Right-of-Use Assets

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Abstract

Accounting Standard Codification (ASC) Topic 842, which is effective since 2019, requires balance sheet recognition of operating lease obligations and right-of-use (ROU) assets. For many firms, the implementation of this standard resulted in a large increase in reported operating assets, thus impairing the time-series consistency of metrics that involve operating assets. This paper shows that ROU assets can be estimated quite precisely using lease commitments information, which is available since the late 1970 (fully available on Compustat since 2000). Adding estimated ROU assets to reported operating assets for pre-ASC 842 observations substantially improves the ability of operating assets to explain cross-sectional and time-series variation in sales.

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1. Introduction

U.S. GAAP distinguishes between operating and finance leases (previously called capital leases), with finance leases representing transactions whose economic substance is akin to borrowing and asset acquisition (for example, if the lease contract covers most of the asset's expected useful life). Until 2018 (Accounting Standard Codification (ASC) Topic 840), operating leases—which are most leases—were not recognized on the balance sheet. An important accounting change, codified in ASC 842 and effective since 2019, requires balance sheet recognition of operating lease obligations and right-of-use (ROU) assets. For many firms the implementation of this standard resulted in a large increase in reported operating assets, thus impairing the time-series consistency of metrics involving operating assets (e.g., operating assets turnover, growth in operating assets). In addition, the omission of ROU assets in the pre-ASC 842 era possibly reduced the ability of reported operating assets to explain and predict variation in sales across firms and over time.[1] This paper investigates whether ROU assets can be estimated with sufficient accuracy for pre-ASC 842 observations, so that adding them to reported operating assets would improve the time-series consistency and overall informativeness of ratios that use operating assets.

The results indicate that ROU assets can be estimated quite precisely using lease commitments information, which is available since the late 1970 (fully available on Compustat since 2000). Comparing operating lease obligations and ROU assets reported under ASC 842 with estimates derived using lease commitments disclosure show that for about 50% of the observations the estimated liability (asset) is with 5% (10%) of the reported amount. In addition, adding the estimated ROU asset to reported operating assets for pre-ASC 842 observations substantially

[1] This is due to substantial cross-sectional and time-series variation in the tendency to lease versus acquire assets (e.g., Cornaggia et al. 2013, Lim et al. 2017).

improves the ability of operating assets to explain cross-sectional and time-series variation in sales. This is especially true when focusing on the five years surrounding the accounting change, 2016 to 2020 (the change is effective since December 2019, with some firms early adopting in 2018). These findings indicate that when using historical information (pre-2019), adjusting reported financial statements to include estimated ROU assets and operating lease obligations would increase their informativeness.

The paper proceeds as follows. Section 2 describes the accounting for leases by lessees before and after the accounting change. Section 3 conducts the empirical analysis, and Section 4 concludes.

2. Accounting for leases

A lease is a contract between a lessor and a lessee that conveys the right to control the use of identified property, plant, or equipment for a period of time in exchange for consideration. Lease transactions are very common. The benefits to lessees include the ability to obtain control over assets with close to 100% financing, bearing lower risk compared to ownership (e.g., of obsolescence), and having greater flexibility (e.g., asset upgrades or returns, contingent rentals, re-negotiation of terms or exit, borrowing capacity). In some cases, lease transactions allow for tax arbitrage, shifting tax deductions between lessors and lessees.[2] For example, Caskey and Ozel (2019) provide evidence that expanding financing capacity, accommodating volatile operations, and maximizing the present value of tax deductions are all important drivers of leasing decisions. Leases may also provide financial reporting benefits, allowing lessees to front-load earnings and

[2] Tax considerations related to leasing versus debt-financed asset acquisition include bonus depreciation, accelerated depreciation, interest deductibility, and the non-deductibility of payments for acquiring as opposed to leasing land. If the lessee and lessor face different economic tax rates (e.g., due to operating losses or limits on interest deductibility), leasing effectively enables a tax arbitrage.

reduce reported debt and assets, with the latter effect providing a further boost to measures of return on assets (Dechow et al. 2011, Cornaggia et al. 2013, Lim et al. 2017). Ma and Thomas (2021) find evidence that after the issuance of ASC 842 managers changed their operational behavior by decreasing their use of long-term operating leases, and this decrease relates to reporting incentives.[3] From lessors' perspective, leases are a form of secured lending with enhanced bankruptcy protection benefits (e.g., ability to evict the lessee in a Chapter 11 bankruptcy and find new tenants), which also enables them to earn a dealer's profit and/or profit from lessees' payment for the benefits they obtain.

Before 2019, under ASC 840, lessees accounted for almost all leases using the operating lease method, under which obligations to make future lease payments and the right to use leased assets were not recognized on the balance sheet. Lease payments were generally recognized as prepaid rent and were expensed over the period to which they related. If the lease contract included escalating lease payments or a "rent holiday," the rent expense was straight-lined with a corresponding balance sheet accrual. In unusual cases, where at least one of four criteria were satisfied, the lease was considered to transfer substantially all of the benefits and risks of ownership to the lessee and was accordingly accounted for as borrowing and asset acquisition (capital lease method).[4] Specifically, at inception the lessee recorded the incurrence of an obligation and the acquisition of an asset equal to the lesser of the present value of the minimum lease payments and the fair value of the leased property. Subsequently, the lessee treated the periodic lease payments as repayment of the lease obligation and interest. The lessee also depreciated the leased property

[3] See Section 5.9 in Nissim (2022a) for a discussion of reporting and earnings quality issues related to leases.

[4] The four criteria were: (1) transfer of ownership at end of lease; (2) option to buy the leased asset at a bargain price; (3) lease term covers at least 75% of the asset's useful live; and (4) the present value of lease payments is at least 90% of the fair value of the leased asset.

in a manner consistent with its normal depreciation policy for owned assets. The depreciation period was restricted to the lease term rather than the life of the asset unless the lease provided for a transfer of title or included a bargain purchase option.

ASC 842, which is effective since 2019, requires the capitalization of substantially all leases on the balance sheet and disclosure of key information about leasing arrangements. Under the new guidance, at the lease commencement date, a lessee recognizes a right-of-use asset and a lease liability. The lease liability is measured at the present value of expected lease payments[5] over the lease term,[6] discounted at the rate implicit in the lease or at the lessee incremental borrowing rate (if the rate implicit in the lease is unknown to the lessee, as is typically the case).[7] The right-of-use asset is measured as the total of the initial lease liability, any lease payments made to the lessor at or before the commencement date, and any initial direct costs incurred by the lessee (e.g., commissions), reduced by any lease incentives received (e.g., tenant improvement allowance, payment by the lessor to release the lessee from a preexisting lease with a third party).

Subsequent ("day 2") accounting depends on the classification of the lease—operating or finance. The classification criteria are similar to the previous ones, with the term "finance lease"

[5] Expected lease payments include the predetermined payments for the non-cancellable portion of the lease as well as (1) payments for renewal periods for any periods when it is reasonably certain that the lessee will exercise the renewal option; (2) variable payments that are based on an index or a rate (e.g., CPI, LIBOR) based on the index or rate at commencement (payments based on usage or performance are excluded); and (3) the amount probable of being owed under a residual value guarantee (for classification purposes—discussed below—the entire potential payment is included in the lease payments).

[6] The lease term is the non-cancellable period of the lease, together with: (1) periods covered by an option to extend the lease if the lessee is reasonably certain to exercise that option, (2) periods covered by an option to terminate the lease if the lessee is reasonably certain not to exercise that option, and (3) periods covered by an option to extend (or not to terminate) the lease in which exercise of the option is controlled by the lessor.

[7] The rate implicit in the lease is the interest rate that causes the aggregate present value of the lease payments and the unguaranteed residual value of the asset to equal the current fair value of the leased asset less any investment tax credit plus the lessor's deferred initial direct costs. Because lessees are usually unable to readily determine the unguaranteed residual value nor the lessor's deferred initial direct costs, most lessees use their incremental borrowing rate. The incremental borrowing rate is defined as the rate of interest that a lessee would have to pay to borrow on a collateralized basis over a similar term, an amount equal to the lease payments in a similar economic environment.

used instead of "capital lease."[8] The accounting treatment for finance leases remains unchanged. Interest expense on the lease liability—calculated using the effective interest method—is recognized separately from the amortization of right-of-use assets, which is typically measured on a straight-line basis over the lease term. The lease liability is reduced each period by the difference between the periodic lease payment and the interest expense.

Under the operating lease model, in contrast, the operating lease cost (excluding variable lease costs which are accounted for separately) is recognized on a straight-line basis over the lease term (i.e., like the old standard). The change in the lease liability is calculated the same way as under the finance lease method, and the amortization of the right-of-use asset is calculated as the difference between the operating lease cost and the interest on the lease liability. In other words, the amortization of the right-of-use assets is essentially a "plug number" that maintains the balance sheet identity, given the operating lease cost (note that the operating lease cost reduces equity and accruing interest increases liabilities). There is no break-down of the operating lease cost between interest expense and amortization of the right-of-use asset, and the whole amount is reported as an operating expense. In addition, right-of-use assets are tested for impairment in the same manner as long-lived assets.

Variable lease payments (whether relating to finance or operating leases) are accounted for separately and are expensed in the period in which they become payable. They include (1) payments resulting from changes in indexes or rates on which the lease payments are based (e.g., CPI, LIBOR) relative to their levels at lease commencement, and (2) payments based on

[8] Under ASC 842, a lease is classified as a finance lease if it satisfies any of the four criteria that were specified under ASC 840 (except that the 75% and 90% bright lines were changed from binding to suggestive, making the standard more principles based), or if the leased asset is so specialized that it is expected to have no alternative use to the lessor at the end of the lease term. Otherwise, the lease is classified as an operating lease.

performance or usage, such as percentage of sales in a retail store lease or excess mileage under a car lease.

Lease-related disclosures, which were quite comprehensive under ASC 840, have been further expanded under ASC 842. Under both standards, lessees are required to disclose future lease payments for each of the next five years as well as the total thereafter, separately for operating and finance/capital leases. Also, under both standards, companies are required to disclose the operating lease cost/rent expense, variable lease cost/contingent rentals, sublease income, and other quantitative information. ASC 842 further requires lessees to disclose the weighted average discount rate used in measuring the lease liability and the weighted average remaining lease term, separately for operating and finance leases, as well as several additional quantitative items. Finally, ASC 842 has significantly expanded required qualitative disclosures (e.g., description of leases, key terms, restrictions, accounting choices and judgements, etc.).

3. Empirical analysis

I start by describing the sample (subsection 3.1) and methodology (3.2) and then present the empirical results. In subsection 3.3, I compare operating lease obligations and right-of-use (ROU) assets reported under ASC 842 with estimates derived using lease commitments disclosure. In subsection 3.4, I evaluate the likely accuracy of using estimated ROU asset as a substitute for reported ROU asset for pre-ASC 842 observations. In the last subsection (3.5), I examine whether and the extent to which adding the estimated ROU asset to reported operating assets for pre-ASC 842 observations strengthens the relationship between sales and operating assets.

3.1 Sample

To construct the sample, I start with the Compustat North America Fundamental Annual file and select all observations with consolidated data (CONSOL = "C"), industrial format (INDFMT = "INDL"), standardized data format (DATAFMT = "STD"), domestic company (POPSRC = "D;" including U.S., Canada, and ADR), and USD currency (CURCD = "USD"). I then obtain and merge data on operating lease obligations and ROU assets from the Compustat Snapshot Annual file. I supplement the operating lease data with information from XBRL files (obtained from https://www.sec.gov/dera/data/financial-statement-and-notes-data-set.html).[9] Because a key lease-related data item (Compustat's MRCTA, discussed below) is consistently available only since 2000, I start the sample period in that year.[10] I next exclude financial firms (GIC sector 40) and REITs (GIC sector 60 since 2017, previously included in GIC 40), because for these sectors the concepts of operating assets and revenue, and the relationships between them, are substantially different from other sectors. (As explained below, the analysis focuses on the impact of ROU assets on the relationship between operating assets and revenue.) I also delete observations that relate to small firms (annual revenue less than 100 million USD in December 2020 prices), and I define the variables as described below. Finally, I trim extreme values of the calculated ratios.[11]

[9] 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). 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.

[10] When comparing the estimates to reported amounts, the sample period starts at 2018, which is the earliest year with reported ROU assets.

[11] 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. Because SPI components are often zero, for SPI-to-revenue and for each of the nine SPI component ratios, I identify outliers excluding zero values.

3.2 Methodology for estimating the ROU asset

Since the late 1970s (SFAS 13, codified in ASC 840), and continuing under ASC 842, firms are required to disclose operating lease commitments for each of the subsequent five years (Compustat's data items MRC1 through MRC5) as well as the total of all commitments after year five ("thereafter commitments"; Compustat's data item MRCTA). Measuring the lease obligation requires estimates of lease payments in each future year, including after year five. Two alternative approaches to estimate annual lease commitments after year five are to either assume that annual lease payments remain constant from year five (until MRCTA is exhausted), or that they remain constant from year six at an amount equal to the average lease commitment during years one through five. (Under both methods, the final payment is the residual amount.) Because existing lease commitments typically decline as leases expire, using year five commitment in extrapolating lease commitments after year five is generally preferable to using the average over years one through five (see, e.g., Imhoff et al. 1991). I therefore assume that annual commitments after year five are constant and equal to year five commitment, unless (1) lease commitments in year five are either zero or greater than the average lease commitments over years one through five, in which case I assume they are equal to that average, or (2) the calculation results in more than 20 years of payments, in which case I spread the "thereafter commitments" over twenty years.[12]

To measure the discount rate for the minimum/fixed lease payments, I first calculate the effective interest rate on reported debt:

$$\textit{Effective Interest Rate on Reported Debt} = \text{XINT} / (.5 \times (\text{RepDebt}_{-1} + \text{RepDebt}))$$

[12] These adjustments are made because some companies have relatively low or even zero commitment for year five and still report substantial lease commitments after year five (e.g., due to residual value guarantees).

Where RepDebt is the sum of debt in current liabilities (Compustat's data item DLC) and long-term debt (Compustat's data item DLTT).[13] For post-ASC 842 observations, I remove the reported operating lease liability from the Compustat's debt variables (Compustat includes it in their debt variables, DLC and DLTT).

I next calculate the median value of *Effective Interest Rate on Reported Debt* each year (year assignment is based on Compustat's convention of June/t to May/t+1) using observations that satisfy the following requirements: (1) non-missing values for interest expense (Compustat's XINT)[14] and interest income (Compustat's IDIT); and (2) the ratio of short-term borrowing (Compustat's NP) to RepDebt is less than 10%. I calculate the effective interest rate only for companies with non-missing interest income (IDIT) to assure that interest expense is not reported net of interest income. The reason for the short-term debt filter is that some firms rely on short-term borrowing (e.g., commercial paper), whose cost is often substantially different from that of long-term debt, and operating leases are akin to long-term debt. I refer to this median ratio as the *Median Effective Rate on LT Debt*. Figure 1 depicts this median ratio along with the median disclosed weighted average discount rate reported by companies under ASC 842 (the disclosed weighted average discount rate is available since 2018 for early adopter and since December 2019 for all public companies). As shown, for the four years with available values for both variables (2019-2021), the two are very similar. I therefore use the *Median Effective Rate on LT Debt* as a proxy for the weighted average discount rate for pre-ASC 842 observations.[15] Using the same

[13] Using average debt is equivalent to assuming that changes in debt on average occur at the middle of the year.

[14] In measuring XINT, Compustat adds capitalized interest back to interest expense (and to nonoperating income, NOPIO), so there is no need to adjust for capitalized interest when estimating the effective interest rate.

[15] This choice is consistent with evidence provided by Binfare et al. (2021), who find that many firms choose a discount rate for leases that likely reflects the unsecured (or subordinated) cost of debt even though operating lease contracts are less risky from the perspective of the lessors (they do not convey asset ownership to the lessee, lease payments have priority in bankruptcy settings, and the lessor has the right to repossess the underlying asset in the event that the lessee enters bankruptcy).

discount rate for all companies (in the same year) obviously induces measurement error. However, as will be shown, the estimated liability is very similar to the reported liability, in part because the cross-sectional variation in the weighted-average discount rate is relatively low.[16]

Given the estimated discount rate and annual amounts of future lease payments, I next calculate the lease obligation by discounting the payments assuming they are made at the middle of each year. I use the same estimate to measure the right-of-use asset.[17]

3.3 Estimated ROU asset as a proxy for reported ROU assets under ASC 842

To evaluate the accuracy of the estimated lease obligation and right-of-use asset, I compare the estimates to the reported amounts under ASC 842. The objective of this analysis is to inform on the likely accuracy of estimates derived for pre-ASC 842 observations, for which operating lease obligations and ROU assets were not reported or disclosed. Table 1 reports distribution statistics for the following ratios: estimated operating lease obligation (EstOblig) divided by the reported obligation (RepOblig), estimated ROU asset (EstROUAsset) divided by the reported ROU asset (RepROUAsset), and reported ROU asset divided by the reported liability. The table also reports statistics for the disclosed weighted average discount rate (RepWA_DR) and for the difference

[16] An alternative approach is to use firm- or industry-specific discount rate, estimated using either the effective interest rate on debt for the firm or industry or based on the firm's credit rating. However, the extent and type of leasing varies across firms even within industries, and the impact of firm level credit risk on its lease discount rate is different from the impact on the borrowing rate due to the highly secure nature of leasing (no transfer of title).

[17] The right-of-use (ROU) asset is initially measured as the total of (1) the initial lease liability (2) any lease payments made to the lessor at or before the commencement date (which are excluded from the liability as it is initially measured on the lease commencement date); (3) any initial direct costs incurred by the lessee (e.g., commissions); and minus (4) lease incentives received at or before lease commencement (e.g., tenant improvement allowance, payment by the lessor to release the lessee from a preexisting lease with a third party). Subsequently, the ROU asset is periodically amortized by an amount equal to the difference between the operating lease cost and the portion representing interest on the lease liability. In addition, ROU assets are tested for impairment in the same manner as long-lived assets. If there are no impairments, lease incentives received after commencement, rent holidays, or escalating payments, any initial difference between the ROU asset and the liability should generally decrease over time. However, in many lease transactions there are significant initial rent holidays and/or escalating lease payments, which generally imply that the ROU asset initially declines at a faster rate than the liability. The net effect of the above factors is that the asset is typically smaller than the liability, as will be shown.

between that rate and the rate used in estimating the lease obligation (EstDR; *Median Effective Interest Rate on LT Debt* described above). The sample for this table consists of annual observations for non-financial/REIT firms during the period 2018 through 2021 for which (1) reported ROU asset or lease obligation is available, and (2) sales are at least $100MM in December 2020 prices.

The statistics reported in Table 1 suggest that for most observations the estimates are reasonably precise. For example, the mean (median) ratio of estimated to reported liability is 1.031 (1.007), and for more than 50% of the observations the estimated liability is within 5% of the reported liability. The estimated right-of-use asset, which is the same as the estimated liability, is less precise—on average it is 13.3% larger than the reported asset (median 8.9%), due mostly to the reported asset being smaller than the reported liability. Still, the estimated ROU asset is within 10% of the reported asset for about 50% of the observations (median ratio is 1.089 and the 5th percentile is 0.952).

3.4 Estimated ROU asset as a substitute for reported ROU assets for pre-ASC 842 observations

The above statistics relate to information reported under ASC 842. However, in addition to requiring balance sheet recognition of lease assets and obligations, ASC 842 changed the definition and measurement of future lease payments. Thus, another source of measurement error that may impair the time series-consistency of using estimated ROA as a substitute for reported ROU asset for pre-ASC 842 observations is the change in the definition of future lease payments disclosed by companies.

Under ASC 840, future lease payments excluded contingent rentals and executory costs (e.g., insurance, taxes, maintenance). ASC 842 continues to exclude contingent rentals and most executory costs, but there are some differences. Instead of executory costs, ASC 842 introduces

the concept of lease and non-lease elements. Lessees are required to allocate the payments to lease and non-lease components (defined as payment for a good or service transferred to the lessee that is separate from the right to use the underlying asset). Unless the company takes advantage of a practical expedient in which the lessee can combine the lease and non-lease components, the disclosed future lease payments relate only to the identified lease components. Property taxes and insurance are not considered non-lease components of a contract as they are not for a service provided by the lessor to the lessee. Therefore, if the contract requires the lessee to reimburse the lessor for these costs, they are considered part of the contract payments. Additional changes in disclosed future lease payments resulted from a revised definitions of lease transactions and operating leases, new timing of lease classification and measurement (inception under 840 versus commencement under 842), and other accounting changes.

To evaluate the impact of changes in the definition and measurement of future lease payments I conduct several analyses. First, I examine the changes in the amount and present value of future lease payments during the ASC 842 adoption year and compare them to changes in total and operating assets (excluding ROU assets). I also examine the magnitudes of (1) the change from the estimated ROU asset (in the year prior to the adoption) to the reported ROU asset, and (2) the growth in reported operating assets, which is due in part to the recognition of ROU asset in the adoption year. Table 2 reports the statistics. It shows that the growth rate in total future lease payments in the adoption year (2018, 2019 or 2020, depending on whether the company early adopted the standard and on its fiscal year end) was 13.4% on average, compared to 7.5% average growth in total assets excluding ROU assets. Similarly, the average growth rate in the present value of future lease payments (EstROUAsset) in the adoption year was 11.7%, compared to 6.7% average growth in operating assets excluding the ROU assets. However, conducting the same

comparisons using medians instead of means suggests a slight decline (rather than an increase) in future lease payments, consistent with the new standard substantially increasing (percentagewise) the amount of future lease payments for some firms but slightly reduced it for most firms. Thus, it appears that the implementation of the new standard is associated with a relatively small change in the definition of future lease payments.

The evidence provided in Table 1 indicates that using the present value of future lease payments to estimate the ROU asset under ASC 842 slightly overstates the ROU asset, implying that the present value of future lease payments in the pre-ASC 842 period is likely to overstate the asset that would have been reported if the standard was effective. In addition, the evidence provided in Table 2 suggests that any systematic bias from changes in the definition of future lease payments is likely to be small. Thus, the overall evidence from Tables 1 and 2 suggests that any bias or error from using EstROUAsset to estimate the ROU asset is likely to be relatively small, and clearly smaller than the alternative of ignoring the lease asset and liability in the pre-ASC 842 years (in which case the size of the error would be 100%).

To further evaluate the potential impact of the two sources of error, Figure 2 presents the time-series of cross-sectional (annual) means of the ratio of ROU asset (reported and estimated) to operating assets. The purpose of the figure is to evaluate if using EstROUAsset as a substitute for reported ROU asset for pre-ASC 842 observations induces a systematic bias. The sample consists of annual observations for non-financial/REIT firms during the period 2016 through 2020 using only firms for which (1) ASC 842 information is available for at least one of the three years 2018-2020, (2) observations are available for each of the five years 2016-2020, and (3) sales in each of the five years are at least $100MM in December 2020 prices. Consistent with the evidence in Table 2 of limited impact of changes in the definition of future lease payments, the ratio of

EstROUAsset to operating assets hardly changes after the adoption of the standard (red dotted light). In contrast, switching from EstROUAsset to reported ROU asset (in 2019 for the large majority of observations) results in a small decline in the ratio of ROU asset to operating assets (the blue line).

Summarizing, the results reported thus far suggest that (1) EstROUAsset is a reasonably precise estimate of the ROU asset as measured under ASC 842, and (2) using EstROUAsset as a substitute for reported ROU asset for pre-ASC 842 observations improves the time-series consistency of operating assets. Still, the evidence related to the informativeness of EstROUAsset is indirect and extrapolative. I next turn to a more direct analysis. Specifically, I address the following question: Does adding EstROUAsset to reported operating assets for pre-ASC 842 observations strengthen their relationship with reported sales? I examine this both in the cross-section (within industry-year) and over time (same firm over time).

3.5 Informativeness of the ROU asset adjustment

For the lease adjustment to be informative, the magnitude of EstROUAsset has to be significant. Panel A of Table 3 reports that the mean (median) percentage increase in operating assets due to adding EstROUAsset to pre-ASC 842 observations is 9.3% (3.6%)—clearly a significant adjustment for most firms, and large for many firms. Panel B of Table 3 examines significance of ROU assets across all observations—reported ROU assets under ASC 842, and EstROUAsset for the pre-ASC 842 observations. As shown, the mean (median) ratio of ROU asset to operating assets (including the ROU asset) across all observations is 7.6% (3.4%).

I next examine whether adding the EstROUAsset to reported operating assets for pre-ASC 842 observations strengthens the relationship between sales and operating assets.[18] To understand the potential of improving information content by this adjustment, consider a company that changed its growth strategy from purchasing to leasing fixed assets (e.g., stores).[19] If one predicts the company's revenue based on the historical relationship between asset growth (or capital expenditures) and subsequent revenue, the revenue forecast will be understated as the recently leased assets are omitted from the balance sheet (pre-ASC 842). In contrast, if reported operating assets are adjusted to reflect leased capacity, the asset/subsequent revenue relationship will be maintained, resulting in unbiased revenue forecasts. Similarly, cross-sectional differences in purchasing versus leasing make it difficult to compare operating capacity across companies based on reported assets. For example, firms that tend to lease rather than purchase assets have relatively high asset turnover ratios even if they are less efficient than their peers. Adjusting reported assets to reflect leased operating capacity would eliminate or at least mitigate this distortion. Of course, under ASC 842 leased assets are no longer omitted from the balance sheet, but this issue comes up whenever using pre-2019 information, which is common in academic research and in quant-type analyses. In addition, given the recency of the ASC 842 chance, the omission of ROU assets in pre-ASC 842 information is still relevant when conducting current fundamental analysis, as

[18] All results reported below are similar when examining the relationship between operating assets and next year sales instead of same period sales.

[19] Such changes are quite common. For example, Cornaggia et al. (2013) provide evidence that firms' lease-versus-buy decisions change significantly over time; Mills and Newberry (2005) find that firms use more operating leases when they enter into contractual loan agreements that provide incentives to manage debt ratings (e.g., contracts that use senior debt rating covenants to set interest rates) or when they become closer to violating these debt rating covenants; Graham et al. (1998) document a negative relation between operating leases and tax rates across firms and over time; and Dechow et al. (2011) find that that the use of operating leases is unusually high during years in which firms misstate their financial statements, and that more firms begin leasing in manipulation years (relative to earlier years).

analysts and other valuation specialists typically consider several years of historical financial information when forecasting (e.g., Bancel and Mittoo 2014, Allee et al. 2020).

Table 4 reports statistics from the distribution of percentage errors when estimating sales based on operating assets, that is, as the product of operating assets and the mean ratio of sales to operating assets. The mean ratio is calculated using either firms from the industry-year (Panel A) or the time-series of the firm (Panel B). Operating assets are measured either excluding the right-of-use asset (Excl. ROU) or including it (Incl. ROU). The percentage error is calculated as the ratio of the difference between actual and estimated sales to actual sales. To evaluate the lease adjustment, I calculate and compare the mean absolute percentage error associated with using operating assets that include versus exclude the lease adjustment. As shown in Table 4, the improvement from adjusting pre-ASC 842 operating assets to include the estimated ROU asset is statistically and economically significant, both when evaluating the sales-asset relationship within industry-year or over time for each firm. The improvement is especially large for industry-year or firms with significant leasing activity (defined as mean ratio for the industry-year (Panel A) or for the firm (Panel B) of EstROUAsset to operating assets greater than 10%).

Figure 3 (Figure 4) presents density curves for the 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 assets. The figure suggests large improvement from using operating assets that include the estimated operating lease asset, especially for industries and firms for which leasing is a significant activity.

The lease adjustment is likely to be especially important for firm-specific time-series analysis in the years surrounding the adoption of ASC 842 because of the change in reported operating assets triggered by the standard. I therefore replicate the analysis of Table 4 focusing on

the period 2016 through 2020 and using only firms for which (1) ASC 842 information is available for at least one of the three years 2018-2020, (2) observations are available for each of the five years 2016-2020, and (3) sales in each of the five years are at least $100MM in December 2020 prices. The results are reported in Table 5. As expected, the improvement from adding estimated ROU assets to reported operating assets for pre-ASC 842 observations is particularly large for this subsample. This result implies that making the lease adjustment is important not just for historically oriented academic or quant analysis, but also when conducting fundamental analysis that involves extrapolating from the firm's recent historical performance and activities. Of course, this latter advantage will become less important over time.

5. Summary and conclusion

An important accounting change, which is generally effective since 2019, requires balance sheet recognition of operating lease obligations and right-of-use (ROU) assets. Previously, operating leases were treated as an off-balance sheet activity, like other executory contracts. For many firms, the implementation of the new standard resulted in a large increase in reported operating assets, hence impairing the time-series consistency of metrics that involve operating assets. In addition, the omission of ROU assets in the pre-ASC 842 era reduced the ability of reported operating assets to explain and predict variation in sales across firms and over time.

This paper shows that ROU assets can be estimated quite precisely using lease commitments information, which is available since the late 1970 (fully available on Compustat since 2000). Adding the estimated ROU asset to reported operating assets for pre-ASC 842 observations substantially improves the ability of operating assets to explain cross-sectional and time-series variation in sales. These results suggest that when using historical information,

adjusting reported financial statements to include estimated ROU assets and operating lease obligations using the approach described in this study would increase their informativeness. Ratios calculated using adjusted operating assets measure operating capacity more accurately and are likely to facilitate more precise sales forecasts than those measured using reported operating assets. Given the common use of such ratios in academic research and quant type analyses, this adjustment is potentially important in many settings. In addition, because the accounting change is relatively recent, analysts conducting fundamental analysis that examine more than a few years of historical information may similarly find these adjustments useful.

References

Allee, K.D., Erickson, D., Esplin, A.M. and Yohn, T.L., 2020. The characteristics, valuation methods, and information use of valuation specialists. *Accounting Horizons*, *34*(3), pp.23-38.

Bancel, F. and Mittoo, U.R., 2014. The gap between the theory and practice of corporate valuation: Survey of European experts. *Journal of Applied Corporate Finance*, *26*(4), pp.106-117.

Binfare, M., Connolly, R.A., Grigoris, F. and Liu, C.H., 2020. A new lease on firm behavior. *Available at SSRN 3672699*.

Caskey, J. and Ozel, N.B., 2019. Reporting and non-reporting incentives in leasing. *The Accounting Review*, *94*(6), pp.137-164.

Cornaggia, K. J., L. A. Franzen, and T. T. Simin. 2013. Bringing leased assets onto the balance sheet. *Journal of Corporate Finance* 22 (September): 345–360.

Dechow, P., W. Ge, C. Larson, and R. Sloan. 2011. Predicting material accounting misstatements. *Contemporary Accounting Research* 28 (1): 17–82.

Graham, J. R., M. L. Lemmon, and J. S. Schallheim. 1998. Debt, leases, taxes, and the endogeneity of corporate tax status. *Journal of Finance* 53 : 131–62.

Imhoff, E.A., R.C. Lipe, and D.W. Wright. 1991. Operating leases: Impact of constructive capitalization. *Accounting Horizons* 5: 51-63.

Lim, S., S. Mann, and V. Mihov, 2017. Do operating leases expand credit capacity? Evidence from borrowing costs and credit ratings, Journal of Corporate Finance 42: 100-114.

Ma, M.S. and Thomas, W.B., 2021. Economic consequences of operating lease recognition. Available on SSRN.

Mills, L. F., and K. J. Newberry. 2005. Firms' off–balance sheet and hybrid debt financing: Evidence from their book-tax reporting differences. *Journal of Accounting Research* 43: 251–82.

Nissim, D. 2022a. Earnings quality. Columbia Business School. Available at https://ssrn.com/abstract=3794378.

Nissim, D. 2022b. Reformulated financial statements. Columbia Business School. Available at https://ssrn.com/abstract=4064722.

Petersen, M.A. 2009. Estimating standard errors in finance panel data sets: Comparing approaches. *Review of Financial Studies* 22 (1): 435-480.

Table 1: Accuracy of right-of-use asset estimate

	Obs.	Mean	StdDev	P5	Q1	Median	Q3	P95
EstOblig / RepOblig	3,903	1.031	0.093	0.940	0.977	1.007	1.056	1.214
EstROUAsset / RepROUAsset	3,684	1.133	0.184	0.952	1.017	1.089	1.204	1.481
RepROUAsset / RepOblig	3,791	0.920	0.097	0.739	0.877	0.944	0.983	1.016
RepWA_DR	3,980	5.1%	2.0%	2.6%	3.8%	4.7%	6.0%	8.8%
EstDR – RepWA_DR	3,980	-0.1%	1.9%	-2.5%	-1.5%	-0.5%	0.7%	3.5%

The sample consists of annual observations for non-financial/REIT firms during the period 2018 through 2021 for which (1) reported ROU asset or lease obligation is available, and (2) sales are at least $100MM in December 2020 prices. The variables are defined as follows:
EstOblig = estimated operating lease obligation, calculated as described in Section 3.
RepOblig = reported operating lease obligation.
EstROUAsset = estimated ROU asset.
RepROUAsset = reported ROU asset.
RepWA_DR = disclosed weighted average discount rate used by the firm in calculating the operating lease liability.
EstDR = cross-section median effective interest rate on LT debt, which is used in estimating the lease obligation.

Table 2: Consistency around ASC 842

	Obs.	Mean	StdDev	P5	Q1	Median	Q3	P95
GrMLP	1,945	13.4%	57.4%	-41.0%	-13.6%	-1.2%	21.1%	120.9%
GrTA_ExROUAsset	2,062	7.5%	24.1%	-18.7%	-3.6%	3.0%	12.3%	55.2%
GrMLP - GrTA_ExROUAsset	1,942	4.6%	61.8%	-70.9%	-20.6%	-5.0%	17.4%	108.4%
GrEstROUAsset	1,949	11.3%	52.5%	-42.5%	-13.3%	-1.4%	19.8%	112.5%
GrOA_ExROUAsset	2,060	6.7%	24.5%	-20.3%	-4.0%	1.8%	10.4%	53.0%
GrEstROUAsset - GrOA_ExROUAsset	1,938	2.8%	53.8%	-69.2%	-19.4%	-3.8%	15.9%	97.0%
GrROUAsset (estimated to reported)	1,828	0.8%	49.5%	-53.2%	-24.4%	-9.7%	9.1%	96.5%
GrROUAsset - GrOA_ExROUAsset	1,819	-7.0%	51.9%	-76.2%	-29.8%	-11.7%	6.7%	83.3%
GrRepOA	2,068	16.3%	31.9%	-15.5%	-0.1%	7.5%	21.8%	80.8%
GrRepOA - GrOA_ExROUAsset	2,066	8.0%	13.2%	0.0%	1.5%	3.4%	7.9%	36.7%

The sample consists of annual observations for non-financial/REIT firms for the fiscal year of ASC 842 adoption (2018, 2019 or 2020, depending on whether the company early adopted the standard and on the fiscal year end) for which (1) reported ROU asset or lease obligation is available, and (2) sales are at least $100MM in December 2020 prices. The variables are defined as follows:
GrMLP = growth rate in total future lease payments.
GrTA_ExROUAsset = growth rate in total assets excluding ROU asset.
GrEstROUAsset = growth in estimated ROU asset, where EstROUAsset is calculated as described in Section 3.
GrOA_ExROUAsset = growth in operating asset excluding reported/estimated ROU asset. Operating assets is measured as described in Nissim (2022b).
GrROUAsset = RepROUAsset / prior year EstROUAsset - 1.
GrRepOA = growth in operating asset measured without including EstROUAsset in the prior year and without excluding RepROUAsset in the adoption year.

Table 3: Significance of the lease adjustment and right-of-use assets

Panel A: Pre-ASC 842 observations

	Obs.	Mean	StdDev	P5	Q1	Median	Q3	P95
EstROUAsset / OA excluding EstROUAsset	60,042	9.3%	16.0%	0.0%	1.2%	3.6%	9.2%	43.0%
OA excluding EstROUAsset / Sales	60,369	1.247	1.016	0.323	0.607	0.934	1.493	3.350
Operating assets (OA) / Sales	60,350	1.332	1.022	0.377	0.699	1.015	1.590	3.439

Panel B: All observations

	Obs.	Mean	StdDev	P5	Q1	Median	Q3	P95
Reported or estimated ROU Asset / OA	65,953	7.6%	11.1%	0.0%	1.1%	3.4%	8.6%	33.6%
OA excluding ROUAsset / Sales	65,515	1.277	1.053	0.326	0.616	0.950	1.532	3.455
Operating assets (OA) / Sales	65,498	1.361	1.058	0.380	0.707	1.030	1.625	3.541

The sample consists of annual observations for non-financial/REIT firms during the period 2000 through 2020, with sales of at least $100MM in December 2020 prices. EstROUAsset is estimated ROU asset, calculated as described in Section 3. Operating assets is measured as described in Nissim (2022b).

Table 4
Impact of the lease adjustment on the relationship between sales and operating assets

	Mean absolute % error					
	Excl. ROU	Incl. ROU	Difference	t-statistic	% difference	Obs.
Panel A: Industry-year cross-sectional analysis						
All observations	37.1%	36.0%	-1.1%	-11.3	-3.0%	62,405
Significant leasing	37.4%	34.8%	-2.6%	-6.5	-6.9%	12,576
Panel B: Firm-specific time-series analysis						
All observations	18.8%	18.0%	-0.8%	-4.3	-4.1%	63,996
Significant leasing	17.6%	15.3%	-2.3%	-4.0	-13.0%	13,856

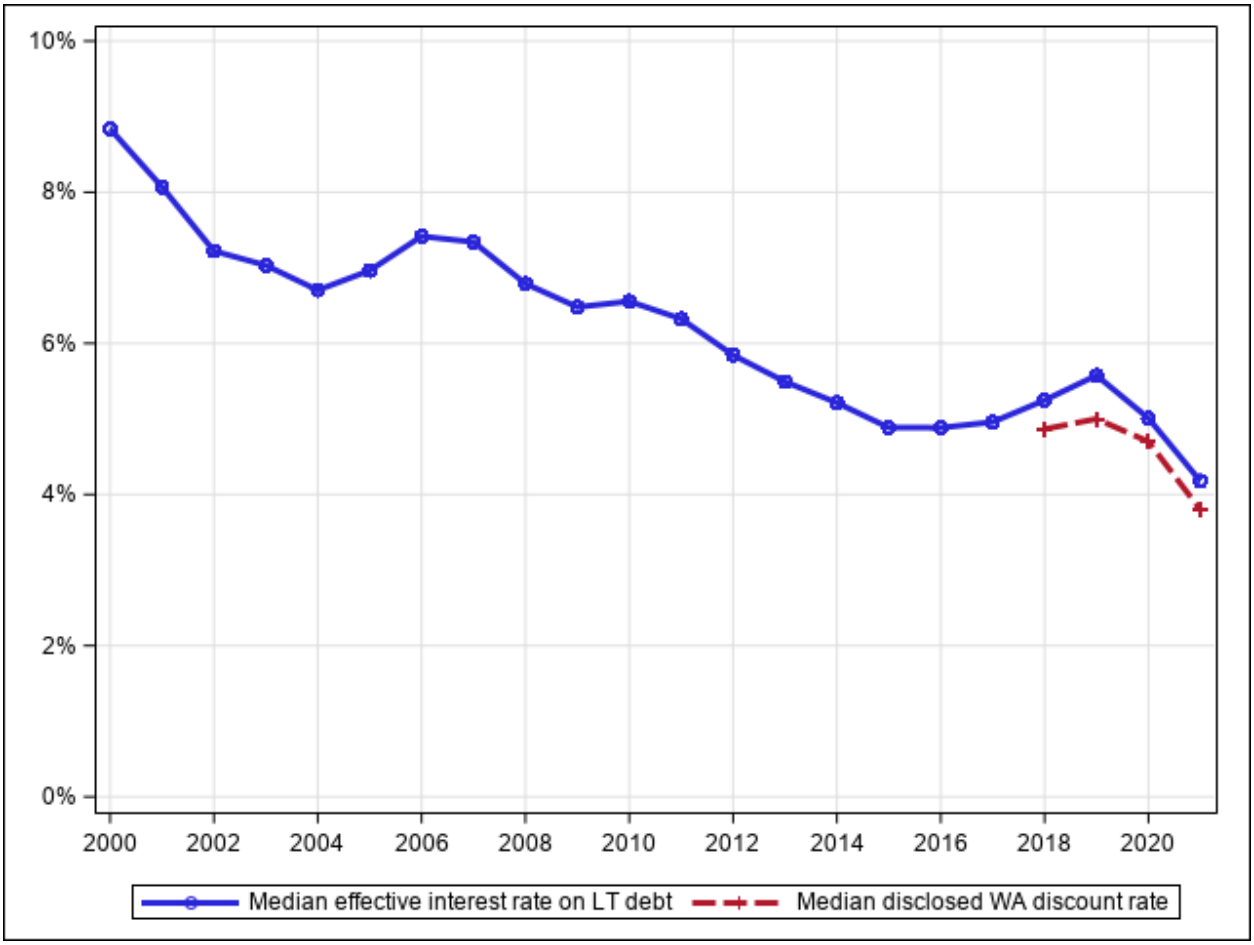
The table reports statistics from the distribution of percentage errors when estimating sales based on operating assets, that is, as the product of operating assets and the mean ratio of sales to operating assets. The mean ratio is calculated using either firms from the industry-year (Panel A) or the time-series of the firm (Panel B). Operating assets are measured either excluding the right-of-use asset (Excl. ROU) or including it (Incl. ROU). Absolute percentage error is the absolute value of the ratio of the difference between actual and estimated sales to actual sales. The sample consists of annual observations for non-financial/REIT firms during the period 2000 through 2020, with sales of at least $100MM in December 2020 prices. (For the industry-year analysis 2020 observations are excluded because ASC 482 is effective for all public firms after December 2019.) Observations belonging to industry-year (firm) with only one observation are excluded from Panel A (Panel B). Firm-year observations are classified as "significant leasing" if the mean ratio (for the industry-year in Panel A or for the firm in Panel B) of EstROUAsset to operating assets is greater than 10%. EstROUAsset is calculated as described in Section 3, and operating assets is measured as described in Nissim (2022b). The t-statistics are calculated using two-ways (firm and year) clustered standard errors (Petersen 2009).

Table 5
Impact of the lease adjustment on the relationship between sales and operating assets in the years surrounding the adoption of ASC 842

	Mean absolute % error					
	Excl. ROU	Incl. ROU	Difference	t-statistic	% difference	Obs.
Panel A: Industry-year cross-sectional analysis						
All observations	37.8%	36.8%	-1.0%	-6.9	-2.6%	6,780
Significant leasing	35.7%	33.6%	-2.1%	-2.5	-5.9%	954
Panel B: Firm-specific time-series analysis						
All observations	23.1%	21.0%	-2.1%	-16.4	-9.1%	8,459
Significant leasing	24.3%	17.7%	-6.7%	-13.5	-27.4%	1,856

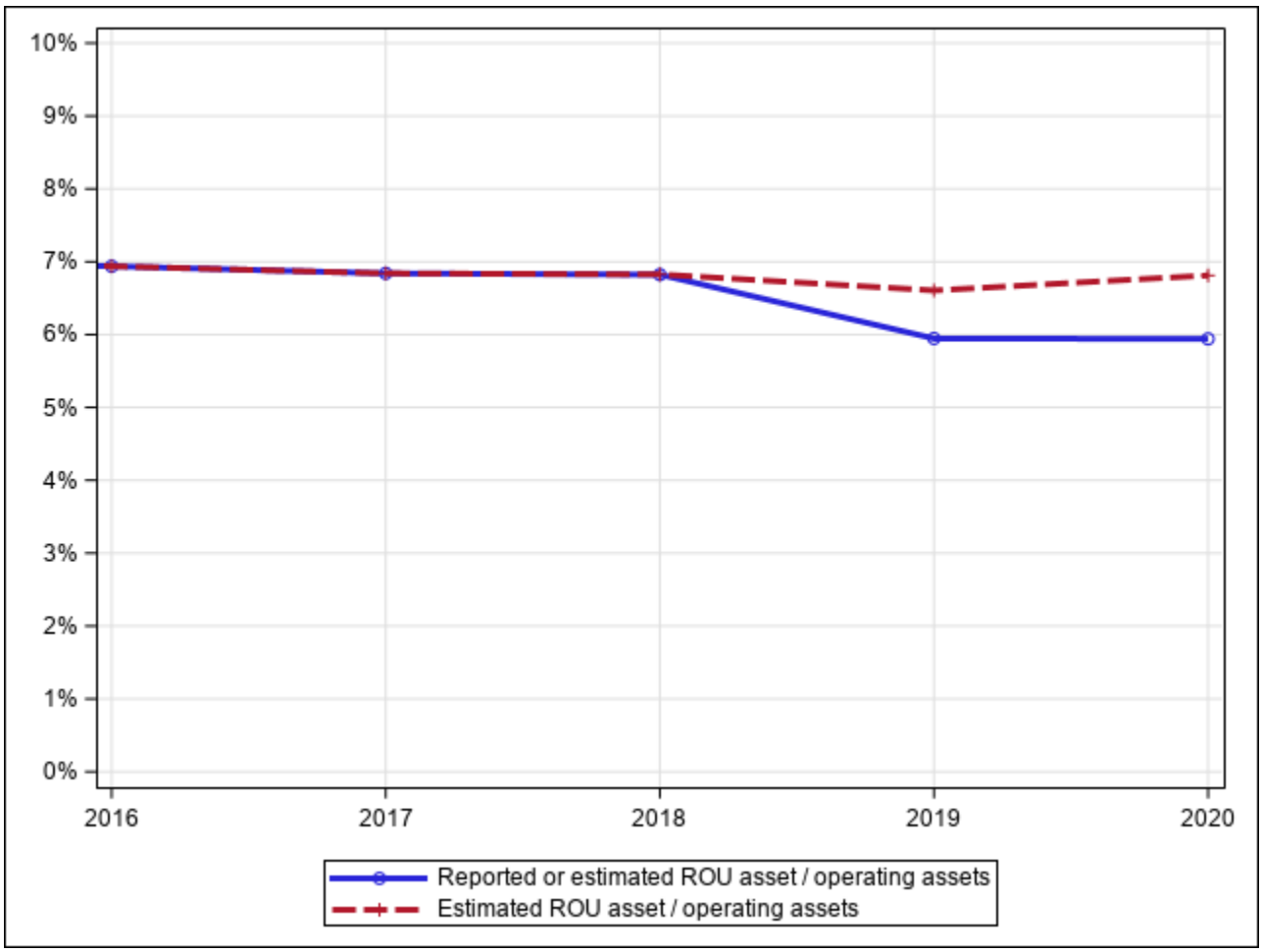
The table reports statistics from the distribution of percentage errors when estimating sales based on operating assets, that is, as the product of operating assets and the mean ratio of sales to operating assets. The mean ratio is calculated using either firms from the industry-year (Panel A) or the time-series of the firm (Panel B). Operating assets are measured either excluding the right-of-use asset (Excl. ROU) or including it (Incl. ROU). Absolute percentage error is the absolute value of the ratio of the difference between actual and estimated sales to actual sales. The sample consists of annual observations for non-financial/REIT firms during the period 2016 through 2020 using only firms for which (1) ASC 842 information is available for at least one year, (2) observations are available for each of the five years, and (3) sales in each of the five years are at least $100MM in December 2020 prices. (For the industry-year analysis 2020 observations are excluded because ASC 482 is effective for all public firms after December 2019.) Observations belonging to industry-year (firm) with only one observation are excluded from Panel A (Panel B). Firm-year observations are classified as "significant leasing" if the mean ratio (for the industry-year in Panel A or for the firm in Panel B) of EstROUAsset to operating assets is greater than 10%. EstROUAsset is calculated as described in Section 3, and operating assets is measured as described in Nissim (2022b). The t-statistics are calculated using firm clustered standard errors (due to the small number of years, I do not cluster by year).

Figure 1: Discount rate for operating leases



The sample used in preparing this figure consists of annual observations for non-financial/REITs firms during the period 2000 through 2021, with sales of at least $100MM in December 2020 prices. Coverage for 2021 is incomplete, and the disclosed weighted average discount rate in 2018 relates to a small set of early adopting firms.

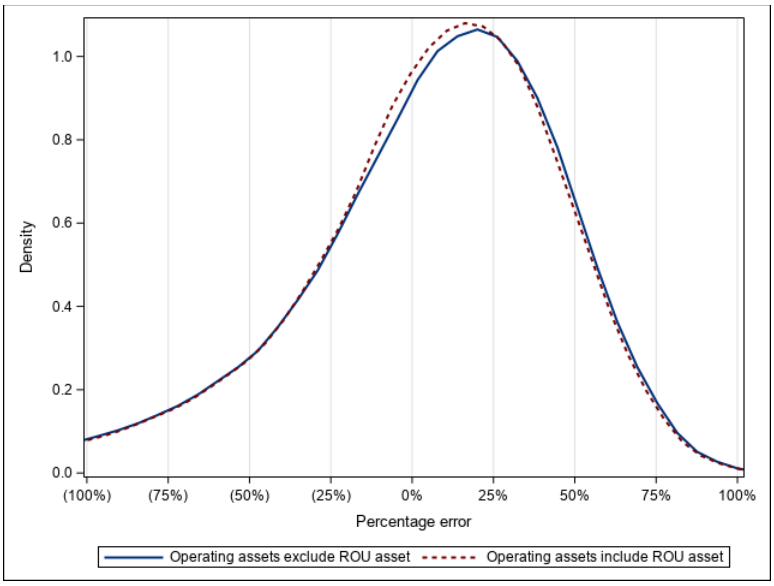
Figure 2: Consistency around the accounting change



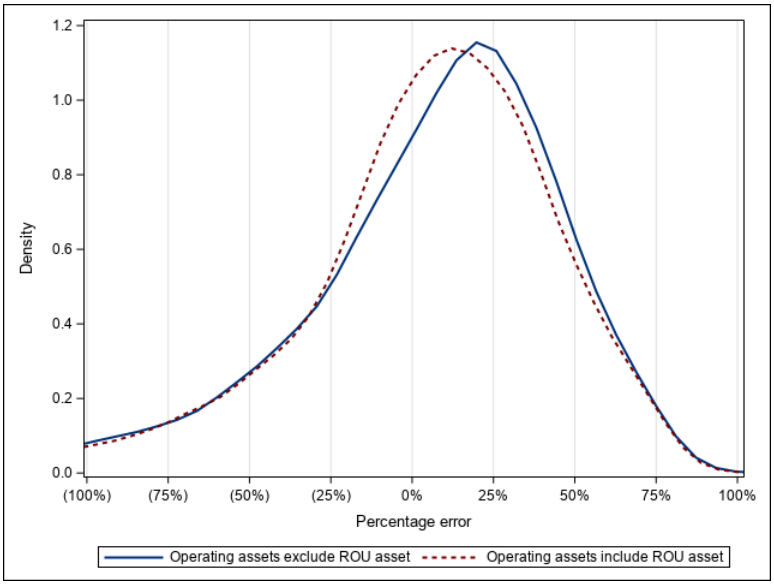
The figure presents the time-series of cross-sectional (annual) means of measures of the magnitude of the ROU asset relative to operating assets. The sample consists of annual observations for non-financial/REIT firms during the period 2016 through 2020 using only firms for which (1) ASC 842 information is available for at least one year, (2) observations are available for each of the five years, and (3) sales in each of the five years are at least $100MM in December 2020 prices. EstROUAsset is calculated as described in Section 3, and operating assets is measured as described in Nissim (2022b).

Figure 3: Percentage error when estimating sales based on operating assets – industry-year cross-sectional analysis

Panel A: All observations (62,405)



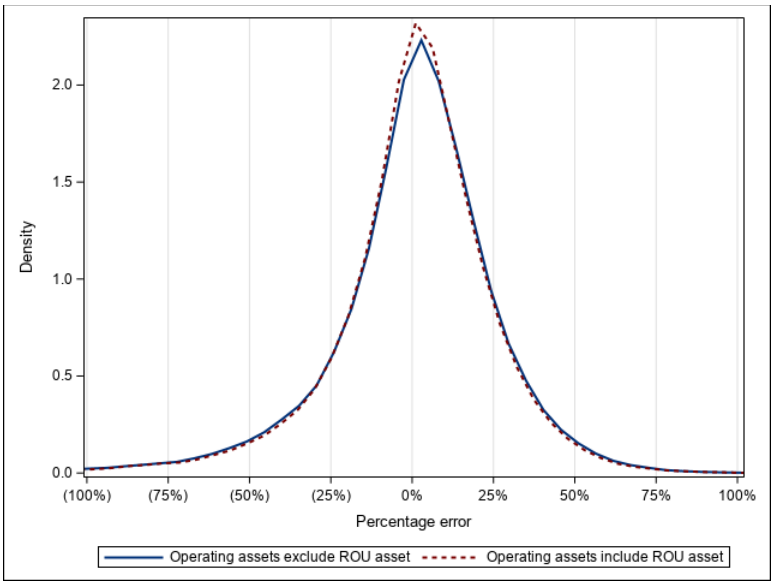
Panel B: Observations from industry-year with significant leasing activity (12,576)



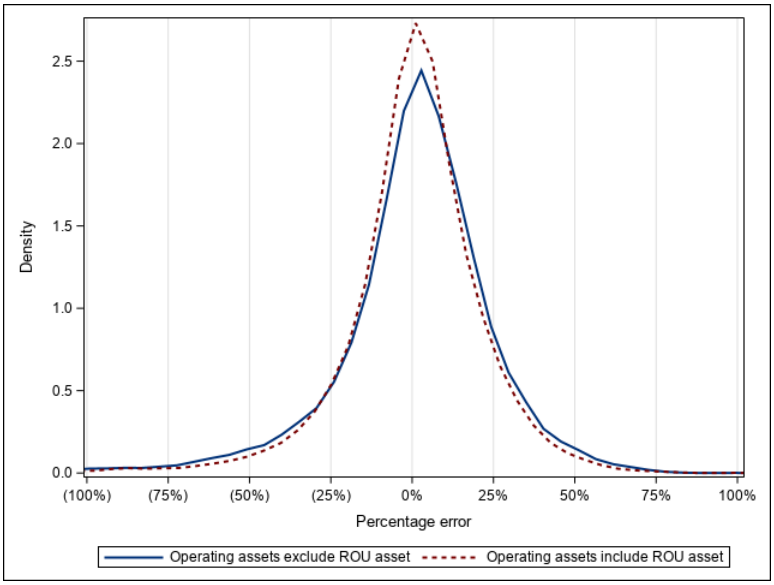
The figures present density curves for the percentage errors when estimating sales based on operating assets, that is, as the product of operating assets and the mean ratio of sales to operating assets for the industry-year. The percentage error is the ratio of the difference between actual and estimated sales to actual sales. The sample consists of annual observations for non-financial/REIT firms during the period 2000 through 2019, with sales of at least $100MM in December 2020 prices. (The year 2020 is excluded because ASC 482 is effective for all public firms after December 2019.) Observations belonging to industry-year with only one observation are excluded. Firm-year observations are classified as "significant leasing" if the mean ratio of EstROUAsset to operating assets is greater than 10%. EstROUAsset is calculated as described in Section 3, and operating assets is measured as described in Nissim (2022b). The curves are estimated using a nonparametric kernel density.

Figure 4: Percentage error when estimating sales based on operating assets – firm-specific time-series analysis

Panel A: All observations (63,996)



Panel B: Firms with significant leasing activity (13,856)



The figures present density curves for percentage errors when estimating sales based on operating assets, that is, as the product of operating assets and the mean ratio of sales to operating assets for the firm. The percentage error is the ratio of the difference between actual and estimated sales to actual sales. The sample consists of annual observations for non-financial/REIT firms during the period 2000 through 2020, with sales of at least $100MM in December 2020 prices. Observations belonging to firm with only one observation are excluded. Firm-year observations are classified as "significant leaing" if they relate to firms with mean ratio of EstROUAsset to operating assets greater than 10%. EstROUAsset is calculated as described in Section 3, and operating assets is measured as described in Nissim (2022b). The curves are estimated using a nonparametric kernel density.