

Explaining Corporate Capital Structure: Product Markets, Leases, and Asset Similarity*

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ABSTRACT

Better measurement of the output produced and capital employed by firms substantially improves the ability to explain capital structure variation in the cross-section. For every firm, we construct the set of other firms producing the same output using the set of product market competitors listed in the firm's public SEC filings. In addition, we improve measurement of capital structure by explicitly accounting for leased capital. These two steps increase the explanatory power of the average capital structure of other firms producing similar output on a firm's capital structure by 50 to 75%, compared to the use of the average unadjusted debt ratio of other firms in the same 3-digit SIC code. We provide evidence that the large explanatory power of the capital structure of other firms producing similar output is related to the assets used in the production process. Our findings suggest that what a firm produces and the assets used in production are the most important determinants of capital structure in the cross-section.

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Despite decades of research, there is much disagreement about the cross-sectional determinants of corporate capital structure. While there are strong patterns in the data (Frank and Goyal (2009)), the explanatory power of variables in the cross-section remain disappointing (Lemmon, Roberts, and Zender (2008)). One conclusion that some might draw from this state of affairs is that we know very little about the theoretical determinants of capital structure.

We propose an alternative explanation: the standard empirical proxies for capital structure and its determinants are measured with significant error, and measurement error typically biases coefficient estimates toward zero and reduces explanatory power. When the empirical proxies are improved, the explanatory power also improves.

We focus on two specific sources of error: the measurement of what firms sell and the measurement of the capital firms employ. There are strong theoretical arguments that two firms producing the same output should have similar capital structures. Indeed, the many frictions that might generate departures from Modigliani and Miller (1958) — such as costs of financial distress (Titman (1984)), asymmetric information (Myers and Majluf (1984)), and contracting costs (Williamson (1988)) — are likely to be similar for firms with similar cash-flow generating processes. Furthermore, theories based on incentive conflicts (Myers (1977), Jensen and Meckling (1976), Jensen (1986), Hart and Moore (1994)) generally imply that the extent to which assets may be pledged as collateral will affect leverage ratios. This pledgeability is in part a function of the fundamental properties of the assets employed in production. If the empirical proxies for the goods produced by a firm and the capital employed by the firm are measured with significant error, then a researcher may mistakenly discredit these theories as having little explanatory power.

We make two adjustments in order to more accurately measure the goods a firm produces and the capital it utilizes. First, we explicitly account for leased capital employed in the production process. In particular, we capitalize operating lease commitments and consider this capitalized value a part of property, plant and equipment (PP&E) and total capital. A number of studies suggest that leasing is a critical element of capital structure, notably Ang and Peterson (1984), Smith and Wakeman (1985), Sharpe and Nguyen (1995), Graham, Lemmon, and Schallheim (1998), Eisfeldt and Rampini (2009). Yet the extant literature that tries to explain cross-sectional variation in capital structure has ignored operating leases. We utilize data on operating lease commitments from a combination of two Standard & Poor's datasets: *Compustat* and *Capital IQ*. We capitalize these operating lease expenses to get an estimate of the total capital leased by a firm.

Second, for every firm in our sample, we obtain a measure of the set of firms that operate in the same product market from *Capital IQ (CIQ)*. More specifically, *CIQ* lists a set of competitors for almost every public firm in their database where the set of competitors is gleaned from company SEC filings. We demonstrate that many operating characteristics of a firm's competitors in *CIQ* are highly correlated with the same variables for the firm in question. The correlations are substantially larger than the correlations obtained using firms in the same 3-digit SIC code (SIC3).¹ We also present network graphs that demonstrate that SIC codes do a poor job of accurately capturing firms' competitors as listed by firms in their own SEC filings.

With these two adjustments, we show that the capital structure of firms that produce similar output has much better explanatory power in the cross-section. The starting point is the cross-sectional regression that relates the book leverage ratio (without leases) as of 2008 to the

¹ Hoberg and Phillips (2009a, 2009b) use textual analysis to define industries and also find improvements in explaining operating activities relative to SIC codes. We discuss the differences between our methodology and their methodology in Section 2.

most powerful predictor of leverage in the existing literature: the average leverage ratio of firms in the same SIC3 (Frank and Goyal (2009), Lemmon, Roberts, and Zender (2008)). This baseline regression produces an adjusted R^2 of 0.20. When we take into account leases (i.e., leverage measured as debt plus leased capital scaled by the sum of owned assets and leased assets) and include the average leverage ratio of firms that produce the same good according to *CIQ*, the adjusted R^2 increases to 0.30. If we weight the regression by the number of competitors for a given firm to give more emphasis to larger competitor groups that are likely more accurate, the adjusted R^2 increases to 0.35.

The average capital structure of firms producing the same output explains more of the variation in capital structure than any other determinant. To put the explanatory power in context, the average leverage ratio of firms producing the same good has an adjusted R^2 of 0.29. Adding the five main firm-specific characteristics used in the extant literature (asset tangibility, the market-to-book ratio, profitability, cash flow variance, and size) increases the adjusted R^2 by only 0.03. Further inclusion of the average leverage ratio of firms in the same SIC3 increases the adjusted R^2 by only another 0.01. If we then remove the average leverage ratio of firms producing the same output, the adjusted R^2 declines to 0.28. In other words, the incremental explanatory power of the average leverage ratio of firms producing the same good is larger than the incremental explanatory power of all other six determinants combined.

Why is capital structure so highly correlated with the output a firm produces? Any theory of capital structure that is based on the properties of a firm's free cash flows fundamentally links the properties of its production process to capital structure. For example, if there are direct or indirect costs of financial distress, these will vary with the business activities of the firm. If asymmetric information affects capital structure, then assets about which there is more

asymmetric information will be more difficult to finance with outside equity. The nature of agency costs would also be closely related to the properties of the firm's business activities: the ability of firms to pledge assets or cash flows from those assets varies with the properties of the assets such as their tangibility.

Along these lines, we present suggestive evidence that capital structure is closely related to the output a firm produces because of the similarity of the assets used in the production process. The first piece of evidence comes from examining the correlation between each of the standard determinants of capital structure (asset tangibility, the market-to-book ratio, cash flow, cash flow variance, and size) for any given firm to the same variables for other firms producing similar goods. Among the standard determinants, the correlation is by far strongest for asset tangibility. More specifically, a regression of the asset tangibility of a given firm on the asset tangibility of firms producing a similar good yields an adjusted R^2 of 0.67. The next strongest correlation among the standard determinants is cash flow where a similar regression yields an adjusted R^2 of only 0.30.

Firms operating in the same product market show remarkable homogeneity in the factors used in production. There is a strong correlation with the *type* of tangible assets employed: for example, a regression of the ratio of machines and equipment to total property, plants, and equipment on the same ratio of firms in the same product market yields an adjusted R^2 of 0.44. The adjusted R^2 when examining capital to labor ratios is 0.77.

We then show that of all the main capital structure determinants of competitors, the average asset tangibility of competitors is the strongest predictor of a given firm's capital structure. Average asset tangibility of competitor firms alone explains 16% of cross-sectional leverage ratio variation; in contrast, the next strongest predictor—the average market-to-book

ratio of competitors—explains only 4% of the variation. The combined marginal impact over competitor tangibility of all of the other competitor variables is only 1%.

The importance of product market asset tangibility for leverage is consistent with the theories that closely tie capital structure to the nature of the assets that the capital is backing. To further investigate this connection, we also study capital structure at a more granulated level by examining the individual types of debt (Rauh and Sufi (2010)). We find that the R^2 between the share of a firm's capital structure in capitalized operating leases and the same share for the firm's product market competitors is 0.49. For secured debt, mortgages, collateralized leases and bank debt, the R^2 is 0.10-0.13, while for convertibles and subordinated debt the explanatory power is very small. The correlation of debt usage among firms producing the same output is strongest for debt that is most closely tied to the assets used in production.

Finally, we group firms into product markets and examine capital structure at the product market level. Unlike SIC codes, our product markets are derived directly from information on competitors provided by firms in SEC filings. We show in a product market level analysis that asset tangibility is the strongest predictor of capital structure. In other words, the across product market variation in capital structure is most closely related to the assets used in production.

The rest of our study proceeds as follows. In the next three sections, we describe the initial sample and our measures of leased capital and product market competitors. We also relate our construction of leasing and product market variables to extant research in these areas. In Section 4, we examine how improved measures of firm capital and product market groups lead to larger explanatory power for the cross-section of corporate capital structure. In Section 5, we present evidence that the strong correlation of leverage ratios within competitor groups is related to the assets used in the production of similar goods. Section 6 concludes.

1. Initial Sample

Our initial sample begins with 4,418 *Compustat* non-financial ($sic < 6000$ or $sic > 6999$) parent ($stko = 1$ or $stko = 3$) firms incorporated in the United States ($fic = USA$) with strictly positive total assets ($at > 0$) as of 2008. We exclude firms with missing data on sales, common shares outstanding, stock price, and lagged total assets, which leaves 4,142 firms.

We also exclude 528 firms with less than \$10 million total capital, where total capital is the sum of total assets and the capitalized value of operating lease commitments.² These very small firms exhibit an extreme distribution on several main determinants of capital structure. For example, almost 80% have negative operating income. We also exclude any firm that experiences extreme asset growth or shrinkage in 2008, where extreme is defined as 300% for asset growth and -66% for asset shrinkage (105 firms). Finally, we exclude 133 “underwater” firms that have total book assets that are less than 90% of total book liabilities. This latter restriction allows us to avoid “winsorizing” leverage ratios, which can dramatically alter the R^2 in leverage regressions. This leaves a final sample of 3,376 firms.

We focus only on the cross-section of firms as of 2008 for two reasons. First, as noted by Lemmon, Roberts, and Zender (2008), “the majority of variation in capital structure is time-invariant.” As Leary and Roberts (2009) note: “...cross-sectional, as opposed to time-series, variation in leverage ratio is arguably the larger mystery in the capital structure puzzle.” The extant research strongly argues that cross-sectional variation in corporate capital structure is where researchers should focus. Second, the set of competitors from SEC filings collected by *CIQ* is available only as of January 2010. As a result, the set of competitors is most accurate for the latest version of *Compustat* available, which at the time of this writing is 2008.

² We describe our calculation of leased capital in the next section.

The top panel of Table 1 present summary statistics for the book leverage ratio and the main determinants of capital structure traditionally used in the literature. The construction of the variables is described in the online appendix. In the top panel, we follow the extant literature and ignore the capitalized value of operating leases. One important note is that only the operating income ratios and the market-to-book ratio are winsorized at the 1st and 99th percentile. We do not winsorize the leverage ratio, which is important given that variation in the leverage ratio is the key element we are trying to explain. The means and medians of the main determinants are in line with those found in previous research. On average, firms have 82 other firms in their SIC3, although the distribution is skewed by a few very large industries. There are 27 firms that do not have any other firms in the same SIC3.

In the next two sections, we describe how we improve on the measures in Panel A of Table 1 by incorporating operating leases and a better measure of firms producing similar goods.

2. Operating Leases and Measuring Capital

Our first goal in this paper is to investigate the possibility that the correlation between firm capital structure and industry capital structure is stronger than previously thought, once firms' assets and liabilities are more accurately measured by accounting for operating leases.

A. Areas of Existing Research

Although operating leases have not to our knowledge been incorporated in large-sample studies that attempt to explain capital structure, a number of papers have posited and even demonstrated that operating leases are an important consideration for firms. A large literature examines the correlation between 1.) nonlease debt levels and tax rates and 2.) lease levels and tax rates (notably Ang and Petersen (1984), Graham, Lemmon and Schallheim (1998)) in order

to understand whether debt and leases are substitutes or complements.³ More recently, Eisfeldt and Rampini (2009) have argued that ignoring operating lease commitments is likely to understate firm's true degree of leverage (see also Rampini and Viswanathan (2010a, 2010b)).

Regardless of whether leases and nonlease debt are complements or substitutes, it is clear that secured debt and leases have much in common in that they represent cash flow commitments the borrower or lessee must make to continue using the asset. However, a key difference between debt and leases is the treatment in bankruptcy. Sharpe and Nguyen (1995) and Eisfeldt and Rampini (2009) show that firms facing a high cost of raising capital can raise cheaper capital by leasing. Eisfeldt and Rampini (2009) in particular argue that the repossession of a leased asset in bankruptcy is substantially less costly than foreclosure on the collateral of a secured loan.

We note that the lack of accounting for the capitalized value of operating leases is not the only way in which a firm's balance sheet may fail to reflect the value of its capital or liabilities. For example, pension obligations have been shown to be an important component of corporate capital structure for firms that sponsor defined benefit pension plans (Shivdasani and Stefanescu (2010), Rauh (2009)). However, since large unfunded pension obligations are concentrated in relatively few industries, they would have a much smaller impact on the correlations between firm capital structure and industry capital structure than a factor such as leases.⁴

B. Discounting and Valuing Operating Leases

³ Ang and Petersen (1984) highlight the so-called "leasing puzzle", namely that the use of debt appeared to be positively associated with leases. At a basic level, they find that firms with lease commitments use more debt than firms without lease commitments. Graham, Lemmon, and Schallheim (1998) present the "first unambiguous evidence supporting the hypothesis that low tax rate firms lease more, and have lower debt levels, than high tax rate firms" by calculating a before-interest marginal tax rate so as to circumvent the endogenous relation between tax rates and debt through interest payments. Other papers that weigh in on the "substitutes or complements" debate include Lewis and Schallheim (1992) and Yan (2006).

⁴ Pension obligations might be expected to have a larger effect on regressions at the industry and product market levels, such as those we present in Table 10.

We extend these insights to the consideration of cross-sectional variation in capital structure, particularly leverage ratios. For accounting purposes, there are two different types of leases: operating leases and capital leases. In a capital lease, the lessee's books treat the assets backed by the lease as though they have been acquired; a corresponding capitalized lease liability appears on the liability side of the balance sheet. In an operating lease, the lease payments are simply expensed and no asset or liability is recognized. Firms must recognize a lease as a capital lease under certain FASB-specified conditions in which the lessee uses the asset for most of the asset's life. The IRS also maintains categories of "true tax" and "non-tax" lease which broadly correspond to operating and capital leases, although there are important differences.⁵

Given the similarity between a lease and a secured debt issue, we integrate debt and leases by calculating a present value of operating lease commitments and considering that present value (as well as the already capitalized leases) as both an asset and a debt secured against the asset.

The literature has used several different methods of capitalizing operating lease commitments. Yan (2006) computes the present value of reported minimum contractual commitments under the 5-year schedule of operating lease commitments reported in company footnotes according to SFAS 13 standards. In individual analytical examples, Damodaran (2006, pages 87-88) takes the present value of reported minimum contractual commitments under the 5-year schedule and includes years 6 and beyond using the item operating leases beyond 5 years. He makes a judgment about how to spread out the total lease payments beyond year 5 based on the ratio of the lease commitment beyond year 5 to the average annual lease commitment over

⁵ See Berk and DeMarzo (2007), Chapter 25 for more details.

the first 5 years. Graham, Lemmon and Schallheim (1998) use the current rental expense plus the present value of operating leases commitments for the next 5 years.⁶

In addition to the decision of what cash flows to discount, capitalizing operating leases requires a decision about what discount rate to use. Again, the literature has used a range of assumptions, including: a flat 10% (Graham, Lemmon and Schallheim (1998)); the firm's average interest rate on short-term borrowings (implemented by Eisfeldt-Rampini (2009) and Sharpe and Nguyen (1995) by using data105 from *Compustat*); and the cost of debt based on the firm's own bond yields or rating (Damodoran (2006)).

These methods all have merits. Our method most closely adheres to Damodoran (2006) as we have access to electronic data containing the complete information from the 10-K footnotes on lease commitments. We therefore take the present value of reported minimum contractual commitments under the 5-year schedule, calculating an approximate life of the annuity beyond year 5 by examining the ratio $N = [\text{lease commitment beyond year 5}] / [\text{average annual commitment over the first 5 years}]$.

Given the analysis of Eisfeldt and Rampini (2009), it seems that a starting point for an appropriate discount rate would be the rate the firm would have to pay on a secured debt issue. Losses in bankruptcy on leased equipment are likely to be small, as the lessor can repossess the equipment in the event of default, so if anything an even lower rate should probably be used. Another desirable feature of a discounting procedure would be that it accounts for the term structure of interest rates. At the same time, we do not want to introduce mechanical correlations between our credit ratings and the credit quality of the firm.

⁶ Lim, Mann, and Mihov (2005) view these methods as understating total leases. They calculate the present value of leases at time t as the average of current year rental expense and the next year's minimum operating lease payments, discounted as a perpetuity.

We therefore discount operating lease commitments using the yield curve for A-rated corporate debt, collected from Bloomberg and stripped so as to obtain a zero-coupon curve. On that curve, the one-year yield was 3.5% in June 2008 and 3.4% in December 2008. The five-year yield was 5.1% in June 2008 and 4.8% in December 2008. The ten-year yield was 5.8% in June 2008 and 5.7% in December 2008. The twenty-year yield was 6.3% in June 2008 and 6.2% in December 2008. The yield curve on the calendar day at the end of each firm's fiscal year is used to discount its operating lease commitments.

C. Operating Lease Data

The data on operating leases come from *CIQ* and *Compustat*, which derive them from the footnote on operating lease commitments in 10-K filings.⁷ The summary statistics in Table 1 show the effect of including operating leases on leverage ratios and operating ratios. At the mean, debt excluding operating lease commitments is 21.8% of book assets, and PP&E is 26.5% of book assets. When capitalized operating leases are treated as both debt and PP&E, the mean leverage ratio rises to 27.7% and the mean tangibility ratio rises to 31.9%. The inclusion of capitalized operating leases increases leverage by 25% and increases tangibility by around 20%.

Incorporating operating leases as a form of capital also requires adding back the rental expense to operating cash flows. Operating income before depreciation rises from an average of 6.8% to an average of 8.3% once the rental expense is added back. We also adjust the market-to-book ratio by adding back to both the numerator and denominator the capitalized value of operating lease commitments.

D. Effects of Operating Lease Capitalization on Capital Structure within Industries

In this section, we present figures which suggest that ignoring operating leases leads to a significant overestimation of within-industry variation in leverage ratios. Figure 1 plots the

⁷ For more information on the operating lease commitment data, see the online appendix.

distribution of book leverage ratios ignoring leases (left column) and including leases (right column). Each row of the figure shows one SIC2 group. These four industries were selected because they represent the industries that have the largest decline in the coefficient of variation (standard deviation scaled by the mean) for leverage ratios when taking into account leases. In selecting these industries we limited the analysis to SIC2 groups with at least 20 firms. Among these large industries, the coefficient of variation drops in every industry when we include leases in the leverage ratio.

The first row in Figure 1 examines the industry for which the inclusion of leased capital decreases the coefficient of variation the most (a drop from 1.4 to 0.3), “Retail Trade: Apparel & Accessory Stores.” The left panel illustrates why ignoring operating leases leads to skewed distributions and large amounts of within-industry variation in leverage ratios. When leases are taken into account (right panel), the distribution looks much more sensible. Given the high amount of leased capital, very few firms in this industry finance their assets with only equity. Researchers would mistakenly conclude that this is an “equity-financed” industry where many firms have zero leverage if they ignore operating leases.

For robustness, we also show the three industries that have the next largest drops in the coefficient of variation when we take into account leases in capital structure, “Services: Engineering and Managements Services,” “Services: Business Services,” and “Retail Trade: Eating and Drinking Places.” In all three cases, the findings are similar. A failure to take into account leases leads to a mistaken conclusion that firms in these industries mostly rely on equity financing. Once leases are taken into account, the distribution of capital structure looks more sensible with a much smaller coefficient of variation. In all four industries, taking into account leases significantly reduces the amount of within-industry variation in capital structure.

3. Identifying a Firm's Product Market

A. Existing Research

While extant research finds that the average capital structure of firms in the same SIC3 is the most powerful determinant of capital structure in the cross-section (Bradley, Jarrell, and Kim (1984), Lemmon, Roberts, and Zender (2008), Frank and Goyal (2009)), researchers have noted that there is a surprising amount of within-industry variation (Almazan and Molina (2005), Mackay and Phillips (2005), Lemmon, Roberts, and Zender (2008)). While researchers have generally relied on 3-digit SIC codes, better measures of product market competitors may significantly reduce within-industry variation in capital structure.

Extant research that uses alternative measures of industries or product markets includes Clark (1989), Kahle and Walking (1996), Fama and French (1997), Andrade and Kaplan (1998), Almazan and Molina (2005), and Mackay and Phillips (2005). Most closely related to our alternative definition of industries is the approach by Hoberg and Phillips (2009a, 2009b). They use text-based similarity scores calculated using the "Business" section in firms' 10-K SEC filings (Item 1 of most filings). We compare the performance of our measure with Hoberg and Phillips (2009) in detail below; the bottom line is that both improve substantially on SIC codes in matching correlations on operating performance whereas our measure uniquely improves the prediction of capital structure.⁸ To the best of our knowledge, no other research uses the set of competitors that firms' self-report in SEC filings.

B. Competitors from Capital IQ

Standard & Poor's *CIQ* data base contains information on the set of competitors listed by firms in their SEC filings. Documentation by *CIQ* indicates that the list of competitors comes

⁸ Hoberg and Phillips (2009a, 2009b) use their alternative measure primarily to understand product market synergies, mergers, advertising, and R&D.

from four main sources: (1) SEC filings including 10-K, 10-KSB, 20-F, 40-F, and Prospectus forms; (2) System for Electronic Document Analysis and Retrieval (SEDAR) filings including annual information forms; (3) Annual reports, and (4) surveys in which *CIQ* attempts to confirm captured data with major public companies. The data set provided by *CIQ* contains 5,186 firms that are in the *Compustat* set of non-financial, U.S.-based parent firms. There are a total of 90,868 competitors for these 5,186 firms in the original data, or about 18 competitors per firm.

There are three additional notes. First, while the data have been collected since 2005, *CIQ* does not have the historical version of the competitor files available. We obtained the data in January 2010, so the file represents the set of competitors for every firm as of that month. For this reason, we focus on the most recent year of *Compustat*. While one could potentially assign the same competitors to the firm in past years, this process would introduce measurement error if the set of competitors for a given firm changes over time.⁹

Second, *CIQ* imputes the data for a large number of the competitor relationships in the following manner. If company A lists companies B, C, and D as competitors, *CIQ* will list company B and C as competitors, even if neither company B or C list each other as competitors. This is true for approximately 70% of the competitor links. Researchers at *CIQ* maintain that this is an accurate algorithm that best captures the actual set of competitors of a firm. Third, the firm-competitor file is symmetric: if company A lists company B as a competitor, then company A is listed as a competitor of company B.

The competitor data is available for 2,825 firms of our initial *Compustat* sample of 3,376 firms. While we only have competitor data for 84% of the firms, these firms represent 98% of both the total assets and sales of the full sample. Firms for which there is no competitor data are

⁹ *Capital IQ* began collecting the data in 2005, but the file that we have is current as of 2010. Appendix Table 1 shows that our core results are robust when examining the cross-section as of 2004 through 2007 using the 2010 file.

far less likely to be covered by *CIQ* in general, and they tend to be much smaller and younger. They have slightly lower leverage ratios and there is no strong industry pattern. Our final list of competitors is self-inclusive and symmetric; in other words, the competitors of every firm are also firms in the final sample.

The last row of Table 1 lists the average number of competitors for firms. On average, a firm has 19 competitors with a median of 11. For 698 firms in the sample, *CIQ* lists fewer than 5 competitors. For these firms, we “top up” the number of competitors to at least 5 by including firms that are two connections from the firm in question (they are a competitor of a competitor). If the number of firms that are two connections away leads to more than 5 competitors, we choose the two-connection-away firms that are closest in terms of the gvkey numerical identifier. The summary statistics presented in Table 1 are inclusive of this “top up” procedure.

C. CIQ Competitors versus SIC3: Operating Performance and Stock Market Volatility

In Panel A of Table 2, we present evidence that the set of *CIQ* competitors is a more accurate measure of firms that produce similar output relative to 3-digit SIC codes. For each variable listed in the left column, we present the R^2 from variations of the following regression:

$$y_i = \alpha + \beta * \bar{y}_{j,-i} + \varepsilon_i \quad (1)$$

Where y_i is the outcome of interest for firm i and $\bar{y}_{j,-i}$ is the average of the outcome for the firms indexed by j that are in the same SIC3 (column 1) or listed as a competitor in *CIQ* (column 2). In column 3, we report the adjusted R^2 with both averages in the regression. When calculating the averages over groups, we always exclude firm i . In addition, the sample of firms remains constant across all three specifications to ensure comparability.

When y_i is measures of income, Table 2 shows that the *CIQ* measure has significantly higher explanatory power than the SIC3. The adjusted R^2 is between 40% and 60% larger for

measures of Operating Income Before Depreciation scaled by measures of lagged assets. When we examine the standard deviation of operating income scaled by lagged assets over the last five years, the improvement is dramatic. The adjusted R^2 when using *CIQ* competitors is five times larger than when using firms in the same SIC3. The improvement in R^2 is smaller when using the operating income to sales ratios and sales growth, but the direction is the same.¹⁰

In Panel B of Table 2, we examine the predicted residuals from monthly regressions of the stock market return for each firm on the value weighted return of the US stock market (NYSE, AMEX, and NASDAQ) obtained from the CRSP-Compustat merged sample over the time period 2003-2008.¹¹ For each firm in the universe, we estimated a monthly CAPM regression and calculated residuals at the firm-month level. We then created averages of these residuals for the firms in our sample at the SIC3 and *CIQ* competitor level. Finally, we estimated the CAPM residual for a given firm-month as a function of the average residual at the SIC3 and *CIQ* competitor level. These regressions are shown in Panel B of Table 2. The standard errors are shown clustered by year. The first two columns show the results of unweighted regressions of the residuals, and in the second two columns the regressions are weighted by the number of *CIQ* competitors that each firm has.

Similar to the evidence on operating income volatility, idiosyncratic stock returns are much more correlated among *CIQ* competitors than firms in the same SIC3. The R^2 in the regression relating a firm's CAPM residuals to the average CAPM residuals of other firms in its SIC3 industry is 0.008, and the average CAPM residuals of other firms in the SIC3 industry is statistically insignificant. Adding the average CAPM residuals of the firm's *CIQ* competitors

¹⁰ Operating income scaled by sales is winsorized at the 5% and 95% level given that it is a flow divided by a flow and has many outliers. The *CIQ* competitor variable outperforms the SIC3 variable if we winsorize at the 1% and 99% level, but adjusted R^2 levels are much lower.

¹¹ The CRSP data item for the market is *vwretd* and the CRSP data item for the stock return itself is *ret*. Both include distributions.

raises the adjusted R^2 to 0.045, and this variable has a coefficient of 0.50 with a t-statistic using error clustering by year of 21. When the results are weighted by the number of *CIQ* competitors, in order to give more weight to product market groups which are more accurately defined, the improvement in R^2 is from 0.036 to 0.102. The coefficient on the average CAPM of *CIQ* competitors is 0.723 and the t-statistic with year-clustering is around 31.

Overall, the evidence in Table 2 demonstrates that *CIQ* competitors are far more similar on operating income and stock market returns than firms in the same SIC3.

Hoberg and Phillips (2009a) present results similar to those in Panel A of Table 2 using their text-based product similarity scores. The specification most analogous to ours is the second column versus the last column of their Table 3. They find a 0.08 increase in the adjusted R^2 when examining operating income scaled by sales, and a 0.07 increase when examining operating income scaled by assets. Our results on operating income scaled by lagged assets are slightly larger, whereas our results on operating income scaled by sales are smaller. Our most powerful results are on operating income and stock market volatility; for these variables, Hoberg and Phillips (2009a) do not provide comparable results. One interesting note is that Hoberg and Phillips (2009a) do not find better predictive power when looking at book or market leverage, which contrasts sharply with our results below.

Why does the average over *CIQ* competitors have such higher explanatory power relative to the average over firms in the same SIC3? We graphically illustrate the reason by mapping the network of two 3-digit SIC codes. More specifically, Figures 2 and 3 present the network graph of SIC3 281 (“Industrial Inorganic Chemicals”) and SIC3 873 (“Research and Testing Services”).¹² In both graphs, the blue crosses represent firms in the SIC3, and the lines from any

¹² We choose these two SIC3 codes because they maximize the difference in the squared residuals when regressing operating income scaled by lagged assets on the averages for *Capital IQ* competitors and firms in the same SIC3

blue cross connect to *CIQ* competitors. A firm marked with a small circle is a *CIQ* competitor in a different SIC3.

Figure 2 maps firms in the SIC3 281 (“Industrial Inorganic Chemicals”) along with their *CIQ* competitors. It is clear from Figure 2 why the SIC3 performs so poorly. First, there are many firms in SIC3 281 that are completely disconnected from any other firm in the SIC3. For example, on the right part of the figure, LSB Industries, Calgon Carbon, and American Pacific all list at least two other competitors and none of the competitors are in the same SIC3. Even Gentek Inc. and Valhi Inc. are only indirectly connected to other firms in the same SIC3. As a result, for these firms, it should come as no surprise that the operating income and stock market volatility is more closely related to *CIQ* competitors than firms in the same SIC3. Finally, even the firms that are relatively central in the SIC3 like Air Products and Praxair Inc list many other competitors that are not in the same SIC3.

Figure 3 maps the network for the SIC3 873 (“Research and Testing Services”). There is a clear main cluster of firms that includes Covance Inc, Pharmanet Development, and Parexel International. But there are also five main clusters of competitors that are loosely connected to the central network; these are centered on Charles River, Celera Corp/Nanogen Inc, Luna Innovations, Arrowhead Research, and National Technical. These five clusters have many *CIQ* competitors within the cluster that are not in the same SIC3 code. Further, the five clusters are only loosely connected with each other. Perhaps the most dramatic example is Syntroleum Corp and Superconductor Technologies, both of which list at least three competitors. Not one of the firms in these two competitive groups is connected to any other firm in the same SIC3 code.

code, respectively. In other words, for illustrative purposes, we choose industries where *Capital IQ* does much better relative to the SIC3. Networks are graphed using NetMiner software which is available at <http://www.netminer.com>.

To give an example of extremes, Celera Corp in the upper right corner claims that its “mission is to discover and develop meaningful new therapies that improve human health.” Syntroleum Corporation in the lower left corner “[provides] process technology for the conversion of natural gas into synthetic liquid hydrocarbons, which can be refined into ultra-clean fuels ...” It is clear that these two companies are not operating in the same product market, and it also clear that the competitors that are not in the same SIC3 shown in Figure 3 are more closely related.

4. Explaining the Cross-Section of Leverage Ratios

Armed with the improved measures of capital employed and goods produced by firms, we present in Table 3 the main finding of our study. In column 1, we estimate equation (1) regressing the book leverage ratio excluding leases on the average book leverage ratio of firms in the same SIC3. This is analogous to specifications in the extant literature. The adjusted R^2 of this specification is 0.20. The specification in column 2 replaces the SIC3 average with the average leverage ratio of firms listed as competitors in *CIQ*. The adjusted R^2 increases to 0.25. The specification reported in column 3 includes both averages and increases the adjusted R^2 to 0.26. In the next three columns, we examine the leverage ratio including the capitalized value of operating leases. Column 6 shows that the inclusion of both the SIC3 average and the average across *CIQ* competitors increases the adjusted R^2 to 0.30. Relative to the baseline specification in column 1, this represents a 50% increase in the explanatory power.

In column 7, we estimate regressions in which we weight firms by the number of competitors listed in *CIQ*. The logic behind this specification is intuitive: where there are fewer competitors, the within-group variability is much higher. In other words, the variance of the error term for firms with fewer competitors is likely higher, and this specification down-weights them

accordingly. While we do not know the true underlying variance of the error term across the distribution of firms based on the number of competitors, we can weight by the number of competitors to give more weight to firms that have more competitors listed. The weighted least squares (WLS) approach has the advantage of using the information on across-firm variance due to the different number of competitors.

The WLS coefficient estimate on the average leverage ratio of *CIQ* competitors increases substantially and the adjusted R^2 increases to 0.35. This represents a 75% increase over the original specification in column 1. In order to conduct a fair test between the 3-digit SIC codes and the *CIQ* competitor groups, we present coefficient estimates from a WLS specification in column 8 where we weight by the number of firms in the SIC3. In contrast to the *CIQ* competitor weighting, the adjusted R^2 actually declines substantially.

Figure 4 generalizes this basic result. For the adjusted R^2 plot in the left panel, we estimate the same specification as in column 5 of Table 3, but progressively limit the sample to firms with a number of competitors greater than x , where x is plotted on the x-axis. For example, if we limit the sample to firms with 10 or more *CIQ* competitors, we obtain an adjusted R^2 of 0.36. As the left panel shows, the adjusted R^2 increases from 0.28 to 0.36 as the sample is limited to firms with at least 10 competitors or more. At that point, the adjusted R^2 is similar if we continue limiting the sample to firms with more competitors.

The plot in the left panel of Figure 4 suggests that there is significance measurement error when averaging for firms for which we have a small number of *CIQ* competitors. These firms bring down the adjusted R^2 considerably. In other words, we surmise that if we knew of more competitors for the firms with few competitors — for example if we knew their private

competitors and the capital structures of those private competitors — the explanatory power of the leverage ratio of firms producing the same output would be even higher.

The right panel of Figure 4 shows that the same argument does not hold true of 3-digit SIC codes. As we progressively limit the sample to firms that have a larger number of firms in the same SIC3, the explanatory power of the average leverage ratio of firms in the same SIC3 actually declines substantially. In other words, the random error in the estimation equation increases substantially when we focus on 3-digit SIC codes containing a large number of firms.¹³ This is precisely the opposite pattern as with *CIQ* competitors. SIC codes do a particularly bad job when there are many firms in the SIC3.

For observations with smaller measurement error, Figure 4 demonstrates that a single variable—the average leverage ratio of firms producing the same output—can explain 36% of the overall variation in leverage ratios. To put this magnitude into perspective, we present a series of regressions in Table 4 which include the traditional determinants of capital structure. The first four columns present the OLS estimates, and the last four columns present the WLS estimates where the regression is weighted by the number of *CIQ* competitors.

Column 1 shows that the average leverage ratio of firms producing the same good has an adjusted R^2 of 0.29. Column 2 shows that adding the five main firm-specific characteristics used in the extant literature increases the adjusted R^2 by 0.03. Further inclusion of the average leverage ratio of firms in the same SIC3 in column 3 increases the adjusted R^2 by another 0.01. If we remove the average leverage ratio of firms producing the same output, the adjusted R^2 declines to 0.28. In other words, the incremental explanatory power of the average leverage ratio

¹³ To ensure a fair comparison for both 3-digit SIC codes and *CIQ* competitors, we limit the sample progressively until there is 20% of the total number of observations remaining for both panels of Figure 4. The cutoff is 29 *CIQ* competitors and 153 firms in the same SIC3.

of firms producing the same good is larger than the incremental explanatory power of all other six determinants combined.

The WLS estimates are even stronger. The adjusted R² when including only the average leverage ratio of firms that produce the same output is 0.35. Adding all other six determinants increases the adjusted R² by only 0.02. The incremental power of the average leverage ratio of firms in the same SIC3 is less than half a percentage point. Removing the average leverage ratio of firms that produce the same output reduces the adjusted R² to 0.29. The incremental explanatory power of the average leverage ratio of firms producing the same output is three and a half times larger than the other six determinants combined.

In Table 4, our measure of asset tangibility is the ratio of owned PP&E to total assets. An alternative measure would be the total PP&E to asset ratio, where the numerator includes both owned PP&E and leased PP&E. The disadvantage of the latter measure is that it generates a mechanical correlation with the leverage ratio including leases as the capitalized value of operating leases is included in the numerator of both variables. However, one could also make the same argument for secured debt and capitalized leases, which under GAAP appear in both debt and assets and would also induce a mechanical correlation. In any case, Table 5 replicates the results using the alternative measure of asset tangibility. Using the alternative measure, the incremental power of the leverage ratio of *CIQ* competitors relative to traditional controls is smaller, and this is driven by the power of the alternative tangibility measure. In the WLS specification, the incremental power of the leverage ratio of *CIQ* competitors remains higher than the incremental power of all six other variables combined.

5. Asset Similarity and Capital Structure

Section 4 demonstrates that the average leverage ratio of other firms producing similar output has by far the largest explanatory power for cross-sectional capital structure variation. This explanatory power is significantly larger when accounting for leases and using a better measure of product market competition. The results suggest that there is far less intra-industry variation in capital structure than suggested by previous studies.

Why do firms producing similar goods have similar capital structures? There is a surprising paucity of literature that addresses this question. In fact, to our knowledge, the only study that addresses this question is the recent working paper of Leary and Roberts (2009) who examine how firms respond to the security issuance decisions of other firms in the same SIC3. They find that idiosyncratic return-driven equity issuances by other firms in the same SIC3 lead to equity issuances by the firm itself, which supports the existence of peer effects in capital structure decisions.

Our approach is quite different. We start from a simple benchmark. If we are to understand the strong correlation of capital structure for firms operating in the same product market space, we should first understand the source of that correlation as it relates to the most reliable determinants of capital structure—namely, size, the market-to-book ratio, asset tangibility, profitability, and the variance of cash flow (Frank and Goyal (2009)). While our approach is not meant to tease out a strict causal relation, we believe understanding how the most reliable determinants of capital structure are related to the strong intra-industry correlation in leverage ratios is an important first step toward understanding the theoretical determinants of capital structure.

A. Firm level analysis

The first exercise we undertake in this section is to examine the correlation of the main determinants of capital structure for firms producing similar output. In Table 6, we present the adjusted R^2 from regressions relating firm characteristics to the average characteristics of *CIQ* competitors. The specification is identical to equation (1) in Section 3, but the outcome variables of interest are the determinants of capital structure.

The first row examines how much of the variation in the total PP&E (both leased and owned) to assets ratio for a given firm is explained by the average of firms producing the same output. The adjusted R^2 is 0.67, which is extremely high in the context of cross-sectional regressions. If we estimate the equation via WLS weighting by the number of competitors, the adjusted R^2 rises to 0.78. The explanatory power is strong for both leased PP&E and owned PP&E when we examine them separately, but the result is stronger for owned PP&E.

These results suggest that firms in the same product market have similar asset tangibility. The next four rows show that they also use similar capital to labor ratios and a similar fraction of capital in machines, buildings, and leases. In fact, a regression of the capital to labor ratio on the capital ratio of *CIQ* competitors yields an adjusted R^2 of 0.87 in weighted regressions.¹⁴

These results suggest that two firms producing the same output utilize very similar assets in the production process. In terms of the other main determinants, the correlation of the determinants within firms producing similar output is significantly lower. The next highest determinant is average operating income scaled by lagged assets, which has an adjusted R^2 of 0.30. Of all the reliable determinants of capital structure, asset composition is by far the most highly correlated within the set of product market competitors. This finding is consistent with

¹⁴ We follow Mackay and Phillips (2005) who measure the capital to labor ratio as total PP&E scaled by the number of employees in millions. Data on the fraction of gross PP&E in buildings, machinery, and equipment are from *Capital IQ*. See the online appendix for more details.

our hypothesis: the high correlation of capital structure within the set of firms producing similar output is related to the similarity of assets used in the production process.

The regressions reported in Table 7 provide an alternative test of this hypothesis. The regressions take the following form:

$$\text{LeverageRatio}_i = \alpha + \beta * \overline{\text{Determinants}}_{j,-i} + \varepsilon_i \quad (2)$$

In equation (2), $\overline{\text{Determinants}}_{j,-i}$ is a matrix of the averages of the five reliable predictors of capital structure for the *CIQ* competitors of a given firm. In other words, the regressions reported in Table 7 attempt to answer the following question: which of the average determinants of other firms producing the same output can explain the most of capital structure variation across firms?

The first six columns of Table 7, Panel A examine the univariate regressions for each of the main determinants. In columns 1 and 2, we examine both the total PP&E to assets ratio and the owned PP&E to assets ratio. The adjusted R^2 for the total PP&E to assets ratio is 0.16 and the adjusted R^2 for the owned PP&E to assets ratio is 0.09. No other determinant comes even close. The next highest determinant is the market-to-book ratio with an R^2 of 0.04. The last two specifications include the averages of all the determinants, and we separately consider total and owned PP&E scaled by assets as our measure of asset tangibility. In either case, the measure of asset tangibility is by far the most powerful statistical determinant, and the incremental adjusted R^2 from including the averages of the other four determinants is small. At the bottom of Table 7, we also show the adjusted R^2 in regressions where we weight observations by the number of *CIQ* competitors. The patterns in the adjusted R^2 from the weighted regressions are similar to those in the adjusted R^2 from the unweighted regressions.

In Table 8, we examine debt structure.¹⁵ If the closeness of leverage ratios of firms producing similar output is due to asset similarity, then the components of the overall leverage ratio that should be most highly correlated within competitor groups are those most closely related to assets. To explore this idea, Table 8 presents regressions where the left hand side variables are the debt components of the overall leverage ratio. The regressions take the following form:

$$DebtComponent/Assets_i = \alpha + \beta * \overline{DebtComponent/Assets}_{j,-i} + \varepsilon_i \quad (3)$$

These specifications are similar to those presented in Table 3, but the leverage ratio is split into its main debt components.

The results in Table 8 show that the strong correlation of leverage ratios within the set of firms producing the same output is driven by debt that is tied more closely to assets. In the first three columns, we examine debt priority. The adjusted R^2 when estimating equation (3) using leases plus secured debt is 0.27. For unsecured debt, the adjusted R^2 declines to 0.14. For subordinated debt, the adjusted R^2 is almost zero. When we examine the individual debt components, we find that the correlation within product market competitors is strongest for capitalized operating leases, mortgages plus collateralized leases, and bank debt, which are arguably the three debt components most directly linked to particular assets.

B. Product market group level analysis

An alternative way to show the relation between asset composition and leverage ratios of firms producing the same output is a product market group level analysis. In order to form product market groups from our list of *CIQ* competitors, we utilize techniques from social

¹⁵ Debt structure data is also from *CIQ*. See the online appendix for more details.

network analysis.¹⁶ More specifically, social network analysis defines a “clique” within a network as a group of agents that are all connected to one another. In our context, a clique would be a set of firms for which *CIQ* lists all the firms as competitors of one another. For example, one five member clique of firms that produce and supply industrial machinery and equipment includes Barnes Group Inc, Lawson Products, Fastenal Co, MSC Industrial Direct, and Industrial Distribution Group Inc. For each of these firms, *CIQ* lists the other four as competitors. One could define this clique as a product market group.

A disadvantage of cliques is that they often overlap considerably (Everett and Borgatti (1998)). Consider the following simple example. Imagine that firms A, B, and C list one other as competitors in addition to firms D and E. Firms D and E list A, B, and C as competitors but not each other. Then there are two cliques of four firms {A, B, C, D} and {A, B, C, E}. These two cliques closely overlap and it would be unwise to treat them as distinct product market groups.

In order to reduce clique overlap, we first find a total of 6,071 cliques of at least three firms in the set of the 2,825 firms in the *CIQ* database. Of the 2,825 firms in the full data base, 2,551 are in at least one clique of at least 3 firms, which implies that firms are on average in 2.4 cliques. These cliques on average include 8.3 firms with the largest clique including 56 firms. In order to reduce the 6,071 cliques into less overlapping product market groups, we implement the following algorithm. For each clique *i*, we calculate an *overlap* between clique *i* and clique *j*, where the overlap is the percentage of firms in clique *i* that are also in clique *j*. The cliques are then sorted in descending order by size. The firms in the first clique are assigned to product group #1. The firms in the second clique are assigned to product market group #1 if the overlap is 50% or greater, otherwise they are assigned to a new product market group. For firms in the

¹⁶ See Wasserman and Faust (1994) for more formal definitions of social network analysis terms. Chapter 7 on cohesive subgroups in particular presents an excellent discussion of group formation.

k th clique, overlap with the first clique through the $(k-1)$ st clique is examined sequentially. The k th clique is assigned to the first product market group with which overlap is 50% or greater; if no clique between the first and the $(k-1)$ st clique has greater than 50% overlap then a new product market group is assigned.

This algorithm produces 228 product market groups for 2,551 firms. The median product market group contains 10 firms, the median firm is in one product market group, and the average number of product market groups a firm is in is 2.0. It is important to note that our product market groups are not mutually exclusive, as firms may operate in multiple product market spaces.

Table 9 lists product market groups that are at the extreme ends of the distribution on selected variables. We limit the set of product market groups to those that include at least three firms. The naming convention we adopt is to name the product market group after three firms in the product group. In order to identify the product market group as narrowly as possible, we choose the three firms that are the largest firms in the fewest *other* product market groups.

Table 9 shows the product market groups that are at the extremes of various financial and operating variables. Firms in an industry headed by Hertz Global, Dollar Thrifty, and Avis Budget are at the top of the leverage ratio ranking excluding leases, with 70.9%. This product market group is clearly car rental. The least levered companies excluding leases tend to be technology and medical companies. These patterns are broadly similar in Panel B, where leases are included. One product market for which leverage is under-measured when leases are ignored now appears in the top 5 (the market comprising assisted living services Brookdale Senior, Kindred HealthCare, and Emeritus Corp). The other panels highlight product market groups

where tangibility, 5yr average cash flow, 5yr cash flow volatility, total sales, and market-to-book are largest and smallest.

In Table 10, we report results from the following product market-level regressions:

$$LeverageRatio_p = \alpha + \beta * Determinants_p + \varepsilon_p \quad (4)$$

where $Determinants_p$ is the matrix of the averages of the standard five variables in the capital structure regressions at the product market level. In other words, the data are collapsed to the product market group level where all variables are the averages of the firms within the product market group. This is analogous to a “between” regression where we are trying to best understand the sources of variation across product market groups that drive differences in leverage ratios.

Panel A presents the OLS estimates. The strongest predictor of the leverage ratio at the product market level is the total PP&E to assets ratio. Since the capitalized value of operating leases appears in the numerator both of the leverage ratio of and the total PP&E ratio, this strong correlation is in part mechanical. In column 2 we examine the correlation between the leverage ratio and the owned PP&E to assets ratio at the product market level. The adjusted R^2 is 0.13. Examining the other determinants, the owned PP&E to assets ratio is found to be the strongest predictor of the leverage ratio at the product market level. Panel B presents the WLS estimates where we weight by the number of firms in the product market group. The owned PP&E to assets ratio becomes an even stronger predictor, with an adjusted R^2 of 0.29.

Figures 5 through 7 display scatter plot versions of the regressions in Table 10. In order to ensure the product market groups can be read, we limit the sample to product market groups with at least 40 firms, which leaves 39 product market groups. Figure 5 examines the scatter plot of the total PP&E to assets ratio and the leverage ratio. The correlation is very strong. The

univariate regression produces an R^2 of 0.63. Product market groups with high leverage ratios include restaurants (the Yum Brands | Wendy's / Arby's | Darden Restaurants group) and pulp-and-paper manufacturers (International Paper | Weyerhaeuser | AbitibiBowater). These product market groups also have a high total PP&E to assets ratio. The product market groups with the lowest leverage ratios tend to include more technology oriented firms, technology services groups, and healthcare and education services groups. Firms in these product market groups also have a very low ratio of total PP&E to assets.

In Figure 6, we examine the owned PP&E to total assets relation with leverage ratios to avoid any mechanical correlation issues associated with the total PP&E to assets ratio. While the correlation weakens, it is still very strong with a univariate R^2 of 0.41. In Figure 7, we examine the next strongest predictor, firm size as measured by the natural logarithm of sales. The correlation is much weaker with an R^2 of 0.14.

Table 10, Figure 5 and Figure 6 demonstrate that the most powerful determinant of the across product-market group variation in leverage ratios is asset tangibility. Firms that produce similar output use similar assets and tangible assets are financed with leverage.

6. Conclusion

The most powerful empirical factor explaining corporate capital structure is the capital structure of other firms operating in the same product market. We show that better measurement of the products a firm produces and the capital it employs in production substantially improves our ability to understand capital structure variation. We also present evidence that this high within product market group correlation is closely related to asset composition. Firms within the same product market group have very similar assets, and asset composition at the product market level is highly correlated with leverage ratios. Our results show that two firms that produce

similar output will have similar leverage ratios, and this effect seems closely related to the assets used in the production process.

Our findings are supportive of research that emphasizes the link between financial structure and real aspects of the firm (Williamson (1988), Hart and Moore (1994, 1998), Diamond and Rajan (2001), Hennessy (2004), Hennessy and Whited (2005), MacKay and Phillips (2005)). Indeed, the main point of Williamson (1988) is that “whether a project should be financed by debt or by equity depends principally on the characteristics of the assets.” Our findings are related to extant empirical studies that find support for these theories in the context of 19th century railroads (Benmelech (2009)), commercial real estate (Benmelech, Garmaise, and Moskowitz (2005)), and airlines (Benmelech and Bergman (2009)).

Our methods improve the measurement of capital by incorporating leases, and they improve the measurement of product market groups by using the firm’s actual competitors instead of SIC product groups. However, we certainly do not claim that we have perfectly measured these quantities. We conjecture that further improvements in measurement would further improve the explanatory power of what a firm produces and the assets used in production for the purpose of understanding capital structure variation. Further improvements in measurement of capital and capital structure remain an important area for research going forward.

In future work, we hope to relate our findings to two other areas of research. First, we have not considered the competitive structure of product markets and how it may be related to the capital structure patterns we document here. Prior research has focused on how competitive structure affects within-industry variation in leverage ratios (MacKay and Phillips (2005)), but it may also be the case that the across product market leverage ratio variation is related to

competitive structure. Second, recent research by Leary and Roberts (2009) suggests that peer effects may help explain why leverage ratios are correlated within industries, although they do not discuss peer effects in the context of asset similarity. We emphasize the importance of asset similarity, but these explanations are not mutually exclusive. One possibility is that peer effects are important in understanding why assets used in production are so similar for two firms producing similar output, which in turn may have an effect on leverage ratios.

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Figure 1: Effect of Operating Leases on Within-Industry Variation in Leverage Ratios

This figure presents histograms of the traditional leverage ratio (left column) and the leverage ratio with leases (right column) for firms in four 2-digit SIC codes. These four industries represent those that have the largest decline in the coefficient of variation (standard deviation scaled by the mean) when operating leases are accounted for.

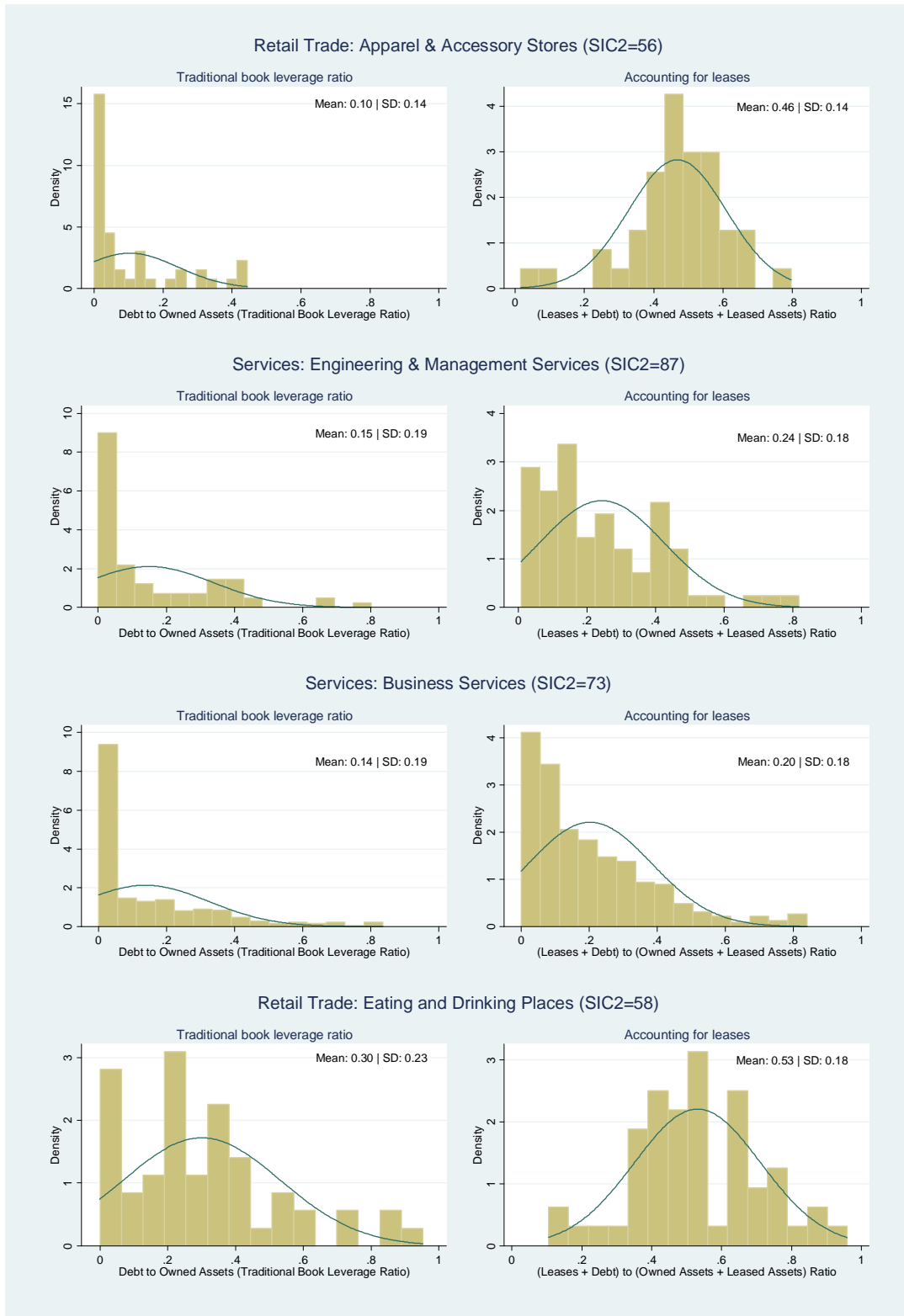


Figure 2: Competitor Network Relationships of Firms in the SIC Group 281

The figure shows the network relationships between firms in SIC Group 281 and the competitors of those firms as revealed in *Capital IQ*. SIC Group 281 contains manufacturing firms in the area of Industrial Inorganic Chemicals.

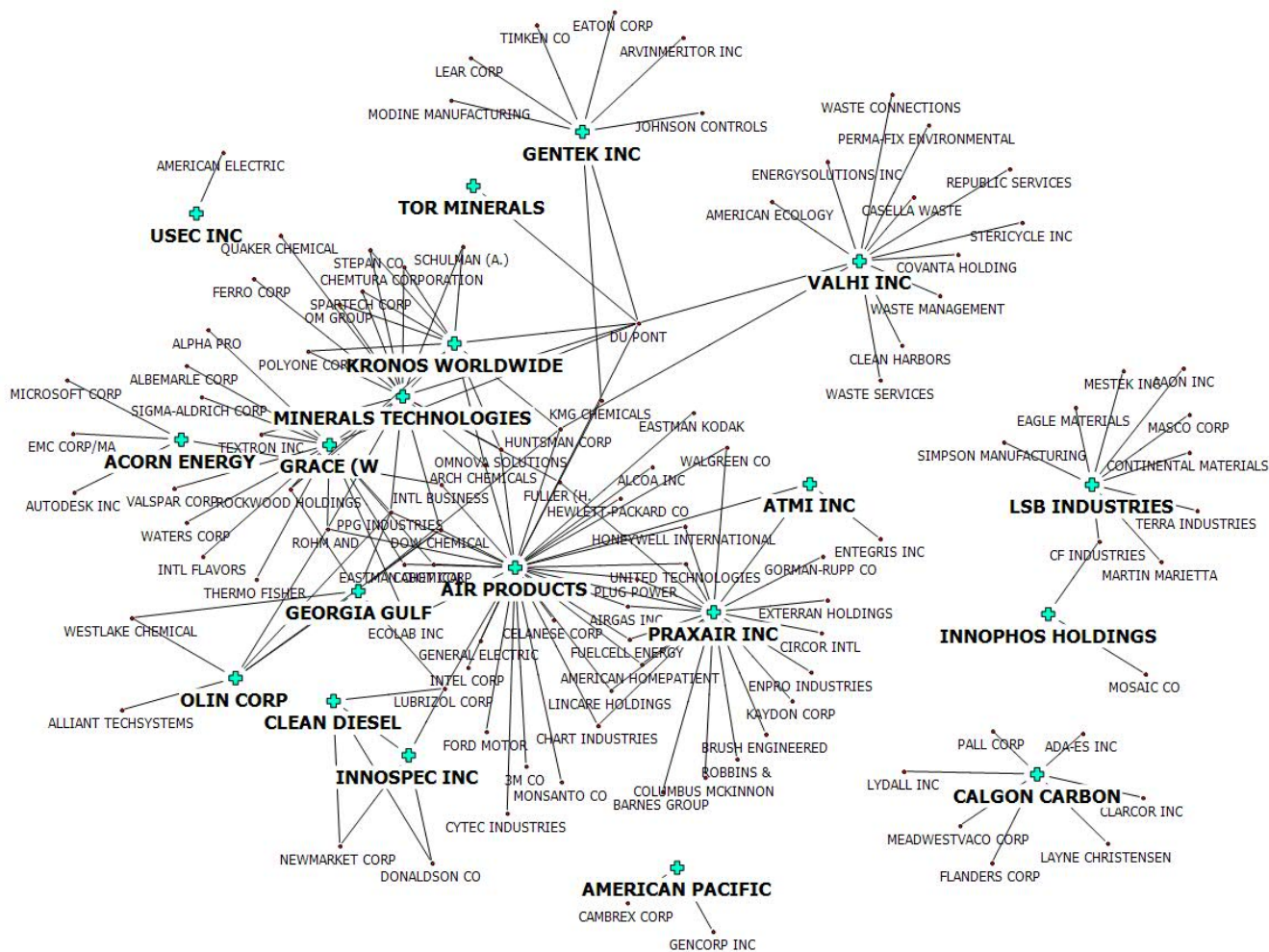


Figure 3: Competitor Network Relationships of Firms in the SIC Group 873

The figure shows the network relationships between firms in SIC Group 873 and the competitors of those firms as revealed in *Capital IQ*. SIC Group 873 is described as firms in Commercial/Physical/Biological Research, Commercial Economic/Sociological/Educational Research, Noncommercial Research Organizations, and Testing Laboratories.

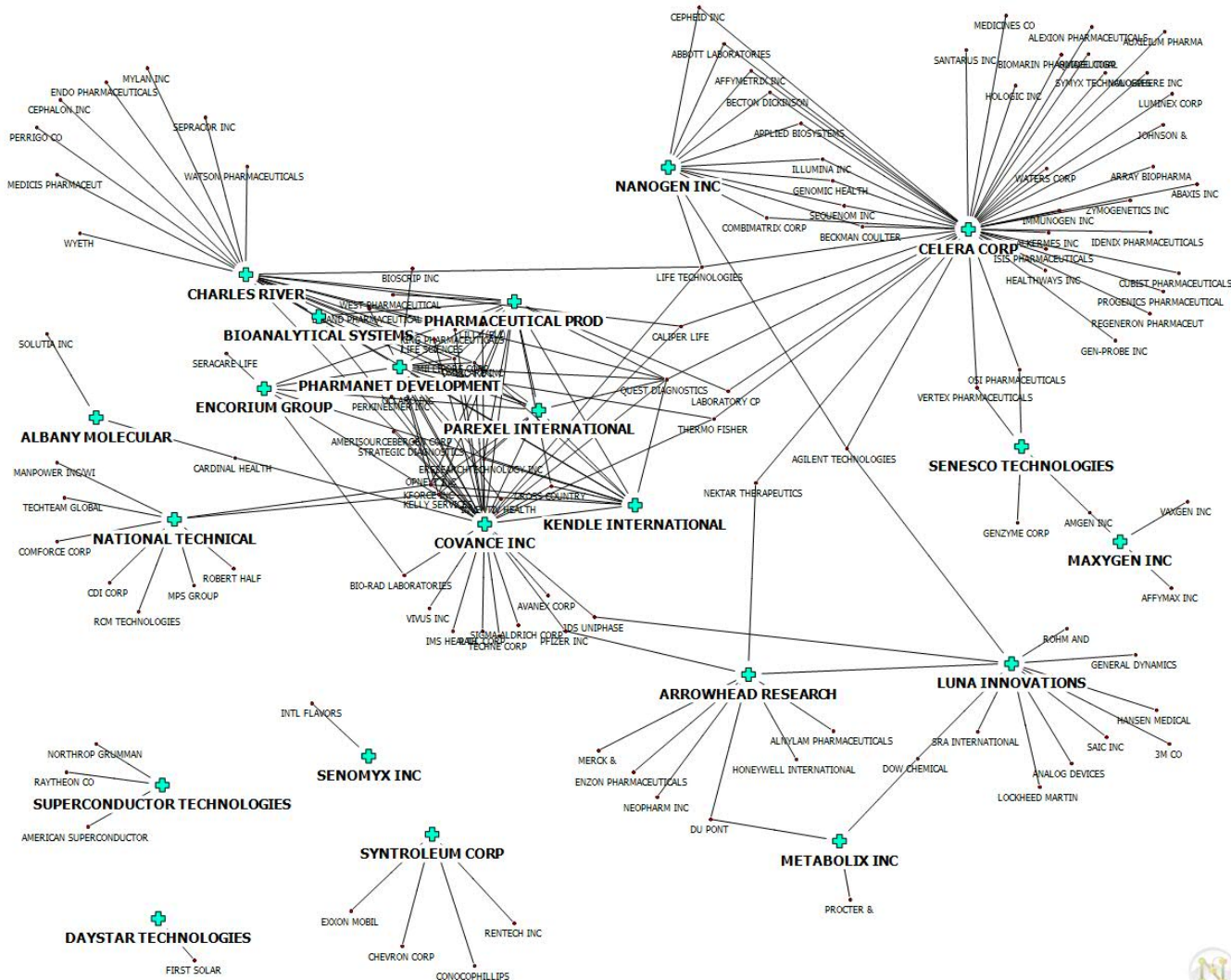


Figure 4: Explanatory Power of Other Group Members' Leverage Ratio by Size of Group

The figure on the left shows the adjusted R^2 from regressions of with-lease leverage ratios on the average with-lease leverage ratio of *CIQ* competitors, run with increasing limits to the sample by number of competitors. The figure on the right shows the adjusted R^2 from regressions of with-lease leverage ratios on the average with-lease leverage ratio of other firms in the same SIC3 group members, run with increasing limits to the sample by number of SIC3 group members. To ensure a fair comparison for 3-digit SIC codes and *CIQ* competitors, we limit the sample progressively until there is 20% of the total number of observations remaining for both panels. As a result, the figure in the left panel plots the adjusted R^2 from each of 29 regressions, and the figure on the right plots the adjusted R^2 from each of 153 regressions.

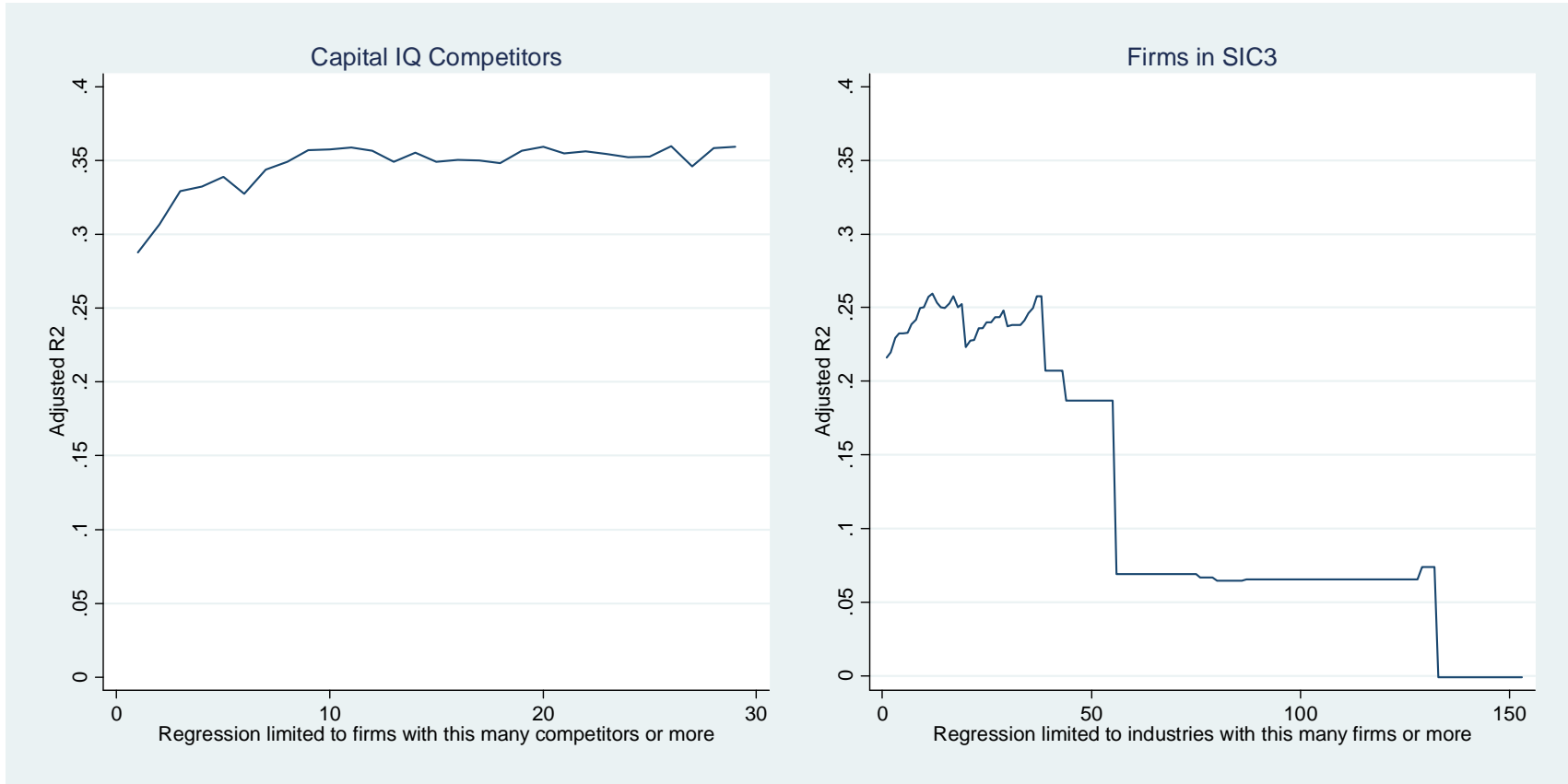


Figure 5: Leverage Ratios and Total Tangibility Ratios in Large Product Market Groups

The figure shows the relation between the average with-lease leverage ratio and the within-group average of Total PP&E_t / (Assets + Leases)_t. Averages are taken within product market groups, where a product market group is defined based on network clique analysis as explained in Section 5.B. Only the 39 product market groups with more than 40 constituent firms are shown.

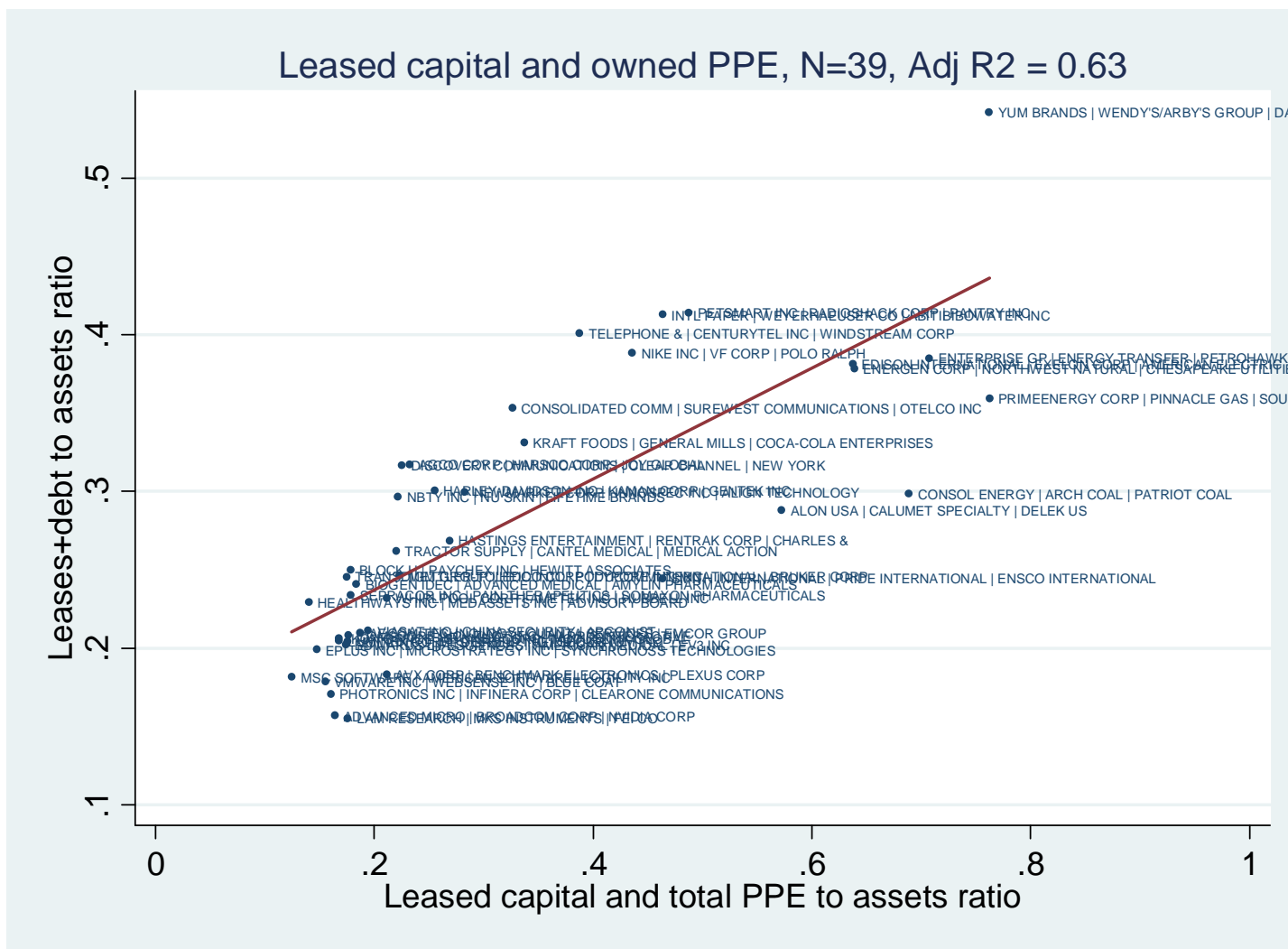


Figure 6: Leverage Ratios and Owned Tangibility Ratios in Large Product Market Groups

The figure shows the relation between the average with-lease leverage ratio and the within-group average of Total PP&E_t / (Assets + Leases)_t. Averages are taken within product market groups, where a product market group is defined based on network clique analysis as explained in Section 5.B. Only the 39 product market groups with more than 40 constituent firms are shown.

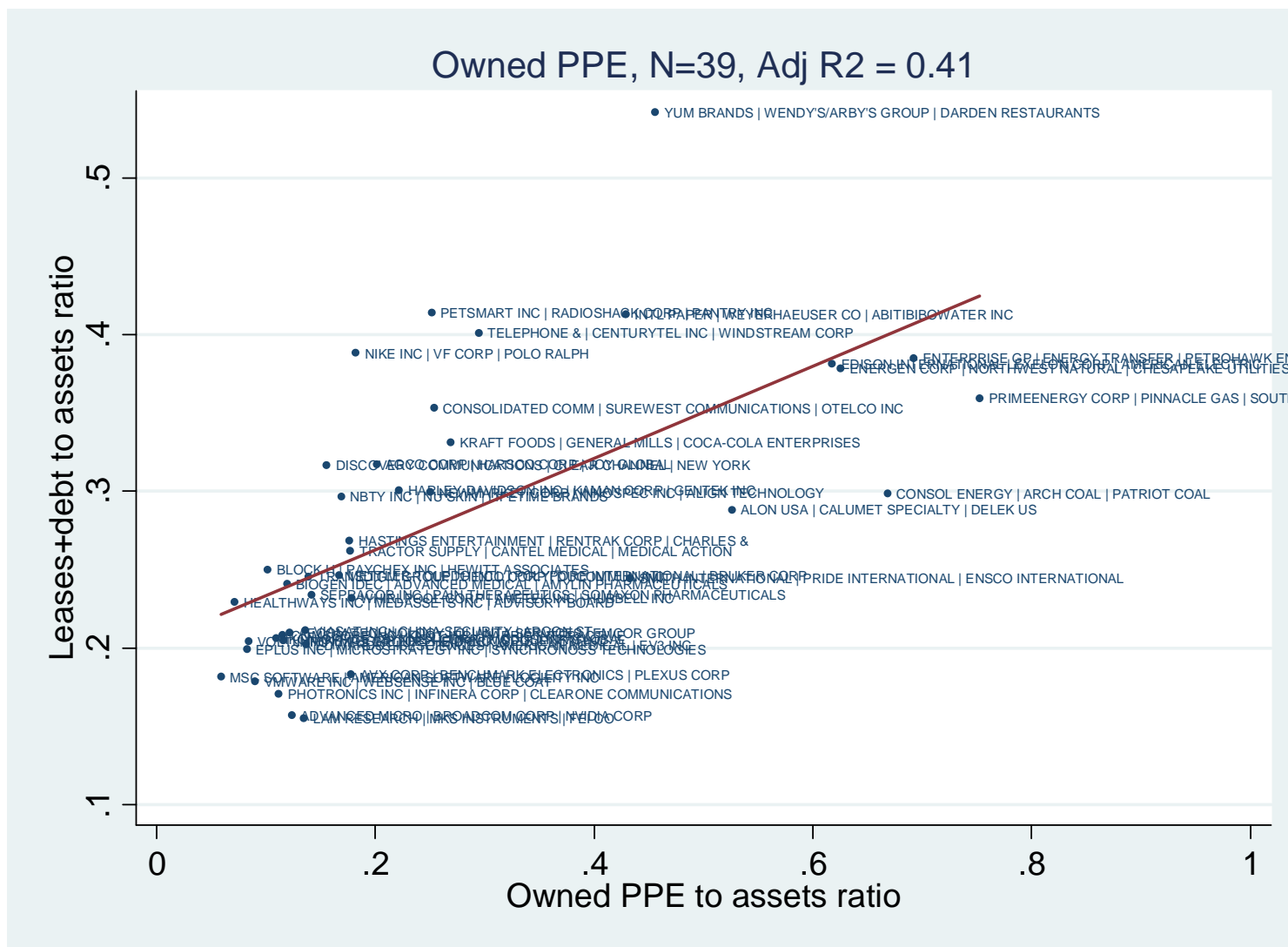


Figure 7: Leverage Ratios and Average Firm Sales in Large Product Market Groups

The figure shows the relation between the average with-lease leverage ratio and the within-group average of $\ln(\text{sales})$. Averages are taken within product market groups, where a product market group is defined based on network clique analysis as explained in Section 5.B. Only the 39 product market groups with more than 40 constituent firms are shown.

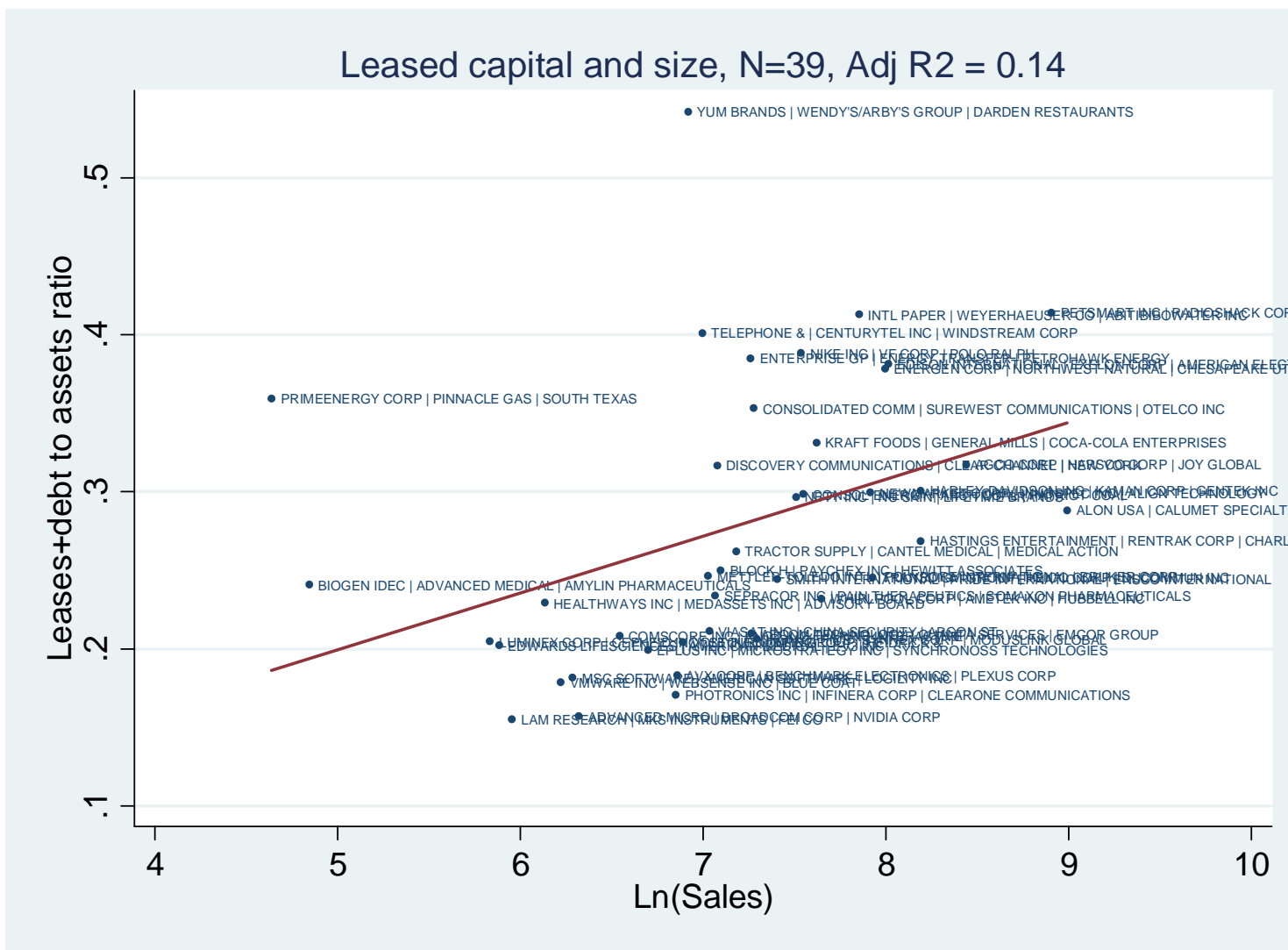


Table 1: Summary Statistics

The table presents summary statistics for the book leverage ratio and the main cross-sectional determinants of capital structure traditionally used in the literature. All observations are for the 2008 fiscal year. The construction of the variables is described in the online appendix. The top panel follows extant literature and ignores the capitalized value of operating leases. The variable Leverage Ratio With Leases is defined as $(Debt + Leases)_t / (Assets + Leases)_t$, where Leases are measured as the capitalized value of operating leases as described in the text. OIBDP is Operating Income Before Depreciation. The operating income ratios and the market-to-book ratio are winsorized at the 1st and 99th percentile.

	Mean	Median	Standard Deviation	25th Percentile	75th Percentile	Count
<i>Unadjusted Variables</i>						
Book Leverage Ratio Without Leases	0.218	0.178	0.210	0.011	0.356	3376
Owned PP&E _t / Book Assets _t	0.265	0.174	0.247	0.069	0.402	3376
OIBDP _t / Book Assets _{t-1}	0.068	0.103	0.214	0.014	0.172	3361
OIBDP _t / Book Assets _{t-1} , 5yr mean	0.071	0.117	0.235	0.043	0.183	3375
OIBDP _t / Book Assets _{t-1} , 5yr stdev	0.083	0.047	0.106	0.024	0.095	3143
Market Assets _t / Book Assets _t	1.403	1.122	0.913	0.882	1.584	3190
ln(Sales)	5.83	5.88	2.29	4.35	7.38	3301
Number of Firms in Same SIC3	82	28	100	12	132	3349
<i>New Variables</i>						
Book Leverage Ratio With Leases	0.277	0.251	0.211	0.090	0.418	3376
Total PP&E _t / (Assets + Leases) _t	0.319	0.235	0.246	0.126	0.483	3376
Owned PP&E _t / (Assets + Leases) _t	0.244	0.157	0.235	0.064	0.358	3376
OIBDP ex Rent _t / (Assets + Leases) _{t-1}	0.083	0.114	0.200	0.034	0.181	3361
OIBDP ex Rent _t / (Assets+Leases) _{t-1} , 5yr mean	0.086	0.127	0.220	0.057	0.191	3375
OIBDP ex Rent _t / (Assets+Leases) _{t-1} , 5year stdev	0.077	0.044	0.098	0.022	0.088	3143
Market Assets _t / (Book Assets + Leases) _{t-1}	1.45	1.21	0.86	0.96	1.64	3190
Number of <i>CIQ</i> Competitors	19	11	21	5	24	2825

Table 2: Firm Characteristics, Industry Groups, and Competitor Groups

Each row of Panel A shows the adjusted R-squared for three regressions: a regression of the characteristic on the average characteristic of other firms in the same SIC3 category; a regression of the characteristic on the average characteristic of at *CIQ* competitors, and a regression of the characteristic on both. OIBDP is Operating Income Before Depreciation. Panel B presents regressions of CAPM residuals on average CAPM residuals of other SIC3 and *CIQ* competitors. Standard errors in Panel B are clustered by year.

Panel A: Adjusted R-Squared in Regression of Characteristic on Average of Other Group Members, 2008

	SIC3	<i>CIQ</i> Competitors	SIC3 & <i>CIQ</i> Competitors
OIBDP _t / Book Assets _{t-1}	0.159	0.233	0.236
OIBDP ex Rent _t / (Assets+Leases) _{t-1}	0.166	0.242	0.242
OIBDP ex Rent _t / (Assets+Leases) _{t-1} , 5yr mean	0.190	0.306	0.304
OIBDP ex Rent _t / (Assets+Leases) _{t-1} , 5year stdev	0.027	0.123	0.137
OIBDP _t / Sales _t	0.152	0.197	0.214
OIBDP ex Rent _t / Sales _t	0.161	0.205	0.228
Sales Growth	0.107	0.142	0.144

Panel B: Regressions of CAPM Residuals on Average CAPM Residuals of Other Members, 2003-2008

	<i>Dependent Variable: CAPM Residuals</i>			
Average CAPM Residuals of Other Firms in SIC3	0.111 (0.074)	0.057 (0.040)	0.301 (0.127)**	0.095 (0.052)*
Average CAPM Residuals of <i>CIQ</i> Competitors		0.500 (0.031)***		0.723 (0.034)***
Constant	0.000 (0.003)	0.000 (0.002)	0.000 (0.002)	0.000 (0.000)
Weighted	No		Yes, by Number of Competitors	
Observations	141,843	141,843	141,012	141,012
R-squared	0.008	0.045	0.036	0.102

Table 3: Leverage Ratios, Industry Groups and Competitor Groups

In the left panel, the dependent variable is the *Leverage Ratio Without Leases* at book values. It follows extant literature and ignores the capitalized value of operating leases in both the numerator and denominator. The variable *Leverage Ratio With Leases* is defined as $(Debt + Leases)_i / (Assets + Leases)_i$, where Leases are measured as the capitalized value of operating leases as described in the text. Robust standard errors are in parentheses. *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

	<i>Dependent Variable</i>							
	<i>Leverage Ratio Without Leases</i>			<i>Leverage Ratio With Leases</i>				
Leverage Ratio of Other Firms in SIC3	0.817*** (0.033)	0.337*** (0.046)		0.831*** (0.030)	0.327*** (0.043)	0.167** (0.067)	0.366*** (0.083)	
Leverage Ratio of <i>CIQ</i> Competitors		0.901*** (0.031)	0.659*** (0.048)		0.925*** (0.028)	0.678*** (0.045)	0.872*** (0.064)	0.642*** (0.080)
Constant	0.042*** (0.007)	0.010 (0.007)	-0.007 (0.007)	0.050*** (0.009)	0.014* (0.008)	-0.006 (0.009)	-0.009 (0.012)	-0.012 (0.011)
Method	OLS	OLS	OLS	OLS	OLS	OLS	WLS <i>CIQ</i>	WLS SIC3
Weights	—	—	—	—	—	—	Comps	Members
Observations	2801	2801	2801	2801	2801	2801	2801	2801
Adjusted R-squared	0.20	0.25	0.26	0.24	0.29	0.30	0.35	0.21

Table 4: Incremental Explanatory Power of Competitor Leverage Ratio over Traditional Determinants Including Owned PP&E

The first four columns show Ordinary Least Squares (OLS) estimates. The second four columns show weighted least squares (WLS) estimates, where the weights are the number of *CIQ* competitors. The Property Plant and Equipment variable is Owned PP&E, which is the unadjusted figure that appears on the balance sheet. Robust standard errors are in parentheses. OIBDP is Operating Income Before Depreciation. *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

	<i>Dependent Variable: Leverage Ratio with Leases</i>							
	<i>Ordinary Least Squares Estimates</i>				<i>Weighted by CIQ Number of Competitors</i>			
Leverage Ratio with Leases of <i>CIQ</i> Competitors	0.916*** (0.030)	0.785*** (0.036)	0.587*** (0.048)		1.015*** (0.037)	0.948*** (0.045)	0.835*** (0.068)	
Leverage Ratio with Leases of Other Firms in SIC3			0.289*** (0.046)	0.682*** (0.036)			0.136** (0.069)	0.726*** (0.050)
Owned PP&E _t / (Assets+Leases) _t		0.090*** (0.018)	0.071*** (0.018)	0.109*** (0.018)		0.036* (0.020)	0.032 (0.021)	0.086*** (0.021)
Market Assets _t / (Assets+Leases) _t		-0.013*** (0.004)	-0.013*** (0.004)	-0.014*** (0.004)		-0.019*** (0.006)	-0.018*** (0.006)	-0.020*** (0.006)
ln(Sales)		0.014*** (0.002)	0.013*** (0.002)	0.015*** (0.002)		0.006** (0.003)	0.006** (0.003)	0.007** (0.003)
OIBDP ex Rent _t / (Assets+Leases) _{t-1} , 5yr mean		-0.098*** (0.024)	-0.101*** (0.024)	-0.106*** (0.024)		-0.066* (0.036)	-0.064* (0.036)	-0.038 (0.037)
OIBDP ex Rent _t / (Assets+Leases) _{t-1} , 5yr stdev		-0.027 (0.053)	-0.017 (0.053)	-0.019 (0.054)		0.054 (0.079)	0.063 (0.079)	0.074 (0.082)
Constant	0.018 (0.009)	-0.021 (0.015)	-0.037 (0.015)	0.004 (0.016)	-0.003 (0.012)	-0.008 (0.021)	-0.013 (0.021)	0.048 (0.022)
Observations	2569	2569	2569	2569	2569	2569	2569	2569
Adjusted R-squared	0.29	0.32	0.33	0.28	0.35	0.36	0.37	0.29

Table 5: Incremental Explanatory Power of Competitor Leverage Ratio Over Traditional Determinants Including Total PP&E

The first four columns show Ordinary Least Squares (OLS) estimates. The second four columns show weighted least squares (WLS) estimates, where the weights are the number of *CIQ* competitors. The Property Plant and Equipment variable is Total PP&E, which is the unadjusted figure that appears on the balance sheet plus the capitalized value of operating leases. Robust standard errors are in parentheses. OIBDP is Operating Income Before Depreciation. *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

	<i>Dependent Variable: Leverage Ratio with Leases</i>							
	<i>Ordinary Least Squares Estimates</i>				<i>Weighted by CIQ Number of Competitors</i>			
Leverage Ratio with Leases of <i>CIQ</i> Competitors	0.916*** (0.030)	0.616*** (0.038)	0.499*** (0.047)		1.015*** (0.037)	0.775*** (0.053)	0.727*** (0.069)	
Leverage Ratio with Leases of Other Firms in SIC3			0.188*** (0.045)	0.495*** (0.038)			0.065 (0.069)	0.522*** (0.056)
Total PP&E _t / (Assets+Leases) _t		0.217*** (0.018)	0.198*** (0.019)	0.245*** (0.019)		0.139*** (0.023)	0.134*** (0.023)	0.207*** (0.023)
Market Assets _t / (Assets+Leases) _t		-0.014*** (0.004)	-0.013*** (0.004)	-0.015*** (0.004)		-0.016*** (0.006)	-0.015** (0.006)	-0.017*** (0.006)
ln(Sales)		0.014*** (0.002)	0.014*** (0.002)	0.016*** (0.002)		0.008*** (0.003)	0.008*** (0.003)	0.009*** (0.003)
OIBDP ex Rent _t / (Assets+Leases) _{t-1} , 5yr mean		-0.115*** (0.023)	-0.116*** (0.023)	-0.122*** (0.022)		-0.094*** (0.035)	-0.093*** (0.036)	-0.082** (0.036)
OIBDP ex Rent _t / (Assets+Leases) _{t-1} , 5yr stdev		-0.028 (0.052)	-0.022 (0.052)	-0.022 (0.052)		0.019 (0.077)	0.024 (0.077)	0.027 (0.079)
Constant	0.018 (0.009)	-0.02 (0.015)	-0.03 (0.015)	0.005 (0.015)	-0.003 (0.012)	-0.005 (0.021)	-0.008 (0.021)	0.046 (0.022)
Observations	2569	2569	2569	2569	2569	2569	2569	2569
Adjusted R-squared	0.29	0.35	0.36	0.32	0.35	0.38	0.38	0.33

Table 6: Firm Characteristics and Average Characteristics of Product Market Competitors

This table shows the adjusted R^2 from regressions relating firm characteristics on the average characteristics of *CIQ* competitors. The specification is identical to equation (1) in Section 3, but the outcome variables of interest are the determinants of capital structure. The second column presents the Adjusted R^2 from WLS specifications where we weight by the number of firms in the product market group. OIBDP is Operating Income Before Depreciation.

	<u>unweighted</u>	<u>weighted</u>
Total PP&E _t / (Assets + Leases) _t	0.67	0.78
Leases _t / (Assets + Leases) _t	0.49	0.66
Owned PP&E _t / (Assets + Leases) _t	0.68	0.79
Capital / Labor _t	0.77	0.87
Owned Machinery PP&E _t / Total PP&E _t	0.48	0.53
Owned Buildings PP&E _t / Total PP&E _t	0.25	0.30
Leases _t / Total PP&E _t	0.34	0.49
Market Assets _t / (Book Assets + Leases) _{t-1}	0.11	0.18
OIBDP ex Rent _t / (Assets+Leases) _{t-1} , 5yr mean	0.30	0.28
OIBDP ex Rent _t / (Assets+Leases) _{t-1} , 5yr stdev	0.12	0.19
ln(Sales)	0.15	0.21

Table 7: Leverage Ratios and Characteristics of Firms in the Same Product Market

Each explanatory variable is an average of one of the “reliable predictors” of capital structure in existing literature. The dependent variable is the leverage ratio including leases. Coefficients are estimated via ordinary least squares. Robust standard errors are in parentheses. *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

<i>OLS coefficients</i>	<i>Dependent Variable: Leverage Ratio with Leases</i>							
Total PP&E _t / (Assets + Leases) _t of <i>CIQ</i> Competitors	0.407*** (0.019)				0.388*** -0.021			
Owned PP&E _t / (Assets + Leases) _t of <i>CIQ</i> Competitors	0.323*** (0.020)				0.284*** (0.022)			
OIBDP ex Rent _t / (Assets+Leases) _{t-1} , 5yr mean of <i>CIQ</i> Competitors	0.260*** (0.033)				-0.062 (0.046) 0.027 (0.046)			
OIBDP ex Rent _t / (Assets+Leases) _{t-1} , 5yr stdev of <i>CIQ</i> Competitors	-0.330*** (0.114)				-0.062 (0.150) -0.026 (0.142)			
ln(Sales) of <i>CIQ</i> Competitors	0.019*** (0.003)				0.017*** (0.004) 0.015*** (0.004)			
Market Assets _t / (Book Assets + Leases) _{t-1} of <i>CIQ</i> Competitors	-0.099*** (0.008)				-0.024*** (0.009) -0.035*** (0.010)			
Constant	0.148 (0.007)	0.199*** (0.006)	0.248*** (0.006)	0.291*** (0.005)	0.142*** (0.022)	0.431*** (0.014)	0.077** (0.031)	0.152*** (0.032)
Observations	2825	2825	2825	2824	2824	2825	2823	2823
Adjusted R-squared in OLS	0.16	0.09	0.02	0.00	0.02	0.04	0.17	0.11
Adjusted R-squared in WLS	0.21	0.12	0.03	0.00	0.02	0.06	0.22	0.13

Table 8: Debt Structure and Debt Structure of Competitors

Each row shows the beta, constant, number of observations, and R-squared from a univariate regression of the given ratio on the average of the same ratio among the firm's *CIQ* competitors.

	Beta	Constant	Observations	Adj R ²
(Leases + Secured Debt) / (Assets + Leases)	0.879*** (0.033)	0.041*** (0.005)	2751	0.27
Unsecured Debt / (Assets + Leases)	0.676*** (0.039)	0.008** (0.004)	2751	0.14
Subordinated Debt / (Assets + Leases)	0.109* (0.057)	0.013*** (0.001)	2751	0.00
Leases / (Assets + Leases)	0.961*** (0.034)	0.008*** (0.002)	2825	0.49
Mortgages & Collateralized Leases / (Assets + Leases)	0.839*** (0.103)	0.003*** (0.001)	2751	0.17
Notes Payable / (Assets + Leases)	0.631*** (0.047)	0.010*** (0.003)	2751	0.12
Bank Debt / (Assets + Leases)	0.721*** (0.056)	0.033*** (0.004)	2751	0.12
Arm's Length Program Debt / (Assets + Leases)	0.288*** (0.067)	0.002*** (0.000)	2751	0.02
Revenue Bonds / (Assets + Leases)	0.430*** (0.102)	0.002*** (0.001)	2751	0.04
Convertible Bonds / (Assets + Leases)	0.436*** (0.088)	0.012*** (0.002)	2751	0.03
Debentures / (Assets + Leases)	0.315*** (0.077)	0.001*** 0.000	2751	0.02
Individual Notes / (Assets + Leases)	-0.029 (0.030)	0.005*** (0.001)	2751	0.00

Table 9: Product Market Groups at Extremes of Financial Variables

This table shows the product market groups among the highest 5 and lowest 5 of the 228 product market groups based on the maximal clique network analysis described in the text.

A.) Leverage Ratio without Leases

Highest

1	DOLLAR THRIFTY HERTZ GLOBAL AVIS BUDGET	0.709
2	REGAL ENTERTAINMENT CINEMARK HOLDINGS CARMIKE CINEMAS	0.691
3	CROWN CASTLE AMERICAN TOWER SBA COMMUNICATIONS	0.637
4	AUTONATION INC PENSKE AUTOMOTIVE SONIC AUTOMOTIVE	0.573
5	ENTERCOM COMMUNICATIONS EMMIS COMMUNICTNS SALEM COMMUNICATIONS	0.529

Lowest

1	COGNEX CORP KEY TECHNOLOGY PERCEPTRON INC	0.000
2	CONTINUCARE CORP METROPOLITAN HLTH WEBMD HEALTH	0.000
3	TOMOTHERAPY INC ACCURAY INC VARIAN MEDICAL	0.008
4	URANIUM RESOURCES URANIUM ENERGY URANERZ ENERGY	0.008
5	TECHNOLOGY SOLUTIONS ELOYALTY CORP SAPIENT CORP	0.011

B.) Leverage Ratio with Leases

Highest

1	REGAL ENTERTAINMENT CINEMARK HOLDINGS CARMIKE CINEMAS	0.804
2	HERTZ GLOBAL DOLLAR THRIFTY AVIS BUDGET	0.736
3	CROWN CASTLE AMERICAN TOWER SBA COMMUNICATIONS	0.717
4	AUTONATION INC PENSKE AUTOMOTIVE SONIC AUTOMOTIVE	0.665
5	BROOKDALE SENIOR KINDRED HEALTHCARE EMERITUS CORP	0.614

Lowest

1	URANIUM RESOURCES URANIUM ENERGY URANERZ ENERGY	0.019
2	COGNEX CORP KEY TECHNOLOGY PERCEPTRON INC	0.263
3	TOMOTHERAPY INC ACCURAY INC VARIAN MEDICAL	0.044
4	CREE INC COHERENT INC ROFIN SINAR	0.051
5	TECHNOLOGY SOLUTIONS ELOYALTY CORP SAPIENT CORP	0.068

C.) Total PP&E_t / (Assets + Leases)

Highest

1	AQUA AMERICA CALIFORNIA WATER AMERICAN STATES	0.836
2	REGAL ENTERTAINMENT CINEMARK HOLDINGS CARMIKE CINEMAS	0.781
3	COEUR D'ALENE HECLA MINING STILLWATER MINING	0.773
4	MCGRATH RENTCORP ELECTRO RENT CONTINENTAL RESOURCES	0.771
5	BASELINE OIL CHINA NORTH MAGNUM HUNTER	0.765

Lowest

1	PULTE HOMES D R HORTON LENNAR CORP	0.024
2	REYNOLDS AMERICAN LORILLARD INC VECTOR GROUP	0.080
3	OMNICELL INC NEWELL RUBBERMAID INFOLOGIX INC	0.088
4	PCTEL INC INGRAM MICRO TECH DATA	0.091
5	MAGMA DESIGN VIRAGE LOGIC MOSYS INC	0.091

D.) OIBDP_t / Book Assets_{t-1, 5yr mean}

Highest

1	EOKINETICS INC TGC INDUSTRIES DAWSON GEOPHYSICAL	0.400
2	MCGRATH RENTCORP ELECTRO RENT CONTINENTAL RESOURCES	0.344
3	BOOTS & BJ SERVICES PIONEER DRILLING	0.299

4	REYNOLDS AMERICAN LORILLARD INC VECTOR GROUP	0.289
5	ION GEOPHYSICAL MITCHAM INDUSTRIES DAWSON GEOPHYSICAL	0.286
Lowest		
1	URANIUM RESOURCES URANIUM ENERGY URANERZ ENERGY	-0.866
2	GENERAL MOLY TIMBERLINE RESOURCES MINES MANAGEMENT	-0.634
3	AMICUS THERAPEUTICS OREXIGEN THERAPEUTICS VANDA PHARMACEUTICALS	-0.541
4	RIGEL PHARMACEUTICALS ARRAY BIOPHARMA NEUROGEN CORP	-0.274
5	DURECT CORP NEKTAR THERAPEUTICS I-FLOW CORP	-0.257

E. OIBDP_t / Book Assets_{t-1}, 5yr stdev

Highest		
1	URANIUM RESOURCES URANIUM ENERGY URANERZ ENERGY	0.369
2	GENERAL MOLY MINES MANAGEMENT TIMBERLINE RESOURCES	0.354
3	HARVEST NATURAL BPZ RESOURCES FAR EAST	0.306
4	AMERICAN ORIENTAL TIENS BIOTECH AMDL INC	0.289
5	ELIXIR GAMING GAMING PARTNERS SHUFFLE MASTER	0.210
Lowest		
1	HERTZ GLOBAL DOLLAR THRIFTY AVIS BUDGET	0.009
2	MCCORMICK & SENSIENT TECHNOLOGIES INTL FLAVORS	0.010
3	AQUA AMERICA CALIFORNIA WATER AMERICAN STATES	0.010
4	INTL SPEEDWAY SPEEDWAY MOTORSPORTS DOVER MOTORSPORTS	0.014
5	BASIN WATER LAYNE CHRISTENSEN GENERAL ELECTRIC	0.014

F. ln(Sale)

Highest		
1	NEWMONT MINING SOUTHERN COPPER FREEPORT-MCMORAN COP&GOLD	10.044
2	RUDDICK CORP NASH FINCH SPARTAN STORES	9.198
3	ALON USA CALUMET SPECIALTY DELEK US	8.993
4	PETSMART INC RADIOSHACK CORP PANTRY INC	8.909
5	OMNICELL INC CARDINAL HEALTH BAXTER INTERNATIONAL	8.895
Lowest		
1	GENERAL MOLY TIMBERLINE RESOURCES MINES MANAGEMENT	-0.280
2	AMICUS THERAPEUTICS OREXIGEN THERAPEUTICS VANDA PHARMACEUTICALS	0.720
3	RIGEL PHARMACEUTICALS ARRAY BIOPHARMA NEUROGEN CORP	1.067
4	DURECT CORP NEKTAR THERAPEUTICS I-FLOW CORP	2.538
5	URANIUM RESOURCES URANIUM ENERGY URANERZ ENERGY	2.921

G.) Market-to-Book

Highest		
1	REYNOLDS AMERICAN LORILLARD INC VECTOR GROUP	2.742
2	AMICUS THERAPEUTICS OREXIGEN THERAPEUTICS VANDA PHARMACEUTICALS	2.729
3	ALLIANCE HEALTHCARE BIO REFERENCE MEDTOX SCIENTIFIC	2.615
4	OSIRIS THERAPEUTICS STEMCELLS INC GERON CORP	2.576
5	AMAG PHARMACEUTICALS ROCKWELL MED WATSON PHARMACEUTICALS	2.343
Lowest		
1	CENTURY ALUMINUM KAISER ALUMINUM ALCOA INC	0.775
2	COEUR D'ALENE STILLWATER MINING HECLA MINING	0.786
3	ADAMS GOLF ALDILA INC CALLAWAY GOLF	0.815
4	LGL GROUP CTS CORP VALPEY-FISHER CORP	0.843
5	INTL SPEEDWAY SPEEDWAY MOTORSPORTS DOVER MOTORSPORTS	0.855

Table 10: Leverage Ratio Regressions at the Product Market Group Level

The table shows OLS (Panel A) and WLS (Panel B) estimates of the relation between leverage (with leases) and the “reliably important” determinants of capital structure, all calculated at the product market group level. Robust standard errors are in parentheses. *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Panel A: OLS Estimates

	Dependent Variable: Leverage Ratio with Leases							
Total PP&E _t / (Assets + Leases) _t	0.386*** (0.038)					0.373*** (0.038)		
Owned PP&E _t / (Assets + Leases) _t	0.269*** (0.045)					0.258*** (0.046)		
Profitability, 5yr mean			0.199*** (0.062)				-0.130* (0.070) -0.124 (0.079)	
Profitability, 5yr stdev					-0.641*** (0.159)		-0.510*** (0.176) -0.506** (0.201)	
Market Assets _t / (Assets + Leases) _{t-1}					-0.053** (0.022)		0.000 (0.018) -0.008 (0.021)	
ln(Sales)					0.03*** (0.005)		0.020*** (0.006) 0.022*** (0.007)	
Constant	0.159*** (0.013)	0.212*** (0.013)	0.251*** (0.011)	0.313*** (0.013)	0.352*** (0.033)	0.076** (0.036)	0.079 (0.051)	0.125** (0.058)
Observations	228	228	228	228	228	228	228	228
Adjusted R-squared	0.31	0.13	0.04	0.06	0.02	0.12	0.40	0.23

Panel B: WLS Estimates, Weighted by Number of Firms in Product Market Group

	Dependent Variable: Leverage Ratio with Leases							
Total PP&E _t / (Assets + Leases) _t	0.374*** (0.026)					0.387*** (0.028)		
Owned PP&E _t / (Assets + Leases) _t	0.296*** (0.030)					0.303*** (0.035)		
Profitability, 5yr mean			0.307*** (0.072)			-0.100 (0.073) -0.028 (0.085)		
Profitability, 5yr stdev			-0.435** (0.199)			-0.419** (0.187) -0.345 (0.225)		
Market Assets _t / (Assets + Leases) _{t-1}			-0.085*** (0.020)			0.024 (0.017) 0.022 (0.020)		
ln(Sales)						0.031*** (0.005) 0.017*** (0.006) 0.019*** (0.007)		
Constant	0.161*** (0.009)	0.204*** (0.009)	0.236*** (0.010)	0.297*** (0.013)	0.399*** (0.031)	0.062 (0.038)	0.042 (0.054)	0.064 (0.063)
Observations	228	228	228	228	228	228	228	228
Adjusted R-squared	0.48	0.29	0.07	0.02	0.07	0.12	0.53	0.35