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Commercial Property Exposure and Corporation Financing Choice

Jing Yang
Finance Department, California State University at Fullerton
Fullerton, CA 92834, USA
jyang@fullerton.edu

ABSTRACT

This study explores the possible relationship between a corporation's capital structure and its commercial property exposure as well as property market characteristics. Using data from the heavily levered and rapidly growing U.S. telecommunications industry, we find a positive association between leverage and commercial property exposure via commercial property ownership since the 1996 telecommunications industry deregulation, after controlling for traditional capital structure determinants, and the association is particularly prominent during the 2007-2009 Great Recession. A possible justification is the collateral effect of real estate properties on leverage. The exposure through property leases also play (albeit smaller) roles in the financing choice. Our findings generally suggest a non-trivial influence of real estate exposure to the firms' financing choices, especially when the capital market is tight hence the collateral effect is critical.

JEL Classifications: R30, G32, G30

Keywords: real estate exposure, capital structure, location effect

I. INTRODUCTION

This study explores whether the characteristics of commercial property investments of a corporation and commercial property market conditions at its headquarter location play any role in this firm's financing choice.

Commercial properties are often expensive. When a firm purchases a commercial property, the purchase cost (affected by concurrent local commercial property market conditions) can affect this firm's cash flows, depreciation and tax expenses. In addition, the subsequent variations in the commercial property prices can affect this firm's collateral values and correspondingly its debt capacity, cost of debt as well as cost of capital. When a firm rents a commercial property, the rental cost (affected also by the local commercial property market situations) can be significant too, and it can influence this firm's cash flows and cost of capital. Probably because the issues are crossing two different research fields – real estate and corporation finance, there has been a paucity of research on the possible links of a firm's real estate exposure and local real estate market conditions to this firm's financing choice. These have motivated us to launch this study, and our findings can help fill the research gap.

This study is linked to the literature about the relationship between a firm's location and its financial characteristics, a growing yet still thin line of the finance literature. Gao, Ng and Wang (2011) find that the location of a firm's headquarter is influential to this firm's capital structure policies, through local culture, social interactions among local corporate executives, and local legal environments. They report that companies sharing the same headquarter location exhibit conformity in their financing policies. Pirinsky and Wang (2006) argue that local investors sometimes are the major investors of local stocks, therefore returns of local stocks often exhibit comovements. Dougal, Parsons and Titman (2015) show that corporation investments are sensitive to the investments, cash flows and stock returns of other firms headquartered nearby regardless of if they are in the same industries. Parsons, Sulaeman and Titman (2018) disclose that financial misconducts (such as corruption) of a corporation are correlated with ethical behaviors of other firms nearby, with social norms transmitting among peers. Our study is focused on a firm's exposure to a different location factor, that is, the local commercial property markets, which has rarely been linked to corporate financial decisions in the literature. Different from those capital structure determinants already extensively studied, the local commercial property market characteristics are quite time-varying, and hence more suitable for us to explore the dynamics of the corporate financial decisions.

Among very few studies that have explored the detailed mechanisms through which the real estate exposure or local real estate market conditions influence firms, most are focused on the effects of local housing markets. For instance, Louis and Sun (2013) report that a firm's long-term stock returns are negatively related to the past growth in housing prices in the state where the firm is located. Their first justification is via the wage effect: as the state housing price level increases, firms within the state are likely to offer higher wages to attract workers, which will reduce their profits leading to lower future returns. Their second justification is via the local bias: growth in local housing prices could raise demand for local stocks (hence temporarily increasing their stock prices) via three channels, leading to a negative association between local housing price growth and future returns of local stocks. The three channels are: (a) a substitution effect

(as housing prices increase, investors are likely to find house investment less attractive and turn to stocks or other investment vehicles); (b) a wealth effect (as housing prices increase, so does household wealth, hence investors may increase their stock holdings); and (c) a borrowing effect (a housing price growth can relax homeowners' borrowing constraints, increasing their debt raising and hence cash availability to buy stocks).

Tuzel (2010) is one of the few that focus on the effects of direct real estate holdings on a firm. She argues that real estate properties are more risky than other forms of capitals (such as equipment) in a firm. The former usually depreciate more slowly than the latter, so the investment of the latter will be reduced first when the firm faces bad productivity shocks, resulting in an increase in the share of real estate properties in its capital holdings. For this reason, a firm already with more real estate holdings will have less space to mitigate the bad shocks; in other words, real estate exposures will increase a firm's vulnerability to bad shocks. Consistent with this argument, she shows a significant risk premium in firms' stock returns associated with real estate exposure, which is measured by the weight of real estate value in Property, Plant and Equipment (or, PPE).

We attempt to provide some complementary contributions to the literature by analyzing the links of a firm's real estate (mainly commercial properties) exposure and its local property market characteristics to its capital structure. In the real estate literature, the studies associated with capital structure are focused on the REITs sector, mostly on the capital structure choice of a REIT or how capital structure affects the risk or performance of a REIT.[1] One of the few studies that analyze the effects of real estate risk exposure on a regular (non-REIT) firm is Deng, Ong and Qian (2018), which measures a firm's real estate risk exposure mainly by its real estate beta in a 2-factor asset pricing model that includes the market risk premium and the real estate risk premium (that is, the difference between the REIT return and the risk free rate). While this is an innovative and interesting way to measure the real estate risk exposure, the real estate beta might not capture the true exposure to the risk from the real property markets, because REIT returns are found to poorly reflect the returns of underlying commercial properties[2]. A secondary measurement of real estate exposure in their study is the real estate weight, the ratio of real estate value over total asset value, which we think may not be as relevant to the real estate exposure as the weight of real estate value in PPE used in Tuzel (2010) especially for firms with a large portion of intangible assets.

In our study, we follow Tuzel (2010) to measure the direct commercial property exposure of a firm, and consider a few possible mechanisms through which the commercial properties might affect capital structure. (1) The tax shield substitution effect. Different types of PPE in a firm incur different rates of depreciation, but commercial properties may incur relatively more depreciation than other PPE types (such as machines) due to their longer lives and larger values. As a result, a higher commercial property exposure may predict a more significant depreciation related tax shield effect, which can substitute the interest expense tax shield effect of debt, making debt a less attractive capital source to the firm. (2) The collateral effect. Buildings are more valuable and last longer than other fixed assets, making them better candidates to serve as collaterals in

[1] These studies include Brounen and Eichholtz (2001), Feng, Ghosh and Sirmans (2007), Hardin and Wu (2010), Harrison, Panasian and Sailer (2011), Sun, Titman and Twite (2015), Cashman, Harrison and Seiler (2016), Giacomini, Ling and Naranjo (2017), Borochin, et al (2017), Pavlov, Steiner and Wachter (2018), and Dogan, Ghosh and Petrova (2019).

[2] See, for instance, Mühlhofer (2013).

debt raising. As a result, Firms with more commercial properties in the assets may raise debt more easily, and the effect becomes stronger when the market values of these collateral properties increase. (3) The rental cost effect. Expenses to rent commercial properties increase a firm's cash outflow, hence elevating its debt default risk and the corresponding cost of debt, making debt less attractive to the firm. Note that the effect in (1) suggests a negative association between real estate ownership exposure and leverage, while the effect in (2) suggests a positive association between the two variables. Furthermore, the effect in (3) suggests a negative association between real estate rental exposure and leverage.

Analyzing the effects of commercial property exposure and commercial property market performance is meaningful. Liu, et al (1990) report that unlike REITs, commercial real estate markets are not quite integrated with the stock market. This implies that commercial property return changes might form a firm risk that cannot be diversified away by the traditional portfolio management. In addition, while most previous studies on the relationship between real estate and finance focus on housing markets, as compared to the housing markets, commercial property markets affect firms more directly since almost all firms own or rent commercial properties, but very few own or buy residential houses. Commercial properties also have indirect effects such as the tax shield substitution effect and the collateral effect. Finally, analyzing a corporation's acquisition or use of commercial property is interesting also because corporations usually overpay for commercial properties and sell them with discounts due to impatience and short marketing time (Wiley (2012)). This type of inefficiency may make commercial properties more influential to a firm's cash flows and correspondingly its cost of capital, increasing the value of our study.

The next section introduces the data, methodology and hypotheses of this study. The third section presents and analyzes empirical results. We then present several robustness tests in the fourth section. The last section concludes.

II. DATA AND METHODOLOGY

This study uses a sample from the U.S. telecommunications industry, investigating firms included in COMPUSTAT (with SIC codes 4900-4999) with headquarters located in MSAs that are included in the NCREIF (National Council of Real Estate Investment Fiduciary) database, during 1975 (the starting year of the NCREIF data) to 2013 (a year that the US economy has experienced many years of rebounding from the 2007-2009 Great Recession, which we simplify as "2007-2009 crisis" or "crisis" here after). We choose telecommunications industry because it generally has a high average financial leverage ratio, and has experienced substantial changes due to the Telecommunications Act of 1996 and the business cycle around the 2007-2009 crisis. In this sense, it is a good sample to study financial choices, witnessing significant regime shifts in the market structure and the average capital structure. In addition, it has experienced unprecedented booming in the recent decades due to successive technology innovations[3], attracting large

[3] An article published at https://www.aei.org/technology-and-innovation/telecommunications/20th-anniversary-1996-telecom-act-lets-get-back-track/ on February 8, 2016 reports that: "The development of the Internet since the 1996 act has been an unqualified success. The Internet ecosystem now accounts for 6 percent of the US economy, but this percentage could be even higher, because it does not include the many traditional companies that have integrated Internet processes as part of their operations… It's not an

amounts of capital inflows[4]. The Telecommunications Act of 1996 substantially reduced the entrance barriers to the telecom market. Leach, Moyne and Yang (2013) report noticeable increases in the telecom firms' capital investments and debt usages after 1996, and they justify these changes as telecom firms' strategies to make them more aggressive in the telecommunications market competitions. The 2007-2009 crisis led to severe cash flow problems to many telecom carriers, some of which were forced to exit the market. After the crisis, telecom market became the most rapidly rebounded market partially due to multiple significant and fast technology breakthroughs in this industry. Corresponding to these regime shifts, we study the influences of commercial property exposure and commercial property market characteristics on the telecom firms' financing choices in multiple sample periods: pre-1996 period (1975-1995), post-1996 period (1996-2013), and crisis period (2007-2009). The capital markets were exceptionally tight during the crisis period, so we will explore whether there were more pronounced collateral effect of properties on telecom companies' debt financing.

This study uses three sets of variables. The first set includes multiple measurements of capital structure. Following the literature (such as Titman and Wessel, 1988, and Billett et al, 2007), we examine the following leverage variables, where debt and total assets are measured by their book values, and equity is measured by either book value or market value: (1) long-term debt to book value of equity ratio ("lD/Eb"); (2) total debt to book value of equity ratio ("tD/Eb"), where total debt is the sum of long-term debt, short-term debt and convertible debt; (3) long-term debt to market value of equity ratio ("lD/Em"); (4) total debt to market value of equity ratio ("tD/Em"); (5) long-term leverage ("lD/TA") calculated as the ratio of long-term debt to total assets; and (6) leverage ("tD/(tD+Em)") calculated as the ratio of total debt to the sum of total debt and market value of equity. The market value of equity is measured by the fiscal year-end close price of the stock multiplied by the number of common shares outstanding. All these variables are computed from the COMPUSTAT data.

The second set of variables are the real estate factors, including the company's real estate exposure variables and the commercial property market characteristic variables. Following Tuzel (2010), we measure a firm's real estate exposure by the weight of its building and capitalized leases (which is found to be mostly property leases rather than equipment leases, as discussed in Tuzel, 2010) in PPE. Specifically, based on the property acquisition costs, we generate two property ownership exposure variables (buildings/PPE, and its difference from the 2-SIC digit sector average) and two property rental exposure variables (leases/PPE, and its difference from the 2-SIC digit sector average), using the COMPUSTAT data. The data source for the commercial property market characteristics is NCREIF. Since the main property type for telecommunications

overstatement to say that the Internet is the 'world's greatest free market success story.' Mobile is another unqualified success. It is undisputed that the US leads on a number of important mobile and wireless measures, including the number of mobile broadband subscriptions, diversification of mobile technologies, and the proliferation of mobile applications. The iPad didn't exist in 2009, but 300 million have been sold since, almost one for every American. Mobile penetration increased from the already high 89 percent to 110 percent."

[4] As reported in the *OECD Communications Outlook: 2003 Edition*, "The telecommunications sector, in particular, increased its capital spending sharply in the 1990s, after governments opened the market to new entrants. Investment was also spurred by the introduction of marketable new technologies -- notably mobile phones and Internet access services. The new regulatory environment, rapid technological innovation and potential for new service development excited the appetite of the investment community. This led to large flows of equity issuance, debt floatation and bank credit."

firms is office, we focus on the office market characteristics. We match each firm-year with the previous year's NCREIF capital return and income return data for office properties within the MSA where the firm is headquartered. Capital return captures the annual appreciation rate of the property price, and income return captures the annual property net operating income (mainly rental income) scaled by the average daily property value.

The third set of variables we use are the traditional determinants for capital structure, which have been constructed and adopted in previous capital structure studies (such as Titman and Wessels, 1988, Billett et al, 2007, and Axelson et al, 2013). They are firm characteristics including: (1) size, measured by the natural logarithm of sales; (2) growth opportunity, measured by the market-to-book ratio of firm value; (3) profitability, measured by the ratio of operating income to sales; (4) non-debt tax shields, including two proxies, the ratio of investment tax credit to total assets, and the ratio of depreciation to total assets; (5) uniqueness, proxied by the ratio of selling expenses to sales; and (6) asset turnover, calculated by the ratio of sales to PPE. The definitions of all the variables used in this study are summarized in the Appendix of this paper.

For each time period mentioned earlier, we will employ an unbalanced panel data with an OLS approach, to regress a capital structure variable on explanatory variables including the previous year's traditional determinants for capital structure, and a set of previous year's real estate factors (either the combination of commercial property ownership exposure, NCREIF office capital gain, and their interaction term; or the combination of commercial property rental exposure, NCREIF office income gain, and their interaction term). The year-fixed effect is controlled. The regressions take the following form:

$$Lev_{j,t} = \alpha + \sum_{i=1}^{n} \beta_i F_{i,j,t-1} + \gamma REE_{j,t-1} + \omega r_{j,t-1} + \theta REE_{j,t-1} r_{j,t-1} + \sigma, \quad (1)$$

where j is the firm index, t is the year index, Lev_t is a leverage variable at year t, $F_{i,t-1}$ is the i-th traditional determinant for leverage at year $t-1$ (with $i = 1, \dots n$), REE_{t-1} and r_{t-1} are the real estate ownership (or rental) exposure and local MSA's office market capital return (or income return) at year $t-1$, and $REE_{t-1}\, r_{t-1}$ is the interaction between REE_{t-1} and r_{t-1}. σ is the error term and α is a constant. To alleviate the possible multicollearity problem, we estimate the variance inflation of each regressor, to examine if real estate factors indeed insert influences to leverage in ways that are not captured by other capital structure determinants.

Note that the signs of the real estate factor coefficients, including γ, ω and θ, will be predicted differently for varied effects of real estate on capital structure. (1) Through the tax shield substitution channel, property ownership will incur depreciation expense, a corporation tax shield, reducing the firm's incentive to use the alternative tax shield, the interest expense, via raising debt. (2) Through the collateral channel, a larger property ownership or a higher property value will increase the collateral value of a firm, enhancing its debt raising ability. (3) Through the rental cost channel, a larger rental cost of leased properties or an increased property rental price will lower firm profit, reducing debt supply for this firm. Based on these different outcomes, we can test the following hypotheses to infer which channels play more important roles:

H1: Leverage is negatively associated with the previous year's commercial property ownership exposure, office capital gain, and/or their interaction term.

If the results are in support of this hypothesis, it indicates that the negative associations between real estate ownership exposure and leverage through mechanisms such as the tax substitution channel, generally dominate their positive associations through mechanisms such as the collateral channel. It is a competing hypothesis of the following hypothesis:

H2: Leverage is positively associated with the previous year's commercial property ownership exposure, office capital gain, and/or their interaction term.

Opposite to the implications for H1, testing results in support of H2 would suggest that the positive associations between real estate ownership exposure and leverage through mechanisms such as the collateral channel, generally dominate their negative associations through mechanisms such as the tax substitution channel. Another non-competing hypothesis is:

H3: Leverage is negatively associated with the previous year's commercial property rental exposure, office income return, and/or their interaction term.

Findings in support of this hypothesis can provide evidence for the rental cost effect in the relationship between real estate rental exposure and capital structure.

The results of these empirical tests together with the descriptive analyses of our data are presented in Section 3. In addition, we also conduct several robustness tests employing alternative econometric methods, to address the concern on the possible standard error biases when using the OLS regressions to model unbalanced panel data. The robustness tests results are presented in Section 4.

III. EMPIRICAL RESULTS

A. Descriptive Analysis

Our raw sample is an unbalanced data with 7445 telecom firm-year observations covering 650 firms during 39 years (from 1975 to 2013). After deleting outliers and those with missing/error values for important variables, we end up with data of three sample periods statistically described in Table 1: pre-1996, post-1997 and crisis period (2007-2009). For all these periods, the six leverage variables (lD/Eb, tD/Eb, lD/Em, tD/Em, lD/TA and tD/(tD+Em)) are analyzed based on their current year values, while other variables are analyzed based on their previous year values, given that their 1-year lagged terms will enter the regressions as the explanatory variables following Equation (1).

Among six leverage variables, lD/Eb (long-term debt to book value of equity ratio) and tD/Eb (total debt to book value of equity ratio) have relatively fewer observations included in the data due to the existence of fully leveraged firms, as well as the existence of observations with strangely reported negative book values of equity in the COMPUSTAT data. Specifically, a fully leveraged firm does not have equity so these two leverage ratios simple do not exist; and we also have to remove an observation with

negative book value of equity as we do not consider a leverage ratio with any value outside [0, 100%]. lD/Em (long-term debt to market value of equity ratio) and tD/Em (total debt to market value of equity ratio) also have fewer observations due to the existence of fully leveraged firms, and the missing data for some firms' stock prices and/or numbers of common stock shares outstanding, which are needed in calculating the market value of equity.

Table 1
Descriptive statistics

		Pre-1996		Post-1996		Crisis (2007-2009)	
Variable	Year	N	Mean	N	Mean	N	Mean
lD/Eb	current year	330	39.78%	715	28.89%	92	27.47%
tD/Eb	current year	330	45.51%	715	31.79%	92	29.06%
lD/Em	current year	234	17.99%	655	18.96%	90	28.24%
tD/Em	current year	234	21.08%	655	20.72%	90	30.24%
lD/TA	current year	559	29.97%	1578	33.96%	231	35.42%
tD/(tD+Em)	current year	574	44.57%	1628	42.07%	245	45.48%
size	previous year	574	4.6992	1628	5.6659	245	5.9586
growth opportunity	previous year	574	1.5516	1628	1.5217	245	1.4120
profitability	previous year	574	-0.6486	1628	-0.5157	245	-0.2140
invest. tax credit/tot assets	previous year	574	0.0019	1628	0.0002	245	0.0000
depreciation/tot assets	previous year	574	0.0686	1628	0.0771	245	0.0703
uniqueness	previous year	574	0.5183	1628	0.5878	245	0.4840
asset turnover	previous year	574	1.9877	1628	2.0132	245	2.8411
buildings/PPE	previous year	574	9.08%	1628	11.34%	245	14.52%
leases/PPE	previous year	574	2.76%	1628	11.64%	245	13.84%
MSA office capital return	previous year	574	-1.78%	1628	0.64%	245	-0.20%
MSA office income return	previous year	574	1.76%	1628	1.75%	245	1.21%

This table reports the descriptive statistics of major variables, which are defined in the Appendix.

Table 1 shows that on average telecommunications firms' real estate exposures generally increase after the 1996 deregulation. The average building/PPE ratio increased from 9.08% to 11.34%. The real estate exposure increase through leasing is more prominent, with the average leases/PPE ratio increased from 2.76% to 11.64%. Both ratios are particularly high during the 2007-2009 crisis (14.52% and 13.84%, respectively). The leverage ratios also exhibit noticeable variations across different periods, albeit with inconsistent trends when leverage is measured via different approaches. Other firm characteristics, however, do not show as obvious variations across periods. These patterns indicate that the real estate exposure change might pay a role in the dynamics of a firm's capital structure.

B. Effects of Real Estate Exposure on Leverages

The leverage regression results for varied time-periods are reported in Tables 2, 3, 4 and 5. In each of these tables, there are two panels. Panel A reports the results associated with

the commercial property ownership exposure, and Panel B reports the results associated with the commercial property rental exposure. It is interesting that there are substantial differences between the results before the 1996 Act and those afterwards, and between the results during the 2007-2009 crisis and those during the whole post-1996 period.

Before 1996

Table 2 reports the leverage regression results for the data before the 1996 Act. In the various regression specifications of Panel A, the real estate ownership exposure (proxied by buildings/PPE, or by buildings/PPE relative to sector average) is negatively associated with the long-term debt to book value of equity ratio (lD/Eb) and the total debt to book value of equity ratio (tD/Eb) in all regression specifications except one (where the proxy is insignificant), with significance levels between 5% and 10%. In these regressions, the real estate ownership exposure's variance inflation stays stably between 1 and 1.3, indicating that its relationship to the book-value based leverage is not very likely driven by its possible correlations with other capital structure determinants. However, its associations to other leverage measurements (mostly market-value based) are insignificant. In addition, local office market capital return does not show any important role in any regression, either as an individual factor or when joining with the real estate ownership exposure. The negative associations between book-value based leverage measurements and real estate ownership exposure are in line with hypothesis H1, suggesting that the relationship between the two factors before 1996 might be largely driven by channels such as the tax shield substitution effect. The lack of the relationship between market-value based leverage measurements and real estate ownership exposure as well as the lack of impacts of property market data on leverage, may be justified by the fact that the tax shield substitution effect are associated more with book values of leverage and properties, than with their market values.

From Panel B, we can see that the coefficient of the real estate rental exposure (proxied by leases/PPE, or by leases/PPE relative to sector average) has a negative sign in every regression as predicted by the rental cost effect hypothesis (H3), but the effect is only weakly significant in just one regression (that is, Specification 2, when leverage is measure by the ratio of total debt to book value of equity, tD/Eb). However, in line with H3, the local office market income return shows strong (at a 1% significance level) negative effect on leverage when leverage is measured by the long-term debt to book value of equity ratio lD/Eb and the total debt to book value of equity ratio tD/Eb, with coefficient magnitudes around -9, and variable inflations at around 1.4. These results indicate that firms' leverage decisions before 1996 are very sensitive to market cost of renting real estate properties (reflected by the office market income return), but not sensitive to the real estate rental exposure itself.

In addition to real estate factors, Table 2 exhibits that to some extent, most controlling variables commonly considered as the usual suspects of capital structure determinants also play expected roles, including firm size, uniqueness and growth opportunities.

Table 2
Leverage regressions for the pre-1996 Telecommunications Act period

Panel A	lD/Eb			tD/Eb			lD/Em			tD/Em			lD/TA			tD/(tD+Em)		
Variable	coef		var inf	coef		var inf	coef		var inf	coef		var inf	coef		var inf	coef		var inf
[specification 1]																		
(1) Intercept	0.289	***	0.00	0.312	***	0.00	0.122	**	0.00	0.121	**	0.00	0.338	***	0.00	0.284	***	0.00
(2) size	0.021	***	1.34	0.021	***	1.34	0.003		1.40	0.003		1.40	0.003		1.30	0.018	***	1.32
(3) growth opportunity	-0.015	*	1.16	0.003		1.16	-0.014	**	1.19	-0.012		1.19	-0.009	**	1.36	-0.010		1.37
(4) profitability	0.001		1.27	0.001		1.27	0.001		1.28	0.001		1.28	0.001		1.53	0.002		1.53
(5) invest. tax credit/tot assets	22.309	***	1.38	24.096	***	1.38	14.168	***	1.42	16.092	***	1.42	0.203		1.40	1.827		1.41
(6) depreciation/tot assets	0.334		1.17	0.175		1.17	0.213		1.17	0.233		1.17	-0.177		1.14	1.031	***	1.13
(7) uniqueness	0.022	**	1.31	0.018	*	1.31	0.004		1.35	0.002		1.35	0.019	***	1.77	0.001		1.77
(8) asset turnover	0.003		1.14	0.003		1.14	0.001		1.15	0.001		1.15	0.000		1.09	-0.003		1.09
(9) buildings/PPE	-0.248	**	1.08	-0.242	*	1.08	-0.036		1.08	0.013		1.08	0.052		1.07	-0.016		1.06
[specification 2]																		
(9) buildings/PPE relative to sector avg	-0.022	**	1.08	-0.021	*	1.08	-0.002		1.08	0.003		1.08	0.005		1.06	-0.002		1.06
[specification 3]																		
(9) buildings/PPE	-0.259	**	1.25	-0.244	*	1.25	-0.057		2.18	0.007		2.18	0.065		1.29	0.029		1.28
(10) MSA office capital return	0.191		2.20	0.087		2.20	0.239		2.22	0.187		2.22	-0.034		2.36	0.310		2.29
(11)=(9)x(10)	-0.524		1.61	-0.056		1.61	-0.525		2.72	-0.137		2.72	0.669		1.81	2.681		1.81
[specification 4]																		
(9) buildings/PPE relative to sector avg	-0.022	*	1.30	-0.020		1.30	-0.001		2.06	0.004		2.06	0.006		1.33	0.003		1.33

(10) MSA office capital return	0.153	2.23	0.049	2.23	0.202	2.23	0.153	2.23	-0.055	2.43	0.300	2.36
(11)=(9)x(10)	0.002	1.67	0.044	1.67	0.015	2.54	0.045	2.54	0.081	1.88	0.235	1.88
Year fixed effects	YES		YES		YES		YES		YES		YES	
Number of observations	330		330		234		234		559		574	

Panel B	lD/Eb		tD/Eb		lD/Em		tD/Em		lD/TA		tD/(tD+Em)	
Variable	coef	var inf	coef	var inf	coef	var inf	coef	var inf	coef	var inf	coef	var inf
[specification 1]												
(9) leases/PPE	-0.278	1.06	-0.355 *	1.06	-0.189	1.07	-0.212	1.07	-0.146	1.07	-0.215	1.07
[specification 2]												
(9) leases/PPE relative to sector avg	-0.008	1.05	-0.010	1.05	-0.006	1.07	-0.007	1.07	-0.004	1.06	-0.005	1.06
[specification 3]												
(9) leases/PPE	-0.547	22.72	-0.640	22.72	-0.633	23.30	-0.730	23.30	-0.229	4.17	-0.475	4.12
(10) MSA office income return	-9.246 ***	1.44	-9.050 ***	1.44	-0.641	1.67	0.188	1.67	-0.749	1.56	0.328	1.53
(11)=(9)x(10)	11.833	22.92	12.604	22.92	20.267	23.50	23.680	23.50	4.797	4.52	15.033	4.46
[specification 4]												
(9) leases/PPE relative to sector avg	-0.008	18.71	-0.010	18.71	-0.015	19.41	-0.017	19.41	-0.006	3.28	-0.013	3.24
(10) MSA office income return	-9.172 ***	1.44	-8.966 ***	1.44	-0.603	1.68	0.223	1.68	-0.774	1.59	0.198	1.56
(11)=(9)x(10)	0.011	18.88	-0.018	18.88	0.410	19.58	0.505	19.58	0.141	3.66	0.459	3.60
Year fixed effects	YES		YES		YES		YES		YES		YES	
Number of observations	330		330		234		234		559		574	

This table reports the results from the OLS regressions of leverage using an unbalanced data from telecommunications industry, where the leverage is measured by data between 1976 and 1995, before the Telecommunications Act of 1996 was enacted. Leverage variables include: long-term debt to book value of equity ("lD/Eb"); total debt to book value of equity ("tD/Eb"); long-term debt to market value of equity ("lD/Em"); total debt to market value of equity ("tD/Em"); long-term leverage ("lD/TA") calculated as the ratio of long-term debt to total assets; and leverage ("tD/(tD+Em)") calculated as the ratio of total debt to the sum of total debt and market value of equity. Debts and total assets are measured by book values. Year fixed effects are controlled. All the regression specifications include the explanatory variables (1) to (8), but for simplification, their results are reported only for Specification 1 in Panel A. All the explanatory variables are lagged by 1 year. ***, ** and * indicate significance at the 1% level, 5% level and 10% level, respectively.

Since 1996

Since the Telecommunications Act of 1996 was enacted, as shown in Table 3, the roles of real estate factors and other capital structure determinants have changed dramatically. For all the regression specifications in Panel A, the real estate ownership exposure turns out to increase all the leverage variables with effects at the 1% significance level. Furthermore, the variance inflations of its coefficients are within 1 to 1.08. Both p-values and variance inflations demonstrate that the real estate ownership exposure is associated with capital structure since 1996 in the extent beyond that could be achieved via possible correlations between real estate exposure factors and other capital structure factors. This result is shocking because real estate factors are usually excluded from capital structure regressions in the literature. The result of a positive effect of real estate ownership exposure on a telecom firm's financial leverage strongly supports hypothesis H2 that the relationship between leverage and owned property exposure since 1996 might have been largely driven by channels such as the collateral effect. However, the collateral effect is shown mainly from the historical cost of the properties, while the property market value change (reflected by the local office market capital return) appears irrelevant.

The big change in the results post 1996 can be associated with the telecom market structure change and the correspondingly substantial increase in the leverage level of the whole telecom industry since the 1996 Act opened the market to entrant telecom firms. Leach, Moyen and Yang (2013) report that telecom firms have significantly increased the use of leverage since 1996, partially driven by their incentives to employ the risk-shifting effect of debt to deter increased competitions. This might help justify why the collateral effect has become more dominating than the tax shield substitution effect since 1996: when the leverage level is low (like before 1996), debt capacity is less constrained, so collateral value of properties does not matter too much when a firm is negotiating with lenders to raise debt. However, collateral value becomes critical when a firm has been equipped with a large amount of debt and hence closer to its maximum debt capacity.

In the regression specifications of Panel B, as predicted by hypothesis H3, the real estate rental factor has negative signs. The effect is significant at a 1% level, with variance inflation around 1, when local office market income return is not incorporated in the regression (see Specifications 1 and 2). However, the real estate rental factor becomes insignificant and/or with abnormally high variance inflation when the local office income return is added into the regression (see Specifications 3 and 4). In the latter case, the office income return itself does not play any important role. Although its interaction with the property rental factor displays a negative sign in three regressions as predicted by H3, the variance inflations are too high (above 10). In other words, the rental cost effect might be highly correlated with the other variables since 1996.

Table 3
Leverage regressions for the post-1996 Telecommunications Act period

Panel A	lD/Eb			tD/Eb			lD/Em			tD/Em			lD/TA			tD/(tD+Em)		
Variable	coef		var inf	coef		var inf	coef		var inf	coef		var inf	coef		var inf	coef		var inf
[specification 1]																		
(1) Intercept	0.179	**	0.00	0.202	**	0.00	0.127	*	0.00	0.160	**	0.00	0.411	***	0.00	0.337	***	0.00
(2) size	0.010	*	1.34	0.009	*	1.34	-0.001		1.34	-0.001		1.34	-0.001		1.37	0.005		1.37
(3) growth opportunity	0.009		1.07	0.009		1.07	0.012		1.07	0.013		1.07	-0.001		1.12	-0.002		1.11
(4) profitability	0.006		3.66	0.002		3.66	0.012		3.64	0.011		3.64	-0.003		3.61	-0.005		3.67
(5) invest. tax credit/tot assets	34.441	*	1.13	49.164	**	1.13	-15.605		1.08	-11.909		1.08	-19.070		1.09	50.041	***	1.08
(6) depreciation/tot assets	0.036		1.09	0.142		1.09	-0.039		1.09	0.011		1.09	-0.071		1.08	-0.010		1.08
(7) uniqueness	0.002		3.60	-0.007		3.60	0.004		3.57	0.000		3.57	-0.007		3.55	-0.007		3.61
(8) asset turnover	-0.003		1.12	-0.004		1.12	-0.005	**	1.12	-0.006	**	1.12	-0.006	***	1.14	-0.009	***	1.14
(9) buildings/PPE	0.356	***	1.05	0.338	***	1.05	0.256	***	1.05	0.228	***	1.05	0.117	***	1.03	0.134	***	1.03
[specification 2]																		
(9) buildings/PPE relative to sector avg	0.031	***	1.03	0.028	***	1.03	0.023	***	1.03	0.020	***	1.03	0.013	***	1.02	0.013	***	1.02
[specification 3]																		
(9) buildings/PPE	0.358	***	1.06	0.341	***	1.06	0.253	***	1.06	0.225	***	1.06	0.120	***	1.05	0.132	***	1.05
(10) MSA office capital return	0.108		2.48	0.070		2.48	-0.243		2.52	-0.311		2.52	0.206		2.36	-0.179		2.39
(11)=(9)x(10)	-0.338		1.49	-0.410		1.49	0.345		1.47	0.304		1.47	-0.582		1.43	0.422		1.42
[specification 4]																		
(9) buildings/PPE relative to sector avg	0.031	***	1.06	0.029	***	1.06	0.022	***	1.06	0.020	***	1.06	0.013	***	1.07	0.012	***	1.08

(10) MSA office capital return	0.071		2.55	0.031		2.55	-0.227		2.56	-0.297		2.56	0.197		2.41	-0.185		2.45
(11)=(9)x(10)	-0.016		1.51	-0.023		1.51	0.022		1.48	0.019		1.48	-0.055		1.48	0.054		1.47
Year fixed effects	YES			YES			YES			YES			YES			YES		
Number of observations	715			715			655			655			1578			1628		

Panel B	lD/Eb			tD/Eb			lD/Em			tD/Em			lD/TA			tD/(tD+Em)		
Variable	coef		var inf	coef		var inf	coef		var inf	coef		var inf	coef		var inf	coef		var inf
[specification 1]																		
(9) leases/PPE	-0.260	***	1.06	-0.261	***	1.06	-0.195	***	1.04	-0.206	***	1.04	-0.213	***	1.05	-0.226	***	1.05
[specification 2]																		
(9) leases/PPE relative to sector avg	-0.029	***	1.04	-0.027	***	1.04	-0.021	***	1.03	-0.022	***	1.03	-0.025	***	1.02	-0.028	***	1.02
[specification 3]																		
(9) leases/PPE	-0.208		20.87	-0.287		20.87	-0.275		20.20	-0.323	*	20.20	0.093		11.91	-0.029		11.76
(10) MSA office income return	3.431		1.41	3.428		1.41	-2.562		1.39	-3.110		1.39	1.532		1.49	-1.375		1.50
(11)=(9)x(10)	-3.057		21.09	1.140		21.09	4.573		20.49	6.568		20.49	-17.685	***	11.95	-11.416	*	11.79
[specification 4]																		
(9) leases/PPE relative to sector avg	-0.044	**	16.67	-0.052	***	16.67	-0.044	**	15.98	-0.049	**	15.98	-0.004		12.43	-0.018		12.15
(10) MSA office income return	2.650		1.44	2.514		1.44	-3.234		1.42	-3.834		1.42	1.014		1.50	-1.841		1.51
(11)=(9)x(10)	0.743		17.05	1.222		17.05	1.186		16.45	1.390		16.45	-1.097	*	12.59	-0.507		12.30
Year fixed effects	YES			YES			YES			YES			YES			YES		
Number of observations	715			715			655			655			1578			1628		

This table reports the results from the OLS regressions of leverage using an unbalanced data from telecommunications industry, where the leverage is measured by data between 1996 and 2013, which is after the Telecommunications Act of 1996 was enacted. Leverage variables include: long-term debt to book value of equity ("lD/Eb"); total debt to book value of equity ("tD/Eb"); long-term debt to market value of equity ("lD/Em"); total debt to market value of equity ("tD/Em"); long-term leverage ("lD/TA") calculated as the ratio of long-term debt to total assets; and leverage ("tD/(tD+Em)") calculated as the ratio of total debt to the sum of total debt and market value of equity. Debts and total assets are measured by book values. Year fixed effects are controlled.All the regression specifications include the explanatory variables (1) to (8), but for simplification, their results are reported only for Specification 1 in Panel A. All the explanatory variables are lagged by 1 year. ***, ** and * indicate significance at the 1% level, 5% level and 10% level, respectively.

Crisis Period

Now we examine a special period after 1996, the crisis period (2007-2009). As shown in Table 4, the effects discussed above (and displayed in Table 3) for the post-1006 period also apply for the crisis period subsample. However, comparing the magnitudes of the coefficients in Tables 3 and 4, we can see that the influence from the property ownership exposure via the collateral channel is in general much more pronounced during the crisis than during the whole post-1996 period, indicating a generally lower significance of the collateral effect during the non-crisis period since 1996. For instance, with Specification 1 and Specification 3, the coefficient of the real estate ownership exposure ("buildings/PPE") in Table 4 (Table 3) is around 0.71 (0.36) for "lD/Eb", 0.68 (0.34) for "tD/Eb", 0.72 (0.25) for "lD/Em", 0.62 (0.23) for "tD/Em", and 0.28 (0.13) for "tD/(tD+Em)", with the coefficient size almost or more than doubled in Table 4 than in Table 3. Similarly, for Specification 2 and Specification 4, the coefficient of the real estate ownership exposure ("buildings/PPE relative to sector average") in Table 4 (Table 3) is around 0.09 (0.03) for "lD/Eb", 0.09 (0.03) for "tD/Eb", 0.09 (0.02) for "lD/Em", 0.08 (0.02) for "tD/Em", and 0.03 (0.01) for "tD/(tD+Em)", with the coefficient size almost or more than tripled in Table 4 than in Table 3. The only exception is for the regressions of "ID/TA", where the effect of "buildings/PPE" and that of "buildings/PPE relative to sector average" are both insignificant in Table 4, while significantly positive in Table 3. In general, the results suggest a greater collateral effect of real estate exposure in the firms' capital structure choices during the crisis period than during the non-crisis period.

To confirm that the collateral effect difference between the crisis period and non-crisis (post 1996) period are indeed significant, we also reestimate the regressions in Table 3 for the post-1996 sample by adding in a crisis dummy (which is 1 if the observation is for 2007-2009 and 0 otherwise) and the terms of its interactions with real estate exposure variables. As displayed in Table 5, the term of the interaction between this crisis dummy and "buildings/PPE" has a positive coefficient that is significant at the 1-5% level in majorities of the leverage regressions, and so is the term of the interaction between the crisis dummy and "buildings/PPE relative to sector average". These results confirm a greater collateral effect of real estate exposure in the firms' capital structure choices during the crisis period since 1996. This finding can be justified by the fact when the capital market becomes tighter as in the crisis, it is more difficult for firms to raise debt and hence the property collateral value becomes more critical for firms to obtain loans.

Table 4
Leverage regressions for the 2007-2009 crisis period

Panel A	lD/Eb			tD/Eb			lD/Em			tD/Em			lD/TA			tD/(tD+Em)		
Variable	coef		var inf	coef		var inf	coef		var inf	coef		var inf	coef		var inf	coef		var inf
[specification 1]																		
(1) Intercept	0.196		0.00	0.257	*	0.00	0.329		0.00	0.387	*	0.00	0.369	***	0.00	0.433	***	0.00
(2) size	-0.002		1.48	-0.006		1.48	-0.032		1.45	-0.037		1.45	-0.010		1.31	-0.012		1.38
(3) growth opportunity	0.073	*	1.18	0.088	**	1.18	0.121	**	1.19	0.149	**	1.19	0.008		1.11	0.009		1.10
(4) profitability	-0.057		16.58	-0.071		16.58	-0.053		16.94	-0.057		16.94	0.036		5.36	0.044		5.64
(5) invest. tax credit/tot assets	-264.965		1.02	-281.572		1.02	-250.277		1.02	-264.309		1.02	147.660	*	1.01	127.489	**	1.02
(6) depreciation/tot assets	0.462		1.22	0.302		1.22	0.967		1.21	0.700		1.21	0.625		1.04	0.789	*	1.04
(7) uniqueness	-0.138		17.91	-0.175		17.91	-0.184		18.12	-0.195		18.12	0.050		5.68	0.041		6.06
(8) asset turnover	-0.008		1.25	-0.009		1.25	-0.013	*	1.26	-0.015	*	1.26	-0.009	**	1.18	-0.010	**	1.17
(9) buildings/PPE	0.715	***	1.07	0.679	***	1.07	0.718	***	1.07	0.620	**	1.07	0.106		1.04	0.277	***	1.02
[specification 2]																		
(9) buildings/PPE relative to sector avg	0.091	***	1.07	0.086	***	1.07	0.092	***	1.07	0.080	**	1.07	0.012		1.03	0.034	***	1.02
[specification 3]																		
(9) buildings/PPE	0.717	***	1.08	0.680	***	1.08	0.728	***	1.08	0.630	**	1.08	0.102		1.05	0.277	***	1.03
(10) MSA office capital return	-0.049		3.27	-0.027		3.27	-0.222		3.22	-0.221		3.22	0.309		2.68	-0.022		2.71
(11)=(9)x(10)	0.385		1.61	0.180		1.61	1.654		1.59	1.559		1.59	-0.619		1.46	0.071		1.44
[specification 4]																		
(9) buildings/PPE relative to sector avg	0.091	***	1.09	0.086	***	1.09	0.091	***	1.09	0.078	**	1.09	0.012		1.03	0.035	***	1.02

(10) MSA office capital return	0.058	3.32	0.073	3.32	-0.116	3.26	-0.135	3.26	0.334	2.72	0.028	2.74
(11)=(9)x(10)	-0.049	1.61	-0.069	1.61	0.112	1.59	0.117	1.59	-0.099	1.45	-0.031	1.43
Year fixed effects	YES		YES		YES		YES		YES		YES	
Number of observations	92		92		90		90		231		245	

Panel B	lD/Eb		tD/Eb		lD/Em		tD/Em		lD/TA		tD/(tD+Em)	
Variable	coef	var inf	coef	var inf	coef	var inf	coef	var inf	coef	var inf	coef	var inf
[specification 1]												
(9) leases/PPE	-0.124	1.07	-0.099	1.07	-0.113	1.07	-0.102	1.07	-0.147 **	1.03	-0.185 **	1.02
[specification 2]												
(9) leases/PPE relative to sector avg	-0.017	1.08	-0.013	1.08	-0.015	1.07	-0.013	1.07	-0.019 *	1.03	-0.025 **	1.02
[specification 3]												
(9) leases/PPE	-0.115	52.41	-0.332	52.41	-1.308	52.16	-1.408	52.16	0.010	7.06	-0.248	7.37
(10) MSA office income return	-0.980	1.43	-2.130	1.43	-8.982	1.41	-8.769	1.41	-6.883	1.25	-9.120 *	1.25
(11)=(9)x(10)	-0.593	53.65	16.269	53.65	83.108	53.39	90.746	53.39	-12.935	7.23	5.422	7.54
[specification 4]												
(9) leases/PPE relative to sector avg	-0.022	54.13	-0.051	54.13	-0.180	53.88	-0.194	53.88	0.003	6.80	-0.034	7.09
(10) MSA office income return	-1.197	1.43	-2.328	1.43	-9.071	1.41	-8.863	1.41	-6.875	1.25	-9.131 *	1.25
(11)=(9)x(10)	0.385	55.47	2.646	55.47	11.458	55.21	12.516	55.21	-1.785	6.96	0.706	7.25
Year fixed effects	YES		YES		YES		YES		YES		YES	
Number of observations	92		92		90		90		231		245	

This table reports the results from the OLS regressions of leverage using an unbalanced data from telecommunications industry, where the leverage is measured by data of the 2007-2009 crisis period. Leverage variables include: long-term debt to book value of equity ("lD/Eb"); total debt to book value of equity ("tD/Eb"); long-term debt to market value of equity ("lD/Em"); total debt to market value of equity ("tD/Em"); long-term leverage ("lD/TA") calculated as the ratio of long-term debt to total assets; and leverage ("tD/(tD+Em)") calculated as the ratio of total debt to the sum of total debt and market value of equity. Debts and total assets are measured by book values. Year fixed effects are controlled. All the regression specifications include the explanatory variables (1) to (8), but for simplification, their results are reported only for Specification 1 in Panel A. All the explanatory variables are lagged by 1 year. ***, ** and * indicate significance at the 1% level, 5% level and 10% level, respectively.

Table 5
Leverage regressions for the post-1996 Telecommunications Act period (with Crisis dummy)

Panel A	lD/Eb			tD/Eb			lD/Em			tD/Em			lD/TA			tD/(tD+Em)		
Variable	coef		var inf	coef		var inf	coef		var inf	coef		var inf	coef		var inf	coef		var inf
[specification 1]																		
(1) Intercept	0.180	**	0.00	0.203	***	0.00	0.129	*	0.00	0.162	**	0.00	0.411	***	0.00	0.340	***	0.00
(2) size	0.010	*	1.34	0.010	*	1.34	-0.001		1.34	-0.001		1.34	-0.001		1.37	0.005		1.38
(3) growth opportunity	0.009		1.07	0.009		1.07	0.011		1.07	0.012		1.07	-0.001		1.12	-0.002		1.12
(4) profitability	0.006		3.66	0.002		3.66	0.012		3.64	0.011		3.64	-0.003		3.61	-0.004		3.67
(5) invest. tax credit/tot assets	34.748	*	1.14	49.463	**	1.14	-14.977		1.08	-11.337		1.08	-19.052		1.09	49.994	***	1.08
(6) depreciation/tot assets	0.054		1.09	0.159		1.09	-0.016		1.09	0.031		1.09	-0.072		1.08	0.001		1.08
(7) uniqueness	0.002		3.60	-0.007		3.60	0.004		3.57	0.000		3.57	-0.007		3.55	-0.007		3.61
(8) asset turnover	-0.003		1.13	-0.003		1.13	-0.005	**	1.13	-0.005	**	1.13	-0.006	***	1.14	-0.009	***	1.14
(9) buildings/PPE	0.309	***	1.17	0.292	***	1.17	0.194	***	1.17	0.171	***	1.17	0.121	***	1.30	0.096	**	1.31
(10) crisis (2007-2009) dummy	-0.046		7.02	-0.050		7.02	0.050		6.92	0.039		6.92	-0.021		6.90	0.069		6.98
(11)=(9)x(10)	0.445	**	1.58	0.433	**	1.58	0.578	***	1.56	0.527	***	1.56	-0.018		1.67	0.178	*	1.68

[specification 2]																	
(9) buildings/PPE relative to sector avg	0.027	***	1.10	0.024	***	1.10	0.017	***	1.10	0.015	**	1.10	0.013	***	1.17	0.009	**	1.18
(10) crisis (2007-2009) dummy	-0.043		6.90	-0.046		6.90	0.056		6.80	0.044		6.80	-0.022		6.79	0.071		6.86
(11)=(9)x(10)	0.069	***	1.52	0.067	***	1.52	0.082	***	1.49	0.075	***	1.49	-0.001		1.52	0.025	**	1.52
[specification 3]																		
(9) buildings/PPE	0.309	***	1.22	0.292	***	1.22	0.193	***	1.22	0.172	***	1.22	0.128	***	1.41	0.087	*	1.44
(10) crisis (2007-2009) dummy	-0.036		8.57	-0.046		8.57	0.044		8.44	0.026		8.44	-0.006		8.38	0.054		8.53
(11)=(9)x(10)	0.447	**	1.60	0.433	**	1.60	0.586	***	1.58	0.532	***	1.58	-0.028		1.72	0.190	*	1.72
(12) MSA office capital return	0.107		2.50	0.067		2.50	-0.230		2.52	-0.298		2.52	0.215		2.37	-0.215		2.41
(13)=(9)x(12)	0.034		3.30	0.099		3.30	0.000		3.31	-0.104		3.31	-0.922		3.04	1.023		2.99
(14)=(9)x(10)x(12)	-0.094		2.98	-0.341		2.98	1.272		3.01	1.310		3.01	0.521		2.75	-0.547		2.69
[specification 4]																		
(9) buildings/PPE relative to sector avg	0.026	***	1.15	0.024	***	1.15	0.017	***	1.15	0.015	**	1.15	0.013	***	1.30	0.008	*	1.32
(10) crisis (2007-2009) dummy	-0.040		8.50	-0.050		8.50	0.047		8.36	0.028		8.36	-0.008		8.26	0.055		8.41
(11)=(9)x(10)	0.070	***	1.53	0.068	***	1.53	0.081	***	1.50	0.073	***	1.50	-0.001		1.54	0.026	**	1.54
(12) MSA office capital return	0.122		2.56	0.079		2.56	-0.153		2.57	-0.229		2.57	0.198		2.41	-0.200		2.45
(13)=(9)x(12)	0.042		2.72	0.048		2.72	-0.049		2.77	-0.057		2.77	-0.051		2.41	0.109		2.42
(14)=(9)x(10)x(12)	-0.137		2.40	-0.162		2.40	0.113		2.48	0.124		2.48	-0.013		2.10	-0.080		2.11
Year fixed effects	YES			YES			YES			YES			YES			YES		

Number of observations	715			715			655			655			1578			1628		

Panel B	lD/Eb			tD/Eb			lD/Em			tD/Em			lD/TA			tD/(tD+Em)		
Variable	coef		var inf	coef		var inf	coef		var inf	coef		var inf	coef		var inf	coef		var inf
[specification 1]																		
(9) lease/PPE	-0.282	***	1.20	-0.288	***	1.20	-0.211	***	1.19	-0.226	***	1.19	-0.224	***	1.25	-0.234	***	1.26
(10) crisis (2007-2009) dummy	-0.029		6.74	-0.040		6.74	0.094		6.66	0.070		6.66	-0.043		6.79	0.081		6.89
(11)=(9)x(10)	0.186		1.45	0.227	*	1.45	0.131		1.46	0.162		1.46	0.068		1.48	0.047		1.50
[specification 2]																		
(9) lease/PPE relative to sector avg	-0.030	***	1.14	-0.029	***	1.14	-0.022	***	1.14	-0.023	***	1.14	-0.026	***	1.16	-0.028	***	1.17
(10) crisis (2007-2009) dummy	0.000		6.64	-0.008		6.64	0.117		6.55	0.095		6.55	-0.030		6.70	0.094		6.79
(11)=(9)x(10)	0.017		1.40	0.022		1.40	0.012		1.41	0.015		1.41	0.006		1.41	0.003		1.43
[specification 3]																		
(9) lease/PPE	-0.319		25.74	-0.428	**	25.74	-0.323		24.93	-0.388	*	24.93	0.097		19.63	-0.003		19.48
(10) crisis (2007-2009) dummy	-0.024		7.08	-0.037		7.08	0.104		6.99	0.079		6.99	-0.022		6.93	0.090		7.02
(11)=(9)x(10)	0.046		60.03	-0.139		60.03	-1.127		59.93	-1.311		59.93	0.084		11.28	-0.045		11.80
(12) MSA office income return	3.158		1.42	3.046		1.42	-2.915		1.40	-3.548		1.40	1.646		1.51	-1.313		1.52
(13)=(9)x(12)	1.714		24.65	7.123		24.65	6.127		23.92	8.805		23.92	-17.537	***	17.96	-12.606		17.73
(14)=(9)x(10)x(12)	10.241		57.80	27.476		57.80	88.419	*	57.72	104.050	*	57.72	-10.995		9.19	0.911		9.64

[specification 4]															
(9) leases/PPE relative to sector avg	-0.054	***	19.82	-0.066	***	19.82	-0.050	**	19.01	-0.057	***	19.01	-0.009	19.30	-0.020	19.03
(10) crisis (2007-2009) dummy	-0.003		6.85	-0.012		6.85	0.120		6.76	0.098		6.76	-0.021	6.79	0.094	6.89
(11)=(9)x(10)	0.009		59.92	-0.020		59.92	-0.153		59.79	-0.180		59.79	0.034	10.08	0.012	10.56
(12) MSA office income return	2.339		1.46	2.081		1.46	-3.659		1.44	-4.354	*	1.44	1.108	1.53	-1.800	1.54
(13)=(9)x(12)	1.166		19.34	1.747	*	19.34	1.395		18.64	1.658	*	18.64	-0.836	18.12	-0.422	17.78
(14)=(9)x(10)x(12)	1.066		58.31	3.590		58.31	11.865	*	58.20	14.118	*	58.20	-2.924	8.34	-1.059	8.74
Year fixed effects	YES			YES			YES			YES			YES		YES	
Number of observations	715			715			655			655			1578		1628	

This table reports the results from the OLS regressions of leverage using an unbalanced data from telecommunications industry, where the leverage is measured by data between 1996 and 2013, which is after the Telecommunications Act of 1996 was enacted. The crisis dummy is 1 if the data is from 2007 to 2009, and 0 if otherwise. Leverage variables include: long-term debt to book value of equity ("lD/Eb"); total debt to book value of equity ("tD/Eb"); long-term debt to market value of equity ("lD/Em"); total debt to market value of equity ("tD/Em"); long-term leverage ("lD/TA") calculated as the ratio of long-term debt to total assets; and leverage ("tD/(tD+Em)") calculated as the ratio of total debt to the sum of total debt and market value of equity. Debts and total assets are measured by book values. Year fixed effects are controlled. All the regression specifications include the explanatory variables (1) to (8), but for simplification, their results are reported only for Specification 1 in Panel A. All the explanatory variables except the crisis dummy are lagged by 1 year. ***, ** and * indicate significance at the 1% level, 5% level and 10% level, respectively.

IV. ROBUSTNESS TESTS

In this section, we perform several robustness tests for our regression findings by using alternative econometric methods. The main purpose is to address the concern on the possible regression inefficiency (with biased standard errors) when we use the previous OLS regressions to model our unbalanced panel data, which covers 650 firms during 39 years. Due to the small sample sizes (mostly with fewer than 750 observations) in varied regressions reported in Tables 1 to 4, in our previous analyses, we only control for year-fixed effects, while not controlling for firm-fixed effects to avoid a significant loss of degrees of freedom. This simple fixed effect structure is also convenient to generate the variation inflation factors of explanatory variables, which is important for us to tell whether real estate exposure variables are influencing the capital structure in ways not captured by other capital structure determinants. However, we want to check if this fixed effect structure gives us different inferences than those generated from alternative econometric structures.

To address this issue, we re-estimate all our regressions by replacing the year-fixed effects with one of the following effects: (1) year fixed effects with clustered standard errors; (2) year-firm random effects with Fuller-Battese estimates; (3) year-firm random effects with Wansbeck-Kepteyn estimates; (4) year-firm random effects with Wallace-Hussain estimates; and (5) year-firm random effects with Nerlove estimates. For the brevity of our result presentation, we only highlight the results of these robustness tests for the post-1996 sample period when the leverage is measured by lD/Eb (long-term debt to book value of equity) in Table 6. In this table, Model 1 is the previous OLS regression with year-fixed effects, and Models 2 to 5 are robustness tests (1) to (5) mentioned above. All the six models exhibit essentially similar results for testing Hypotheses 1, 2 and 3. This is true when we use alternative leverage measurements and/or test other sample periods in our study. These suggest that our previous findings from the OLS regressions with year-fixed effects controlled are robust to multiple alternative econometric structures.

Table 6
Robustness tests on leverage regressions for the post-1996 Telecommunications Act period

Panel A	lD/Eb											
Variable	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	coef		coef		coef		coef		coef		coef	
[specification 1]												
(1) Intercept	0.179	**	0.179	***	0.180	***	0.186	***	0.187	***	0.168	***
(2) size	0.010	*	0.010	**	0.010		0.009		0.009		0.012	
(3) growth opportunity	0.009		0.009		0.014	**	0.013	**	0.012	*	0.017	***
(4) profitability	0.006		0.006		0.006		0.005		0.006		0.005	
(5) invest. tax credit/tot assets	34.441	*	34.441		41.126	**	40.862	**	46.109	**	31.213	
(6) depreciation/tot assets	0.036		0.036		0.062		0.060		0.050		0.082	
(7) uniqueness	0.002		0.002		0.006		0.005		0.005		0.008	
(8) asset turnover	-0.003		-0.003		-0.002		-0.002		-0.003		-0.002	
(9) buildings/PPE	0.356	***	0.356	***	0.241	***	0.235	***	0.260	***	0.212	***
[specification 2]												
(9) buildings/PPE relative to sector avg	0.031	***	0.031	***	0.023	***	0.023	***	0.024	***	0.021	***
[specification 3]												
(9) buildings/PPE	0.358	***	0.358	***	0.244	***	0.238	***	0.263	***	0.212	***
(10) MSA office capital return	0.108		0.108		0.099		0.070		0.074		0.178	
(11)=(9)x(10)	-0.338		-0.338		-0.537		-0.647		-0.695		-0.219	
[specification 4]												
(9) buildings/PPE relative to sector avg	0.031	***	0.031	***	0.023	***	0.023	***	0.025	***	0.020	***
(10) MSA office capital return	0.071		0.071		0.056		0.026		0.027		0.149	
(11)=(9)x(10)	-0.016		-0.016		-0.041		-0.050		-0.054		-0.009	
Year fixed effects	YES											
Year fixed effects with clustered standard errors			YES									
Year-firm random effects (Fuller-Battese estimate)					YES							
Year-firm random effects (Wansbeck-Kapteyn estimate)							YES					
Year-firm random effects (Wallace-									YES			

Hussain estimate)						
Year-firm random effects (Nerlove estimate)						YES
Number of observations	715	715	715	715	715	715

Panel B	lD/Eb					
Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	coef	coef	coef	coef	coef	coef
[specification 1]						
(9) leases/PPE	-0.260 ***	-0.260 ***	-0.184 ***	-0.188 ***	-0.210 ***	-0.124 ***
[specification 2]						
(9) leases/PPE relative to sector avg	-0.029 ***	-0.029 ***	-0.018 ***	-0.018 ***	-0.021 ***	-0.013 **
[specification 3]						
(9) leases/PPE	-0.208	-0.208 *	-0.213	-0.205	-0.197	-0.251
(10) MSA office income return	3.431	3.431 *	0.534	0.536	1.290	-0.492
(11)=(9)x(10)	-3.057	-3.057	1.560	0.904	-0.760	6.780
[specification 4]						
(9) leases/PPE relative to sector avg	-0.044 **	-0.044 ***	-0.031 *	-0.031 *	-0.034 *	-0.028 ***
(10) MSA office income return	2.650	2.650	0.278	0.310	1.020	-0.671
(11)=(9)x(10)	0.743	0.743	0.625	0.592	0.605	0.765 ***
Year fixed effects	YES					
Year fixed effects with clustered standard errors		YES				***
Year-firm random effects (Fuller-Battese estimate)			YES			
Year-firm random effects (Wansbeck-Kapteyn estimate)				YES		
Year-firm random effects (Wallace-Hussain estimate)					YES	
Year-firm random effects (Nerlove estimate)						YES ***
Number of observations	715	715	715	715	715	715

This table reports the results from the OLS regressions of leverage using an unbalanced data from telecommunications industry, where the leverage is measured by data between

1996 and 2013, which is after the Telecommunications Act of 1996 was enacted. The leverage variable is long-term debt to book value of equity ("lD/Eb"). Year fixed effects are controlled. All the regression specifications include the explanatory variables (1) to (8), but for simplification, their results are reported only for Specification 1 in Panel A. All the explanatory variables except the crisis dummy are lagged by 1 year. ***, ** and * indicate significance at the 1% level, 5% level and 10% level, respectively.

V. CONCLUSION

This study explores and compares various possible channels that a corporation's real estate exposure may affect its financing choices, including the collateral channel, tax shield substitution channel and rent cost channel. Using data from the U.S. telecommunications industry, which has experienced significant market structure change and leverage increase in the past two decades, we add in traditional leverage regressions with real estate factors such as firms' real estate exposure through commercial property ownership or rental, local commercial property market capital returns and income returns, and their interactions with each other. After controlling for traditional leverage determinants, we find positive impacts of real estate exposure through commercial property ownership on the firms' financing choices since the Telecommunications Act of 1996, an act that removed entry barriers to the telecom market. These positive impacts have been particularly substantial during the 2007-2009 Great Recession. The real estate exposure through property leases also play roles in the capital structure decisions. The commercial property market capital return and income return, however, appear insignificant in affecting leverage. Our results suggest a generally non-trivial influence of real estate exposure to the firms' financing choices, especially when the capital market is tight and the collateral effect is critical. It is a novel study for the relationship between real estate and capital structure decisions, and we hope it can complement and extend the existing literature of both capital structure and real estate.

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APPENDIX

Variable	Definition
lD/Eb	Ratio between book value of long-term debt and book value of equity.
tD/Eb	Ratio between book value of total debt and book value of equity.
lD/Em	Ratio between book value of long-term debt and market value of equity.*
tD/Em	Ratio between book value of total debt and market value of equity.*
lD/TA	Ratio between book value of total debt and book value of total assets.
tD/(tD+Em)	Ratio between book value of total debt and sum of book value of total debt and market value of equity.*
size	Natural logarithm of sales (in $ million).
growth opportunity	Market-to-book ratio of firm value.
profitability	Ratio of operating income to sales.
invest. tax credit/tot assets	Ratio of investment tax credit to total assets.
depreciation/tot assets	Ratio of depreciation to total assets.
uniqueness	Ratio of selling expenses to sales.
asset turnover	Ratio of sales to PPE.
buildings/PPE	Percent of building costs in total PPE costs.
leases/PPE	Percent of leases costs in total PPE costs.
buildings/PPE relative to sector avg	Percent of building costs in total PPE costs - its average for the sector with same first two SIC code digits in the same year.
leases/PPE relative to sector avg	Percent of leases costs in total PPE costs - its average for the sector with same first two SIC code digits in the same year.
MSA office capital return	NCREIF capital return for office properties in the MSA where the firm headquarter is located.
MSA office income return	NCREIF income return for office properties in the MSA where the firm headquarter is located.

* Market value of equity is measured by the fiscal year-end closing stock price multiplied by the number of common shares outstanding.