	-0.7	-0.1	-0.8
(2)-(3)	-0.276	-0.275	-0.160	-0.340
	-3.2	-1.6	-0.7	-1.1
Average R-squared	0.535	0.229	0.133	0.088
Average observations	2,187	1,918	1,710	1,549

Panel C: Operating profitability (*Ln of $RNOA_{t+j}$*)

	j = 1	j = 3	j = 5	j = 7
Intercept	-0.864	-1.390	-1.669	-1.825
	-23.6	-25.8	-31.6	-63.9
Ln of Operating Profit Margin$_t$ (1)	0.680	0.469	0.367	0.320
	46.1	17.9	14.5	24.3
Ln of Operating Asset Turnover$_t$ (2)	0.738	0.525	0.422	0.370
	55.2	18.3	10.9	13.8
Negative of Ln of Operations Funding Ratio$_t$ (3)	0.939	0.793	0.723	0.701
	47.2	42.0	27.9	17.7
(1)-(2)	-0.058	-0.056	-0.054	-0.050
	-7.1	-4.2	-3.3	-2.2
(1)-(3)	-0.259	-0.323	-0.356	-0.381
	-9.9	-16.2	-15.3	-9.8
(2)-(3)	-0.202	-0.268	-0.302	-0.331
	-8.9	-12.5	-8.9	-5.4
Average R-squared	0.546	0.285	0.189	0.151
Average observations	1,805	1,555	1,386	1,261

The table presents the times-series means and t-statistics of coefficients estimated using cross-sectional (annual) regressions. The t-statistics are calculated using Heteroscedasticity and Autocorrelation Consistent standard errors with two lags (see Greene (2012), page 960, concerning the selection of number of lags). The sample consists of annual observations for non-financial/REIT/utility firms during the period 2001 through 2020, with sales of at least $100MM in December 2020 prices. All ratios are defined in Appendix C and are calculated using reformulated financial statements constructed as described in Nissim (2022b).

Table 6
Out-of-sample predictability

Panel A: Shareholders' profitability (ROE_{t+j})

	Mean squared error		Difference	t-statistic for difference	Percentage change	Observations
	No decomp.	With decomp.				
Future year j = 1	0.0451	0.0432	-0.0018	-7.1	-4.10%	30,491
Future year j = 3	0.0532	0.0521	-0.0011	-4.2	-2.09%	18,943
Future year j = 5	0.0614	0.0607	-0.0007	-4.0	-1.18%	9,965
Future year j = 7	0.0717	0.0711	-0.0006	-1.0	-0.78%	2,961

Panel B: Recurring profitability ($Recurring\ ROE_{t+j}$)

	Mean squared error		Difference	t-statistic for difference	Percentage change	Observations
	No decomp.	With decomp.				
Future year j = 1	0.0206	0.0206	-0.0001	-2.5	-0.39%	29,410
Future year j = 3	0.0310	0.0308	-0.0001	-2.4	-0.44%	18,271
Future year j = 5	0.0393	0.0391	-0.0001	-2.4	-0.37%	9,621
Future year j = 7	0.0465	0.0464	-0.0001	-2.5	-0.26%	2,860

Panel C: Operating profitability ($Ln\ of\ RNOA_{t+j}$)

	Mean squared error		Difference	t-statistic for difference	Percentage change	Observations
	No decomp.	With decomp.				
Future year j = 1	0.3945	0.3865	-0.0080	-4.2	-2.02%	24,223
Future year j = 3	0.5915	0.5807	-0.0107	-4.1	-1.82%	14,896
Future year j = 5	0.7340	0.7208	-0.0132	-3.4	-1.80%	7,930
Future year j = 7	0.8002	0.7814	-0.0188	-3.2	-2.34%	2,308

The sample consists of annual observations for non-financial/REIT/utility firms during the period 2001 through 2020, with sales of at least $100MM in December 2020 prices. All ratios are defined in Appendix C and are calculated using reformulated financial statements constructed as described in Nissim (2022b). The t-statistics are calculated using two-ways (firm and year) clustered standard errors (Petersen 2009).

Table 7
Comparison of the strength of the relationship of sales with operating assets (OA) versus with net operating assets (NOA)

	Mean absolute % error					
	NOA	OA	Difference	t-statistic	% difference	Obs.
Industry-year analysis	44.8%	34.9%	-9.9%	-36.5	-22.1%	57,343
Firm-specific analysis	23.4%	17.0%	-6.3%	-25.7	-27.1%	56,677

The table reports the mean absolute percentage error when estimating sales based on operating assets (that is, as the product of operating assets and the mean ratio of sales to operating assets). It also reports the mean absolute percentage error when estimating sales based on net operating assets, and it compares the two metrics. The mean ratios of sales to operating assets and to net operating assets are calculated using either firms from the industry-year (first row) or using the time-series of the firm (second row). The percentage error is calculated as the ratio of the difference between actual and estimated sales to actual sales. The sample consists of annual observations for non-financial/REIT/utility firms during the period 2001 through 2020, with sales of at least $100MM in December 2020 prices. Observations belonging to industry-year (firm) with only one observation are excluded from industry-year (firm-specific) analysis. Operating assets and liabilities are measured as described in Nissim (2022b). The t-statistics are calculated using two-ways (firm and year) clustered standard errors (Petersen 2009).

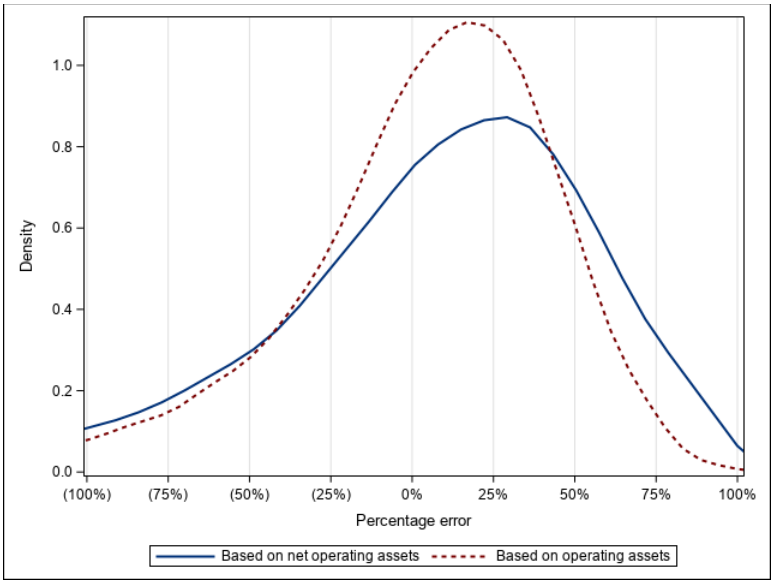
Table 8
Comparison of the strength of the relationship of operating liabilities with operating assets (OA) versus with sales

	Mean absolute deflated error					
	Sales	OA	Difference	t-statistic	% difference	Obs.
Industry-year analysis	15.6%	14.4%	-1.2%	-5.6	-7.8%	57,343
Firm-specific analysis	7.7%	6.9%	-0.8%	-6.3	-9.9%	56,677

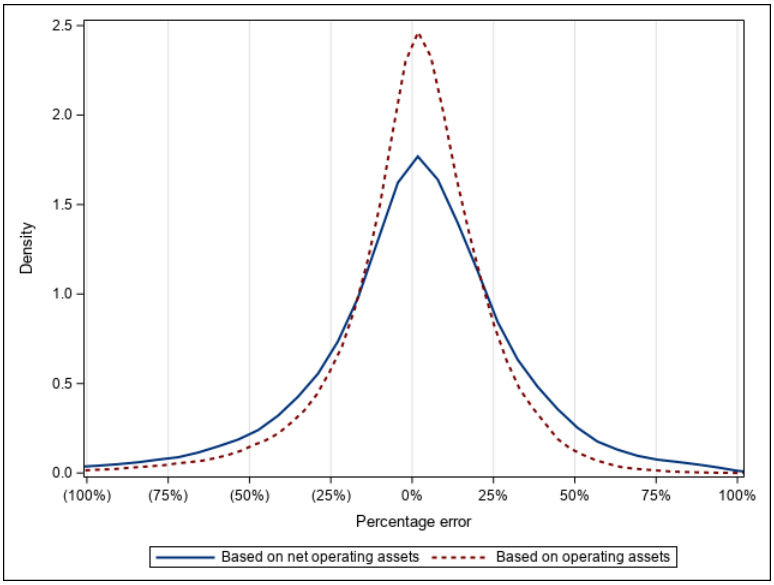
The table reports the mean absolute sales-deflated error when estimating operating liabilities based on operating assets (that is, as the product of operating assets and the mean ratio of operating liabilities to operating assets). It also reports the mean absolute percentage error when estimating operating liabilities based on sales (that is, as the product of sales and the mean ratio of operating liabilities to sales), and it compares the two metrics. The mean ratios of operating liabilities to operating assets and to sales are calculated using either firms from the industry-year (first row) or using the time-series of the firm (second row). The deflated error is the ratio of the difference between actual and estimated operating liabilities to sales. The sample consists of annual observations for non-financial/REIT/utility firms during the period 2001 through 2020, with sales of at least $100MM in December 2020 prices. Observations belonging to industry-year (firm) with only one observation are excluded from industry-year (firm-specific) analysis. Operating assets and liabilities are measured as described in Nissim (2022b). The t-statistics are calculated using two-ways (firm and year) clustered standard errors (Petersen 2009).

Figure 1: Percentage error when estimating sales based on operating assets versus based on net operating assets

Panel A: Industry-specific cross-sectional analysis



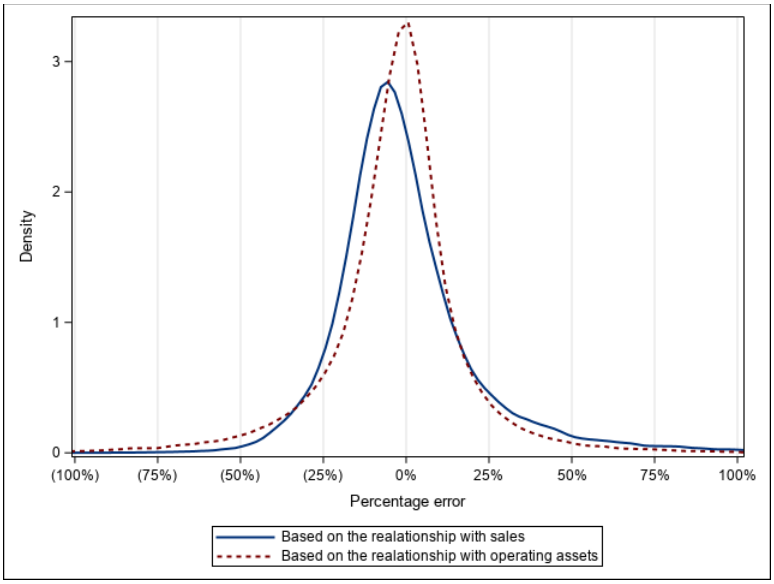
Panel B: Firm-specific time-series analysis



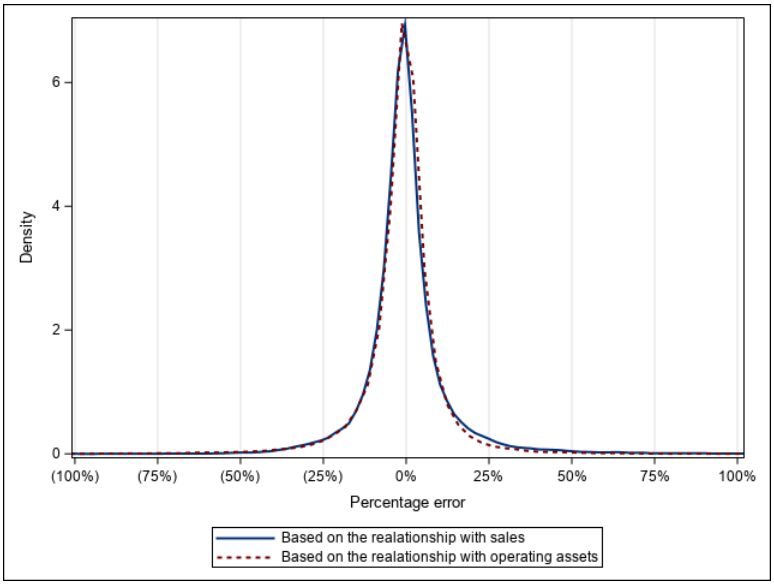
The figure presents density curves for percentage error when estimating sales based on operating assets (that is, as the product of operating assets and the mean ratio of sales to operating assets). It also presents density curves for percentage error when estimating sales based on net operating assets. The mean ratios of sales to operating assets and to net operating assets are calculated using either firms from the industry-year (Panel A) or using the time-series of the firm (Panel B). The percentage error is calculated as the ratio of the difference between actual and estimated sales to actual sales. The sample consists of annual observations for non-financial/REIT/utility firms during the period 2001 through 2020, with sales of at least $100MM in December 2020 prices. Observations belonging to industry-year (firm) with only one observation are excluded from industry-year (firm-specific) analysis. Operating assets and liabilities are measured as described in Nissim (2022b). The curves are estimated using a nonparametric kernel density.

Figure 2: Sales-delated error when estimating operating liabilities based on operating assets versus based on sales

Panel A: Industry-specific cross-sectional analysis



Panel B: Firm-specific time-series analysis



The figure presents density curves for sales-deflated errors when estimating operating liabilities based on operating assets (that is, as the product of operating assets and the mean ratio of operating liabilities to operating assets). It also presents density curves for sales-deflated errors when estimating operating liabilities based on sales (that is, as the product of sales and the mean ratio of operating liabilities to sales). The mean ratios of operating liabilities to operating assets and to sales are calculated using either firms from the industry-year (Panel A) or using the time-series of the firm (Panel B). The deflated error is the ratio of the difference between actual and estimated operating liabilities to sales. The sample consists of annual observations for non-financial/REIT/utility firms during the period 2001 through 2020, with sales of at least $100MM in December 2020 prices. Observations belonging to industry-year (firm) with only one observation are excluded from industry-year (firm-specific) analysis. Operating assets and operating liabilities are measured as described in Nissim (2022b). The curves are estimated using a nonparametric kernel density.