Capital market frictions, Leasing and Hedging

Introduction:

The main theory of integrated corporate risk management, financing and investments formalized by Froot, Scharfstein and Stein (FSS hereafter, 1993) is based on the effective risk aversion of firms subject to financial constraints. According to this theory, the rationale for hedging is that, when firms are subject to financial constraints, hedging ensures that firms have sufficient internal funds to take advantage of profitable investment opportunities and avoids the need for costly external financing. Hedging accomplishes this by reducing the volatility of cash flows and thus better aligning the availability of internal funds (financing needs) with capital expenditures (investments). Importantly, this intuition suggests that financially constrained firms should hedge as they are effectively risk averse. However, in practice, large firms, which are arguably less financially constrained, hedge whereas small firms, which are likely more financially constrained, often do not engage in risk management. This is considered as a *puzzle* in the literature.

A missing link in FSS(1993) and the other models is that none of them consider the possibility that financially constrained firms can deploy a lot more capital using lease financing. The opportunity cost of engaging in risk management and conserving debt capacity for future financing needs is forgone current investment, and is higher for constrained firms. Indeed, the more constrained the firm, the more likely it is that investment financing needs override hedging concerns. Hence, instead of engaging in hedging to improve debt capacity in order to undertake capital expenditures, financially constrained firms could instead deploy property, plant and equipment (PPE) through leasing. Based on this intuition Rampini and Viswanthan(2010) expand the FSS (1993) model and develop a dynamic model which provides a unified theory of optimal investment, capital structure, leasing, and risk management. Rampini and Viswanthan(2010) argue that there is a fundamental trade-off between firms' financing and risk management policy and poorly capitalized firms optimally do not engage in risk management and may abstain from risk management with positive probability.

Past studies on hedging (see Nance, Smith and Smithson(1993), Mian(1996), Geczy, Minton and Schrand (1997), Graham and Rogers(2002), Lin, Pantzalis and Park (2010), Campello, Lin, Ma and Zou(2011)) use notional values of derivatives as a measure of hedging and end their sample period by 2002. However, with the adoption of Statement of Financial Accounting Standards (SFAS) 133 and SFAS 161, the derivative reporting requirements have substantially changed. Recently, Lins, Servaes and Tamayo (2011) document that the requirements to report derivatives at fair values had a material impact on derivatives use and conclude that speculative activities have been reduced. The Coca-Cola Company has the following note about notional values in its 2006 annual financial statement (10K):

The notional amounts of the derivative financial instruments do not necessarily represent amounts exchanged by the parties and, therefore, are not a direct measure of our exposure to the financial risks. The amounts exchanged are calculated by reference to the notional amounts and by other terms of the derivatives, such as interest rates, foreign currency exchange rates or other financial indices.

DeMarzo and Duffie (1991) and Breeden and Viswanathan (1998), provide theoretical models linking hedging and information asymmetry. As per DeMarzo and Duffie (1991) and Breeden and Viswanathan(1998), firms with high information asymmetry should hedge more. Geczy, Minton and Schrand (1997) control for information asymmetry using *institutional ownership and number of analyst following* as proxies in their logit regressions with hedging dummy as the dependent variable. Their findings do not support DeMarzo and Duffie (1991) prediction that firms with high information asymmetry should hedge more. Also, Dadalt, Gay and Nam (2002) examine whether hedging reduces information asymmetry. In their regressions hedging is the test variable along with other controls. They use *analysts forecast accuracy* and *dispersion in analysts' earnings forecasts* as proxies for information asymmetry. They find evidence consistent with DeMarzo and Duffie (1995) and Breeden and Viswanathan (1998).

But, past empirical evidence, as mentioned above, on links among hedging and information frictions is relatively scarce and mixed. The market microstructure based proxies for asymmetric information offer a clearer interpretation than the ex ante firm characteristics and other proxies viz**.** analyst coverage, dispersion of analysts' forecasts, and magnitude of earnings surprises which have multiple, often ad hoc interpretation[1]. Hence, using market based proxies for information asymmetry and both fair and notional values for hedging, I contribute to the finance literature by comprehensively examining the role of information asymmetry and leasing, which is hitherto unexplored, as firms' hedging determinants after controlling for various other factors.

[1] The ***percentage of the firm's shares held by institutions*** is the most popular measure of information asymmetry [Géczy, Minton and Schrand (1997); Graham and Rogers (2002); Rogers (2002); Dionne and Triki (2004, 2005)]. It is important to recognize that a negative coefficient reported for this variable in regressions with hedge ratio as the dependent variable could have another explanation than being an indication of a lower incentive to hedge in order to reduce information asymmetry costs. In fact, institutions are usually well diversified and might find it less useful to manage the risk at the firm level. Consequently, they may encourage a reduction in the hedging ratio.

The ***number of financial analysts following the firm*** [Géczy, Minton and Schrand (1997)] is another proposed measure in the literature for information asymmetry. When the firm is under greater public scrutiny, it should suffer less from information asymmetry. Consequently, information asymmetry should decrease with the number of analysts following its operations and so does the incentive to hedge. However, a positive coefficient for this variable could be interpreted either as evidence supporting the reduction of information asymmetry cost motive or as indication that analysts choose to follow firms with fewer earnings surprises.

DaDalt, Gay and Nam (2002) use earnings related measures of information asymmetry. The first measure they consider is "***the analysts forecast accuracy***" and is defined as the absolute value of the average earnings forecast error. A limitation of this measure is that it captures the magnitude of information asymmetry under the premise that managers disclose unanticipated firm specific information only around earnings announcements. The second measure used in DaDalt, Gay and Nam (2002) is the ***dispersion in analysts' earnings forecast***. According to them, analysts are unable to provide a precise and unanimous forecast of the firm's earnings when there is a lack of information about it. The concern when using this measure is that one never knows whether the dispersion in forecasts are caused by a higher level of information asymmetry or by other factors such as inherent forecasting errors caused by different forecasting models used by analysts.

Using a sample of 218 non-financial firms drawn from S&P 100, S&P 400 and S&P 600 indices covering the recent five year period of 2006-2010, I find that information asymmetry proxied by either illiquidity or bid-ask spread is positively and significantly related to hedge intensity. I also find that operating lease ratio (OLR) is significantly and negatively related with hedge intensity. These results are robust to several alternative measurements of key variables, different regression specifications, estimation techniques and corrections for endogeneity.

The rest of the paper is organized as follows. Section-I reviews the literature and develops testable hypotheses. Section-II deals with data collection and variable measurement. Section-III covers empirical modeling, estimation and results. Section-IV addresses robustness checks. Section-V concludes.

I. Literature Review and Hypothesis Development:

1.1. Determinants of Hedging

The main objective of the paper is to examine the role of information asymmetry (IA) and leasing on the extent of hedging. Hence, I first explore the role of information asymmetry and leasing as determinants of hedging and subsequently review the relevant literature on other motivations to hedging such as financial distress, taxes and managerial risk aversion.

A. Information Asymmetry

DeMarzo and Duffie (1991) model information asymmetry as a determinant of corporate hedging. In their model, risk management reduces the noise in the firm’s dividend stream. DeMarzo and Duffie (1991) argue that equityholders can benefit from hedging when managers have private information about an unobservable risk that affects the firm's payoffs. In their model, hedging offers uninformed equityholders reduced noise about their information sets regarding the variability of a firm's payoffs. Graham, Harvey and Rajagopal (2005), according to a broad survey of financial executives, document that less predictable earnings could lead to low stock prices because investors dislike uncertainty.

DeMarzo and Duffie (1995) and Breeden and Viswanathan(1998) consider a different source for information asymmetry that concerns managerial competence/reputation. Both DeMarzo and Duffie (1995) and Breeden and Viswanathan(1998) argue that firms with higher information asymmetry between managers and equityholders should hedge more. In their model, risk management reduces the noise in the learning process concerning the manager's capabilities and corporate hedging is adopted mainly by high quality managers to signal their superior abilities. Noise in this context refers to factors contributing to earnings that are believed to be outside of managerial control. The intuition as per Breeden and Viswanathan(1998) is that managers who are skilled at managing some business risks or uncertainties would like their ability be discovered quickly by the market. To ensure this they hedge those risks in which they have no direct control or specific skills. Thus, hedging is an attempt, by higher ability managers, to improve the informativeness of the learning process by 'locking-in' their superior ability. Based on the above arguments on hedging and information frictions, I posit the following hypothesis:

H1: The extent of hedging is positively related to information asymmetry

This follows directly from the theoretical arguments of Demarzo and Duffie (1991, 1995) and Breeden and Viswanathan(1998) that firms with high information asymmetry should hedge more to reduce information asymmetry between managers and markets and to mitigate agency costs/costly external financing.

B. Leasing

Consider the risk management rationale for the use of lease financing. Lease financing is often preferable in cases where firms want to mitigate the risk of capital expenditures incurred with respect to positive net present value (NPV) projects. Should such investment underperform expectations, leased assets have an embedded put option that can be exercised without risking the balance sheet assets. Further, firms might view leases as a way to transfer the risk of fluctuations in the value of the asset. Bessembinder(1991) argues that hedging improves debt capacity i.e. the ability borrow additional debt. Eisfeldt and Rampini (2008) argue that leased capital has higher *debt capacity* than debt capital because of the senior legal standing of leases to all outstanding fixed claims. They further argue that financially constrained firms value the additional debt capacity more and hence lease more of their capital than less constrained firms. Further, in case of lease financing, the leased asset itself acts as collateral to the lessor and the lessee firm does not have to pledge its own assets as collateral unlike secured debt which could pose collateral constraints for borrowers. Hence lessors may be willing to provide more lease capital than the debt capital provided by secured lenders. Thus for financially constrained firms leasing may not only enhance the debt capacity but also serve as an effective mechanism to mitigate especially the risks associated with capital expenditures. Hence, I propose the following hypotheses on leasing and hedging:

H2: The extent of hedging is negatively related to the ratio of leased capital.

This follows, from the theoretical arguments of Rampini and Viswanathan(2010) that financing needs can override hedging concerns for poorly capitalized firms. Since poorly capitalized firms lease more of their assets (see Eisfeldt and Rampini(2009)), firms that lease more should hedge less as the need for financing the investments and conserving the debt capacity dominate the hedging concerns.

Other theories of Hedging:

C. Tax Incentives

Smith and Stulz (1985) argue that if taxes are a convex function of earnings, then it is optimal for firms to hedge in order to reduce expected tax liability. Further, Stulz (1996), Ross (1996), and Leland (1998) suggest that tax shields associated with debt financing provide an incentive for risk management. They argue that by reducing risk, hedging enables the firm to increase debt capacity and to reduce tax liabilities due to increases in leverage. Graham and Rogers (2002) report that firms hedge to increase debt capacity and interest deductions and find no evidence that firms hedge in response to tax convexity. They also identify an important link between hedging and the capital structure decisions and argue that hedging-leverage causality can go both ways. On the other hand, using a different sample and control variables, Geczy, Minton, and Schrand (1997) find no support for this hypothesis.

D. Financial Distress

According to Smith and Stulz (1985), financial distress costs provide a possible explanation of why firms hedge. If financial distress is costly, firms are better off with hedging activities because they reduce its probability. Assuming a fixed investment policy, they argue that hedging can decrease the present value of financial distress costs even if hedging is costly. Hence, hedging increases shareholders' wealth as it decreases the expected bankruptcy costs and the loss of debt tax shield. However, as argued in Purnanandam (2008) the existing empirical studies find mixed evidence in support of the distress-cost based theories of hedging. For example Graham and Rogers (2002), Haushalter (2000) find a positive relation between hedging and leverage (a proxy for distress) where as Mian (1996), Tuffano (1996) do not find a positive relation between the two variables.

E. Managerial Risk Aversion

Managers are usually less diversified than regular shareholders because managers have their human capital and current and future compensation tied to the firm's performance or value. Hence corporate volatility can be costly for the managers if they have concave utility functions i.e. they are risk-averse and if some of their compensation is related to the volatility of corporate income or cash flows. According to Stulz (1984), if managers cannot effectively hedge corporate volatility in their personal accounts or if it is cheaper for the firms to hedge than it is for managers, then managerial welfare may be improved by corporate hedging. Corporate hedging can be optimal if it reduces the compensation required by managers. Tuffano (1996) and Schrand and Unal (1998) find evidence that hedging decreases with managerial option ownership and increases with managerial shareholdings[2]. However, the empirical evidence on this is mixed as Geczy et al. (1997) and Haushalter (2000) find no evidence that either managerial risk aversion or shareholdings affect corporate hedging. Also, in addition to managerial stock and option ownership, managerial incentive compensation (MIC) can affect the extent of hedging. Firms that rely more on incentive compensation to mitigate shareholder-manager agency issues should rely less on hedging.

II. Data Collection and Variables Measurement

I collect panel data on S&P 100 for large cap, bottom 100 firms of S&P 400 for mid cap, and middle 100 firms of S&P 600 for small cap excluding financial firms, utilities and telecommunications, for the period of (2006-2010) from COMPUSTAT annual database. This time period also covers the great recession of 2009 when firms faced severe financial constraints and hence allows me to test more precisely the role of financial constraints on the hypothesis-2. I exclude financial firms as they use derivatives for trading purposes. I also exclude the highly regulated utility and telecom sectors from the sample. This sample contains a wide range of firms and thus better reflects the differences across the firms with respect to firm size, age, information asymmetry, leasing and risk management practice. I use *Mergent Online* database to obtain the historical annual financial statements (10-Ks). I hand collect hedging data for both the notional and fair values of currency and interest rate hedging by performing a string search using keywords like hedge, derivatives, swaps etc. on the 10-Ks.

I chose this time period because Financial Accounting Standards Board (FASB) implemented Statement of Financial Accounting Standards (SFAS) No. 133, "Accounting for

[2] Tuffano (1996) finds evidence that CFO tenure is negatively correlated with the probability of hedging but he finds CEO tenure has no significant effect on the derivative usage decision.

Derivative Instruments and Hedging Activities." in June 2000 and most firms adopted it by 2001. This statement requires that firms recognize all derivatives as either assets or liabilities and measure those instruments at fair market value.[3] Under this standard, fair value is defined as the price that would be received to sell an asset or paid to transfer a liability (i.e., the "exit price") in an orderly transaction between market participants at the measurement date.

Another important issue acknowledged in prior studies on hedging is the inability of the researcher to distinguish the hedging motivation of an entity from risk management to speculation. For the first time, FASB through SFAS 133 required hedging performance rather than hedging intent, as the criterion for determining whether to apply deferral accounting for the derivative gain or loss. In March 2008, FASB issued FAS 161 which amends and expands the disclosure requirements of FASB Statement No. 133, *Accounting for Derivative Instruments and Hedging Activities.* FAS 161 requires disclosures related to objectives and strategies for using derivatives; the fair-value amounts of, and gains and losses on, derivative instruments; and credit-risk-related contingent features in derivative agreements. *The main requirement is to disclose the objectives and strategies for using derivative instruments by their underlying risk as well as a tabular format of the fair values of the derivative instruments and their gains and losses.* No longer are companies so willing to speculate, knowing that if the hedge goes wrong, they cannot avoid reporting the derivative losses in their financial statements. While the revised accounting

[3] SFAS #133 requires special accounting for two types of hedges viz. fair value hedges and cash flow hedges. In a fair value hedge, a derivative is used to hedge or offset the exposure to changes in the fair value of a recognized asset or liability or of an unrecognized firm commitment. Cash flow hedges are used to hedge exposures to cash flow risk i.e. exposure to the variability of cash flows. The accounting for **fair value hedges** records the derivative at its fair value in the balance sheet with any gains or losses recorded in income. However, derivatives used in **cash flow hedges** are accounted for at fair value on the balance sheet, but gains or losses are recorded in equity as part of other comprehensive income (OCI). The effective portion is recorded in OCI. The ineffective portion goes into current income.

reporting standards may not be able to completely isolate the two, one can at least expect that the recent data to be more reliable.

I follow Campello et al.(2010) and define notional hedge ratio (nhr) as the ratio of sum of notional values of both interest rate and foreign exchange derivatives to lease adjusted total assets. Lease adjusted total assets are defined as sum of total assets and capitalized value of operating leases i.e. (rental expense + present value of future rental commitments for the next 5 years + present value of thereafter portion). Past studies on leasing (Yan(2002), and Graham, Lemmon and Schallheim (1998)) use 10% as the typical discount rate. Hence, I also use 10% as the discount rate in computing the present value of rental commitments and the thereafter portion. Fair value hedge ratio (fhr) is defined as the ratio of sum of fair values of both interest rate and foreign exchange derivatives to lease adjusted total assets. Hedging Dummy (HD) is defined as equal to 1 if either fhr or nhr is greater than zero else it is equal to zero. I define operating lease ratio (OLR) as the ratio of capitalized value of operating leases to lease adjusted total assets.

Based on extensive literature survey, Bharath et al. (2009) argue that the adverse selection is an important determinant of market liquidity, when liquidity is proxied by either bid-ask spread or trading volume.[4] Hence, I use a market microstructure measure of stock illiquidity viz. "ILLIQ", measured as the average ratio of daily absolute return to the dollar trading volume on that day as per Amihud (2002), to proxy for information asymmetry[5].

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[4] Firm managers constitute a subset of the informed traders who in turn are a subset of all traders (both informed and uniformed) in the market. Further they note that the market microstructure measures of information asymmetry are proxies for this adverse selection, albeit imperfect ones since they also encompass informed traders who are not firm managers. Nonetheless, these proxies capture the financial markets' perception of the information advantage held by firm insiders and the resulting adverse selection costs, which are what ultimately affects the cost of issuing information-sensitive securities.

[5] $ILLIQ_{iy} = \frac{1}{D_{iy}} * \sum_{t=1}^{D_{iy}} |R_{iyd}| / VOLD_{iyd}$

where D_{iy} is the number of days for which data are available for stock *i* in year *y*. R_{iyd} is the return on stock *i* on day *d* of year *y* and $VOLD_{iyd}$ is the respective daily dollar volume. The stock price changes without trading when investors agree about the implication of news, while disagreement induces increase in trading volume. Thus, Amihud (2002) argues that ILLIQ can be interpreted as a

Following Adam and Goyal (2008), I use Tobin's Q i.e. market to book ratio of assets as a proxy for the firm's growth opportunities[6]. Debt ratio (DR) is measured as the ratio of book value of long term debt to the book value of lease adjusted total assets. Recently, Hadlock and Pierce (2010) conclude that firm size and age are particularly useful predictors of financial constraint levels and question the validity of commonly used measures of financial constraints such as Kaplan and Zingales(KZ) and Whited and Wu(WW) indices. Hence, I use firm size and firm age as proxies for financial constraints. I measure firm size as a natural logarithm of net sales. Firm age in any given year is measured as ln(1+difference between that year and the year of incorporation). Research and development intensity (RD) is defined as ratio of annual Research & Development expenditure to lease adjusted total assets. I measure exposure to foreign exchange rate risk (foreign) as the ratio of foreign sales to total sales as per Geczy et al. (1997). Taxrate is defined as the ratio of taxes paid to pretax income. Volatility (Vola) in any sample year is defined as the standard deviation of EBITDA over the 5 years preceding the sample year.

I follow Campello et al.(2010) and Acharya et al. (2007) and compute modified Altman's Z index(MZ) as *3.3× (Pretax Income/Lease Adjusted Total Assets) +1.0 × (Net Sales/Lease Adjusted Total Assets Total Assets) + 1.4×(Retained Earnings/ Lease Adjusted Total Assets) + 1.2×(Current Assets–Current Liabilities)/(Lease Adjusted Total Assets).* Following Almeida and Campello (2007), I define *debt capacity (DC) = (cash holdings + 0.715 × receivables + 0.547 × inventory + 0.535 × PPE)/ total assets.* Entrenchment Index (EIndex), a proxy for corporate governance, is computed as per Bebchuk, Cohen and Ferrell(2009). The level of EIndex for any given firm in a given year is computed as a sum of points by assigning one point for each of the

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measure of consensus belief among investors about new information. However, at any point in time, stock liquidity is very likely to be driven by adverse selection but not exclusively so because of inventory and order processing costs. Hence, as a robustness check, I use yearly average of daily closing bid-ask spread from **CRSP** as an alternative measure for information asymmetry and define $\boldsymbol{BASPREAD_{iy}} = \mathbf{(Ask_{iy}-Bid_{iy})/[(Ask_{iy}+Bid_{iy})/2]}$

[6]There is a considerable debate on whether Q as measured conventionally is indeed a good measure of growth opportunities. Recently, Adam and Goyal (2008) examine various proxies for the investment opportunities and conclude that the market-to-book assets ratio has the highest information content with respect to investment opportunities.

six components of the index that the firm has: staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes, and super majority requirements for mergers and charter amendments. I collect the data on these variables from Governance data set of ***RiskMetrics***. By definition poorly governed firms have higher EIndex value.

I measure managerial stock incentive compensation (MSIC) as a ratio of value of restricted stock granted during the year to total compensation as per Rogers (2002). Total compensation includes salary, bonus, other annual, total value of restricted stock granted, total value of stock options granted (using Black-Scholes OPM), long-term incentive payouts, and all other total[7]. I collect the data on these variables from ***Compustat Execucomp*** database. The descriptive statistics for all the variables mentioned above are reported in Table-I and key variables are briefly discussed here.

The notional hedge ratio has a mean of 0.028, a median of 0 and a maximum value of 0.81. The median firm has a fair value hedge ratio of 0 and a maximum value of 0.246. The hedging dummy has a mean of 0.374. The operating lease ratio(OLR) has a median of 0.087 and a mean of 0.172. The debt ratio (DR) has a median of 0.134 and a mean of 0.156. The median firm has a illiquidity(ILLIQ) of 0.0013 and a mean of 0.0123 with a maximum value of 1.4563. Similarly, Bid-Ask spread(BASPRD) has a minimum of 0.041, a maximum of 0.89 and a median value of 0.029. The median firm has a size of 21.12 with and the average firm has a size of 21.59. The age of youngest form is 0 and that of the oldest firm is 5.33 with a median of 3.56.

Table-II provides the total annual dollar amount of both the interest rate and foreign exchange derivatives usage on both notional and fair value basis. During the sample period it

[7] I also measure managerial option compensation (Option) as the ratio of value of options granted to top 5 executives during the year to the total compensation. However, due to the data limitations , I ignore this variable from further analysis.

appears that firms used more interest rate derivatives than foreign exchange derivatives. Also, with the onset of great recession in 2009, it appears that firms have reduced their usage of interest rate and foreign exchange derivatives. The fair value of the interest rate derivatives has reduced by 48.93% and that of the foreign exchange rate has decreased by 23.27% from year 2009 to 2010.

The pairwise correlations among the key variables are reported in Table-III and briefly discussed here. The fair value hedge ratio(fhr) has a significant correlation coefficient with the notional hedge ratio(nhr). The hedging dummy (hd) has significant and positive correlation with both the fair value hedge ratio and notional hedge ratio. The operating lease ratio is significantly negatively correlated with notional hedge ratio and negatively correlated with fair value hedge ratio. Illiquidity(illiq) has positive correlation with both fair value hedge ratio and notional hedge ratio and significant positive correlation with hedging dummy. Bid-Ask spread(basprd) has positive correlation with fair value hedge ratio, notional hedge ratio and hedging dummy but not significant. Firm size is significantly and positively related to notional hedge ratio and hedging dummy. However, the correlation coefficient between size and fair value hedge ratio is negative and insignificant. Firm Age is positively and significantly correlated to notional hedge ratio and hedging dummy but positive and insignificant with respect to fair value hedge ratio. Debt ratio (DR) is positively and significantly related to notional and fair value hedge ratios as well as the hedging dummy. Debt capacity (DC) is negatively correlated to notional and fair value hedge ratios as well as the hedging dummy but it is not significant.

Univariate results are reported in Table-IV and briefly discussed here. It appears that young firms hedge less compared to old firms. The mean difference of the fair value hedge ratio between young and old firms is significant. However, the difference in the notional hedge ratio is not significant in the sample. Similarly, it appears that small firms hedge less compared to large firms. The mean difference of the notional hedge ratio between small and large firms is significant. However, the difference in the fair value hedge ratio is not significant. Further, as hypothesized, firms with high operating lease ratios tend to have low hedge ratios. The mean differences are significant for both notional and fair value hedge ratios.

III. Empirical Models, Estimation and Results

3.1. Information Asymmetry, Leasing and Hedging

In the comprehensive hedging model, presented below, information asymmetry (IA) and operating lease ratio (OLR) are test variables. I lag the independent variables to attribute causal interpretation and mitigate spurious correlations among the regressors and the regressand. I correct for time-series dependence among the error terms by clustering the residuals based on firm id (gvkey). Also, the included time dummies should remove any cross-sectional dependence between observations in the same time period[8]. I use these heteroskedasticity and autocorrelation robust standard errors for inference.

$$\boldsymbol{HR_{it} = a_0 + a_1 * IA_{it-1} + a_2 * OLR_{it-1} + a_3 * DR_{it-1} + a_4 * Q_{it-1} + a_5 * Age_{it-1} + a_6 * Size_{it-1} + a_7 * MZ_{it-1} + a_8 * DC_{it-1} + a_9 * Foreign_{it-1} + a_{10} * Vola_{it-1} + a_{11} * Tax\ Rate_{it-1} + a_{12} * RD_{it-1} + a_{13} * MSIC_{it-1} + Industry\ Dummies + Year\ Dummies + \epsilon_{it}} \quad \textit{(1)}$$

HR is either fair value or nominal hedge ratio. *IA* is information asymmetry proxied by either illiq(Amihud, 2002) or percent bid-ask spread(basprd). *OLR* is operating lease ratio. *DR* is debt ratio. *Q* is M/B ratio of total assets, a proxy for growth opportunities. *Age* is the firm age, since the date of incorporation, and proxies financial constraints. *Size* is ln(net Sales) a proxy for the financial constraints. *MZ* is modified Altman's Z-score and proxies financial distress. *DC* is debt capacity. *Foreign* is foreign sales/Total sales and proxies currency exposure. *Volatility* is standard deviation of past five years cashflow. *Taxrate* is income taxes paid as a fraction of

[8] Petersen (2009) provides a comprehensive comparison of different approaches used in estimating standard errors in financial panel data sets and the implications for inference.

pretax income. *RD* is research and development as a fraction of lease adjusted total assets. *MSIC* is managerial stock incentive compensation and proxies for managerial risk aversion.

I estimate the model-1 using panel fixed effects, Fama-MacBeth(1973) and the results are reported in Table-V and briefly discussed here. Consider Model-1. The coefficient on OLR is negative and significant as hypothesized. This follows from the arguments by Rampini and Viswanathan(2010) that there is a fundamental trade-off between firms' financing and risk management policy and financing needs can override hedging concerns for financially constrained firms. The coefficient on information asymmetry, proxied by, ILLIQ is positive and significant as hypothesized. This follows from the argument by Demarzo and Duffie(1991) that firms with high information asymmetry should hedge more to reduce information asymmetry between managers and markets and to mitigate agency costs/costly external financing.

The coefficient on managerial stock incentive compensation is negative and significant. This follows as firms that rely more on incentive compensation to mitigate shareholder-manager agency issues should rely less on hedging. The coefficient on debt ratio is positive and significant as predicted. This is consistent with Graham and Rogers(2002) that hedging increases leverage and vice-versa. The coefficient on debt capacity is negative as expected but not significant. The coefficient on R&D is positive and significant as expected. This follows because firms with high R&D tend to have high growth opportunities and firms with high growth opportunities should hedge more to mitigate the agency costs of underinvestment (see Nance, Smith, Smithson(1997), Lin (2007))[9]. The coefficient on size is positive as expected, because large firms are less constrained and hence should hedge more, but not significant. Another explanation is due to the

[9] Another interpretation of this result is firms with high R&D tend to have more information asymmetry with respect to their growth opportunities. Hence as argued, in the main text, firms with high information asymmetry should hedge more.

economies of scale associated with hedging as per Dolde (1993)[10]. Hence large firms should hedge more as they have less cost of setting up and running an in house hedging program. The coefficient on age is positive as expected, because older and established firms are less constrained and hence should hedge more, but not significant. The coefficient on Q is positive and significant as expected because firms with higher investment opportunities suffer the most from the costs of underinvestment. Hence they should hedge more to mitigate the underinvestment costs. The coefficient on cash flow volatility is positive as expected but not significant. The coefficient on modified Z-score(MZ) is negative as expected because firms with high financial distress should hedge more to reduce the probability of bankruptcy. The coefficient on foreign is positive and significant as predicted. This follows because the higher the foreign sales the higher is the firm's exposure to exchange rate risk and hence should hedge more. Finally the coefficient on tax rate is negative and significant. This is consistent with Geczy et al. (1997) argument that firms facing a convex tax function will hedge less, ceteris paribus. I also report, in Table-V, the Probit estimation results by using a dummy variable for notional hedge ratio. The operating lease ratio is negative and highly significant as hypothesized. The coefficient on illiquidity is positive and highly significant as predicted. Please refer Table-V for additional details.

Now I examine the economic significance of the hypothesized variables viz. information asymmetry and operating lease ratio. Consider Model-1. A one standard deviation increase in illiquidity (illiq) increases the notional hedge ratio by 0.168% from its expected value. This is considerable given that the mean notional hedge ratio is 2.8%. Similarly, one standard deviation increase in operating lease ratio increases the notional hedge ratio by 0.166%. Again, this is considerable given that the mean notional hedge ratio is 2.8%.

[10] Firm size and age could be noisy proxies for the financial constraints as they could also proxy for information and agency frictions. But one can argue that information and agency frictions are the key drivers of financial constraints.

I repeat the analysis using fair value hedge ratio (fhr) and report the estimation results in Table-VI[11]. For brevity, I just discuss the statistical and economic significance of the hypothesized variables. Consider Model-1. The coefficient on operating lease ratio is negative and significant as expected even after controlling for financial constraints proxied by firm size and age. Similarly the coefficient on information asymmetry, proxied by illiquidity is positive and significant. In terms of economic significance, one standard deviation increase in operating lease ratio decreases the fair value hedge ratio by 0.1%. This can be compared to the mean fair value hedge ratio of 0.18%. Similarly, one standard deviation increase in illiquidity increases fair value hedge ratio by 0.05%. This is considerable compared to the mean fair value hedge ratio of 0.18%. While using fair values instead of the notional values for hedge intensity has reduced the significance levels of test variables the economic significance appears to be considerable.

One can argue that the independent variables leverage and incentive compensation are endogenous choice variables to a firm. As Geczy et al. (1997) noted it is almost impossible to eliminate all these endogeneity problems[12]. Since these are the control variables, I do not pursue this issue further. Consistent with previous studies on hedging determinants by Geczy et al.(1997), Tuffano(1996), and Nance et al.(1993), I lag the endogenous variables by one period. However, this does not solve the problem completely if the endogenous variables are serially correlated. Hence, I also offer several other ways of dealing with endogeneity, in robustness checks, in section IV below.

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[11] In an unreported analysis, in addition to controlling for size and age among other variables, I also interact high size(above median size) dummy with OLR and high age(above median age) dummy with OLR in equation-1 to see the effect of OLR on both NHR and FHR for high vs. low financial constraints. I find that the coefficients on the interaction terms are not significant. Hence, it appears once I control for the financial constraints proxied by size and age, the interaction variables created using dummies based on these two variables have no significant explanatory power. The results are available from the author.

[12] Wooldridge (2002) argues that in applied econometrics, endogeneity usually arises in three ways viz. omitted variables, measurement error, and simultaneity. He mentions that the distinctions among the three forms are not always sharp and an equation can in fact have more than one source of endogeneity. The use of lagged dependent variables in dynamic models could be yet another source of endogeneity!

IV. Robustness Checks

4.1 Instrumental Variable Regressions

I estimate equation (1) using instrumental variable approach. I use fixed asset ratio (FAR), measured as a ratio of netPPE to total assets and EIndex dummy(EID) coded as 1 if EIndex is above median else equal to zero, a proxy for corporate governance, as instruments for operating lease ratio(OLR). I select the above two based on both the past studies on determinants of leasing as well as the pair-wise correlation of these two variables with operating lease ratio in the sample data. The economic intuition is as follows: Robicheaux et al.(2008) offer empirical evidence that agency cost reducing measures such as corporate governance and lease financing are complements. Sharpe and Nguyen(1995) argue that fixed asset ratio can serve as a proxy for capital intensity and that firms with high capital intensity lease more of their capital stock i.e. PPE. The correlation between OLR and FAR is 0.2274 with a p-value of 0. The correlation between OLR and EIndex dummy is 0.1042 with a p-value of 0.001. I overidentify the system, by including more than one instrument for the endogenous variable, as it is a necessary condition to test instrument exogeneity.

The estimation is carried out using two-step *generalized method of moments* (GMM). This estimator also produces both heteroskedasticity and autocorrelation (HAC) consistent estimates of both the slope coefficients and the corresponding standard errors. Only the second stage regression results are reported in Table-VII for brevity and briefly discussed here. The sign on predicted OLR is negative as expected and also highly significant confirming hypothesis2. The coefficient on bid-ask spread (basprd) is positive and significant confirming hypothesis1. I repeat the analysis using fair value hedge ratio and report the results in Table-VII. Again, the sign on predicted OLR is negative as expected and also significant. The coefficient on illiquidity is positive but not significant. Consider the Model1. A one standard deviation increase in predicted value of operating lease ratio decreases the notional hedge ratio by 0.46%. This is considerable given the mean notional hedge ratio is 2.8%.

The instrument validity is checked through Sargan statistic, reported below Table-VII, for overidentification. The Sargan statistic has a value of 0.595 with a p-value of 0.44 thus failing to reject the null hypothesis that instruments are valid. I further check the relevance of instruments through a test of week instruments. The Cragg-Donald Wald F-statistic, reported below Table-VII, has a value of 24.18 with a critical F value (at IV size 10%) equal to 19.93. Since the test statistic is larger than the critical value, I reject the null that the equation is weakly identified. This further mitigates the concern whether instruments are weakly correlated with the endogenous regressor.

4.2 Simultaneous Equation Modeling of Hedging and Leasing

Now I address the problem of joint determination of hedging and leasing. One can argue that the risk management and financing are strategic decisions and determined simultaneously by a firm as part of its business strategy. However, finance theory does not offer any clear theoretical models to address this problem. Hence, consistent with past empirical studies on hedging by Geczy et al. (1997), Graham and Rogers (2002), Lin and Smith (2007), and Purnanandam (2008) and past studies on leasing by Robicheaux et al. (2008) , Eisfeldt and Rampini(2009) and Sharpe and Nguyen (1995), I model hedging and leasing decisions as a simultaneous system using the structural equations as under:

$$HR_{it} = a_0 + a_1 * IA_{it-1} + a_2 * OLR_{it}^{*} + a_3 * DR_{it-1} + a_4 * Q_{it-1} + a_5 * Age_{it-1} + a_6 * Size_{it-1} + a_7 * MZ_{it-1} + a_8 * DC_{it-1} + a_9 * Foreign_{it-1} + a_{10} * Vola_{it-1} + a_{11} * Tax\ Rate_{it-1} + a_{12} * RD_{it-1} + Industry\ Dummies + Year\ Dummies + \epsilon_{it} \quad (1a)$$

$$OLR_{it} = \beta_0 + \beta_1 * HR_{it}^{*} + \beta_2 * IA_{it} + \beta_3 * DR_{it} + \beta_4 * DC_{it} + \beta_5 * Size_{it} + \beta_6 * Age_{it} + \beta_7 * Q_{it} + \beta_8 * MZ_{it} + \beta_9 * Taxrate_{it} + \beta_{10} * FAR_{it} + \beta_{11} * EID_{it} + Year\ and\ Industry\ Dummies + \varepsilon_{it} \quad (2)$$

Where OLR^* and HR^* are the predicted values from the first stage OLS regressions. I exclude fixed assets ratio (FAR) and Entrenchment Index Dummy(EID) from the hedging equation and Foreign, Volatility and R&D from the leasing equation. The structure of the exclusion restrictions ensures that the system is identified. I use three-stage least squares(3SLS) as the estimation technique. For inference, the standard errors are corrected for the fact that the estimated values are used for the endogenous regressor. The results of the last stage regressions, using notional hedge ratios, are reported in table-VIII and discussed briefly here.

Consider the hedging equation. The coefficient on operating lease ratio is negative and highly significant thus supporting the hypothesis-2 that firms that lease more hedge less. In terms of economic significance, one standard deviation increase in operating lease ratio(OLR) from its predicted value would decrease the notional hedge ratio by 0.88%. This appears significant considering that the mean notional hedge ratio is 2.79%. Similarly, the coefficient on illiquidity (illiq) is positive and significant thus supporting hypothesis-2. The coefficient on debt ratio (DR) is positive and significant as expected. The coefficient on debt capacity is negative as expected but not significant. The coefficient on Q is positive and significant. The coefficient on cash flow volatility is negative and significant. The coefficient on modified Z-score is negative and significant. The coefficient on foreign is positive and significant. The coefficient on tax rate is negative and significant. The coefficients on R&D, size and age are not significant.

In the leasing equation, the coefficient on notional hedge ratio(nhr) is negative and highly significant. This indicates that hedging and leasing causality can go both ways. I repeat the analysis using fair value hedge ratios and report the results in Table-IX. The main result that firms that lease more hedge less holds good.

V. Conclusions

This paper contributes to the literature on capital market imperfections, leasing, and hedging. First, using broad market microstructure based measures of information asymmetry, I offer empirical evidence consistent with theory that firms with higher information asymmetry hedge more. Second, I examine the effect of lease intensity on hedging and offer the first empirical evidence on *hedging puzzle*. Using a sample of 218 non-financial firms drawn from S&P 100, S&P 400 and S&P 600 indices covering the recent five year period of 2006-2010, I find that firms that lease more of their PPE use less financial derivatives, consistent with the theoretical predictions of Rampini and Viswanathan(2010). The results are robust to several alternative measurements of key variables, different regression specifications, estimation techniques and corrections for endogeneity. My empirical results suggest that the ability to deploy leased capital, by financially constrained firms, has significant effect on corporate risk management activities and a comprehensive analysis of determinants of hedging should not ignore leasing from the analysis.

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Table I

Descriptive Statistics – Full Sample for the period of 2006-2010

This table reports summary statistics on the main outcome, test and control variables. The sample covers an average of 218 non-financial lessee firms taken from Standard & Poor's (S&P) 100, S&P 400 and S&P 600 over the period of 2006-2010. Variable definitions are included in the Appendix 3. The number of firm-year observations reported in the first column.

	#Obs.	Mean	Std.Dev	Minimum	Quartile1	Median	Quartile3	Maximum
NHR	1084	0.0279	0.0721	0	0	0	0.0191	0.812
FHR	1084	0.0018	0.0119	0	0	0	0.0003	0.2464
HD	1084	0.3736	0.484	0	0	0	1	1
OLR	993	0.1717	0.2004	0.001	0.0421	0.0874	0.2113	0.879
ILLIQ	1041	0.0123	0.0846	0	0.0001	0.0013	0.0041	1.4563
BASPRD	1041	0.0414	0.0583	0.0057	0.0185	0.029	0.0461	0.8901
EINDEX	819	2.6618	1.4165	0	2	3	4	6
MSIC	1070	0.0097	0.0115	0	0.0035	0.0059	0.0121	0.1992
DR	993	0.1561	0.1493	0	0.0197	0.134	0.2316	0.7802
DC	953	0.3517	0.1355	0.0513	0.2547	0.3586	0.4456	0.8837
RD	993	0.0308	0.052	0	0	0.0059	0.0492	0.6423
SIZE	1082	21.5973	2.0099	13.7366	20.2333	21.1242	23.3644	26.78
AGE	1084	3.5891	0.8193	0	3.0445	3.5553	4.3041	5.3279
Q	1070	2.0037	1.165	0.5334	1.2991	1.7159	2.3394	15.4038
VOLA	1031	0.037	0.0379	0.0019	0.0159	0.0276	0.0442	0.3755
MZ	1047	2.1248	1.1808	-7.9252	1.4352	2.1011	2.8056	6.152
FOREIGN	1084	0.2628	0.3241	0	0	0.0827	0.499	1
TAXRATE	1084	0.23	0.14	0	0.11	0.26	0.36	0.4

Table II

Derivative Usage over the Period of 2006-2010

This table reports the total dollar amount of interest rate and foreign exchange rate derivatives on both notional and fair value basis for the period of 2006-2010. The sample non-financial firms are taken from Standard & Poor's (S&P) 100, S&P 400 and S&P 600. TNIR is the total notional value of interest rate derivatives. TFIR is the total fair value of interest rate derivatives. TNFR is the total notional value of foreign exchange derivatives. TFFR is the total fair value of foreign exchange derivatives. The number of firms is reported in the last column.

Year	**TNIR (Millions of $)**	**TFIR (Millions of $)**	**TNFR (Millions of $)**	**TFFR (Millions of $)**	**# of Firms**
2006	100537.50	1582.38	28916.25	573.90	215
2007	200198.10	3011.28	36647.84	824.25	218
2008	223932.00	3942.31	45177.88	1502.64	218
2009	220694.20	6203.74	61551.29	2365.14	218
2010	168068.20	3168.22	61662.92	1814.88	215

Table III
Pairwise Correlation Coefficients

This table presents pairwise correlation coefficients for the key determinants of hedging and leasing. The sample covers an average of 218 non-financial lessee firms taken from Standard & Poor's (S&P) 100, S&P 400 and S&P 600 over the period of 2006-2010. Variable definitions are included in the Appendix 3. The star indicates significance at 5% or better.

	NHR	FHR	HD	OLR	ILLIQ	BASPRD	SIZE	AGE	DR	DC
NHR	1									
FHR	0.2396*	1								
HD	0.5020*	0.1908*	1							
OLR	-0.1062*	-0.0456	-0.0433	1						
ILLIQ	0.025	0.0119	0.0824*	0.0990*	1					
BASPRD	0.0438	0.0023	0.0334	0.0185	0.5792*	1				
SIZE	0.1533*	0.0174	0.2556*	0.0279	-0.0664*	-0.0647*	1			
AGE	0.0746*	0.0484	0.1142*	-0.0159	-0.0001	-0.0512	0.3759*	1		
DR	0.3553*	0.0664*	0.2306*	-0.2451*	-0.0565	-0.1151*	0.1693*	0.1228*	1	
DC	-0.0405	-0.0324	-0.0183	-0.5983*	-0.003	0.0844*	0.1639*	-0.0232	-0.0863*	1

Table IV
Univariate Analysis of Hedge Ratios

This table reports the univariate results of hedge ratios. Panel A classifies firms into young and old based on age and reports the notional (nhr) and fair value (fhr) hedge ratios of young and old firms. Panel B classifies firms into small and large based on size and reports the two hedge ratios by young and small firms. Panel C classifies firms into low and high lease based on operating lease ratio and reports the two hedge ratios by low and high lease firms. Further, the differences across the three dimensions and the corresponding T-statistics are also reported. Variable definitions are included in the Appendix3.

			Panel A		
			BY AGE		
		Young	**Old**	**Diff**	**T -Stat**
	Mean	0.025314	0.030669	-0.00535	-1.212
NHR	Std.Dev	0.0577	0.0205		
	N	555	529		
		Young	**Old**	**Diff**	**T -Stat**
	Mean	0.001	0.003	-0.002	-2.21
FHR	Std.Dev	0.005	0.016		
	N	555	529		
			Panel B		
			BY SIZE		
		Small	**Large**	**Diff**	**T -Stat**
	Mean	0.0185	0.0373	-0.0188	-4.326
NHR	Std.Dev	0.0534	0.0857		
	N	540	544		
		Small	**Large**	**Diff**	**T -Stat**
	Mean	0.0012	0.0022	-0.001	-1.372
FHR	Std.Dev	0.003	0.017		
	N	540	544		
			Panel C		
			BY OLR		
		Low	**High**	**Diff**	**T -Stat**
	Mean	0.0348	0.0218	0.013	2.911
NHR	Std.Dev	0.0845	0.0582		
	N	509	575		
		Low	**High**	**Diff**	**T -Stat**
	Mean	0.0026	0.001	0.0016	2.095
FHR	Std.Dev	0.0167	0.0044		
	N	540	544		

Table V
Regressions of Hedging Determinants Using Notional Values

This table reports regression results with notional hedge ratio and hedging dummy as the dependent variables and proxies information asymmetry and operating lease ratio as the main test variables. The sample covers an average of 218 non-financial lessee firms taken from Standard & Poor's (S&P) 100, S&P 400 and S&P 600 over the period of 2006-2010. Variable definitions are included in the Appendix. Industry dummies are included in all models and year dummies are included in all the models except for Fama-MacBeth(1973) regressions but not tabulated. T-statistics are reported below the slope coefficients in parentheses for significant coefficients. The * indicates significant at 10%, ** significant at 5% and *** significant at 1%, respectively. The number of firm-year observations and R^2 values for each model are also reported.

		OLS (1)	Fama-Mac (2)	Probit (3)	OLS (4)	Fama-Mac (5)	Probit (6)
	Exp. Sign	NHR_{it}	NHR_{it}	NHD_{it}	NHR_{it}	NHR_{it}	NHD_{it}
OLR_{it-1}	-	-0.0083**	-0.0074**	-0.8721**	-0.0085**	-0.0072*	-0.9170***
		(-2.11)	(-2.767)	(-2.577)	(-2.23)	(-2.128)	(-2.6967)
$ILLIQ_{it-1}$	+	0.0199	0.01	1.1855			
		(1.9803)**	1.0504	(2.8452)***			
$BASPRD_{it-1}$	+				0.0152	0.02	1.0932
					(1.7345)*	(1.799)*	(2.794)***
$MSIC_{it-1}$	-	-0.5616*	-0.7797***	-46.3002***	-0.5636*	-0.7881***	-47.1391***
		(-1.9509)	(-8.0061)	(-4.9984)	(-1.7103)	(-7.5806)	(-5.0325)
DR_{it-1}	+	0.1153***	0.1234***	1.5733***	0.1157***	0.1250***	1.6069***
		(4.7856)	(10.3763)	(3.9635)	(6.3605)	(10.963)	(4.0322)
DC_{it-1}	-	-0.0226	-0.0243**	0.4772	-0.0235	-0.0245**	0.4935
		(-0.9440)	(-2.9507)	0.969	-0.9916	(-2.9848)	1.0017
RD_{it-1}	+	0.1759**	0.1538***	3.0799**	0.1767***	0.1538***	3.3842**
		(2.3977)	(11.3623)	(2.1299)	(2.9481)	(10.923)	(2.30)
$SIZE_{it-1}$	+	0.0014	0.0006	0.0651**	0.0013	0.0005	0.0681**
		0.8836	0.6995	(2.2975)	0.8519	0.5854	(2.407)
AGE_{it-1}	+	0.0016	-0.0028	-0.1655**	0.0016	-0.0028	-0.1636**
		0.39	-0.7915	(-2.4966)	0.5178	-0.7823	(-2.4646)
Q_{it-1}	+	0.0055**	0.0081**	0.2010***	0.0054**	0.0079**	0.1973***
		(2.0784)	(4.5926)	(3.5254)	(2.0975)	(4.4961)	(3.4419)
$VOLA_{it-1}$	+	0.0046	-0.0812	-3.2531**	0.0068	-0.0786	-3.3057**
		0.0514	-1.5670	(-2.1064)	0.0896	-1.5395	(-2.1424)
MZ_{it-1}	-	0.003	-0.0035***	-0.0809	-0.003	-0.0035***	-0.0927
		-1.3505	(-5.2153)	-1.3742	-1.2025	(-5.2032)	-1.5702
$FOREIGN_{it-1}$	+	0.0148*	0.0213***	0.5585***	0.0147*	0.0212***	0.5692***
		(1.8242)	(5.3318)	(3.5452)	(1.9394)	(5.5141)	(3.6096)

$TAXRATE_{it-1}$	-	-0.0264*	-0.0367**	-0.6054	-0.0269	-0.0367**	-0.5766
		(-1.6765)	(-3.8733)	-1.5951	(-1.6191)	(-3.6789)	-1.5191
CONSTANT		-0.0419	0	-1.5405**	-0.0407	0.0021	-1.6596**
		-1.0215	0	(-2.2502)	-0.5886	0.1419	(-2.4259)
Observations		875	875	875	875	875	875
R-squared		0.22	0.15	0.11	0.22	0.15	0.11

Table VI
Regressions of Hedging Determinants Using Fair Values

This table reports regression results with fair value hedge ratio and hedging dummy as the dependent variables and proxies information asymmetry and operating lease ratio as the main test variables. The sample covers an average of 218 non-financial lessee firms taken from Standard & Poor's (S&P) 100, S&P 400 and S&P 600 over the period of 2006-2010. Variable definitions are included in the Appendix. Industry dummies are included in all models and year dummies are included in all the models except for Fama-MacBeth(1973) regressions but not tabulated. T-statistics are reported below the slope coefficients in parentheses for significant coefficients. The * indicates significant at 10%, ** significant at 5% and *** significant at 1%, respectively. The number of firm-year observations and R^2 values for each model are also reported.

		OLS (1)	Fama-Mac (2)	Probit (3)	OLS (4)	Fama-Mac (5)	Probit (6)
	Exp. Sign	FHR_{it}	FHR_{it}	FHD_{it}	FHR_{it}	FHR_{it}	FHD_{it}
OLR_{it-1}	-	-0.0054*	-0.0047*	-1.6677***	-0.0054*	-0.0049*	-1.6653***
		(-1.761)	(-2.2649)	(-4.8133)	(-1.765)	(-2.4486)	(-4.7963)
$ILLIQ_{it-1}$	+	0.0062*	0.001	-1.1879 **			
		(1.7245)	0.1255	(-1.9950)			
$BASPRD_{it-1}$	+				0.0065*	0.004	-0.6314*
					(1.7464)	0.6702	(-1.7616)
$MSIC_{it-1}$	-	-0.1234	-0.1777*	-34.5360***	-0.124	-0.1791*	-34.6334***
		(-1.6243)	(-2.2385)	(-3.8691)	(-1.6323)	(-2.2706)	(-3.8739)
DR_{it-1}	+	0.0092**	0.0036* *	1.7932***	0.0094**	0.004* *	1.7711***
		(2.1929)	(2.744)	(4.4188)	(2.2353)	(2.764)	(4.3562)
DC_{it-1}	-	-0.0193***	-0.0141**	1.5349***	-0.0196***	-0.0143**	1.5690***
		(-3.5147)	(-4.0411)	(3.0214)	(-3.5777)	(-4.0910)	(3.0939)
RD_{it-1}	+	-0.0018	0.0011	2.1112	-0.0012	0.0011	2.0555
		-0.1284	0.3986	1.5477	-0.0871	0.5478	1.4981
$SIZE_{it-1}$	+	-0.0016***	-0.0010**	0.0395	-0.0016***	-0.0010**	0.0406
		(-4.5337)	(-3.1217)	1.3824	(-4.5712)	(-3.0860)	1.4224
AGE_{it-1}	+	0.0012*	0.0006**	0.0157	0.0013*	0.0006**	0.0137
		(1.7002)	(3.3573)	0.234	(1.7403)	(3.1691)	0.2048
Q_{it-1}	+	0.0009	0.0015	0.1271**	0.0009	0.0015	0.1332**
		1.5718	1.6147	(2.199)	1.4669	1.6157	(2.2846)
$VOLA_{it-1}$	+	0.0186	0.0079	-2.9388*	0.0193	0.0088	-3.0277*
		1.0696	0.874	(-1.8442)	1.1109	1.0432	(-1.8970)
MZ_{it-1}	-	-0.0012**	-0.001*	-0.0053	-0.0012**	-0.0010*	-0.0034
		(-2.1383)	(-2.122)	-0.0896	(-2.1181)	(-2.2075)	-0.057

$FOREIGN_{it-1}$	+	0.0034*	0.0045**	0.8954***	0.0034*	0.0045**	0.9000***
		(1.9447)	(2.743)	(5.6245)	(1.9343)	(2.8369)	(5.6563)
$TAXRATE_{it-1}$	-	-0.0097**	-0.0096*	-0.7176*	-0.0098**	-0.0097*	-0.6972*
		(-2.5134)	(-2.0878)	(-1.8623)	(-2.5616)	(-2.0530)	(-1.8128)
Constant		0.0375**	0.0242**	-2.4223***	0.0379**	0.0246**	-2.4378***
		(2.3508)	(3.2084)	(-3.4601)	(2.3761)	(3.1265)	(-3.4751)
Observations		875	875	875	875	875	875
R-squared		0.11	0.06	0.12	0.11	0.06	0.12

Table VII
Instrumental Variable Regressions of Hedging Determinants

This table reports the instrumental variable regression results with notional hedge ratio and fair vale hedge ratio as the dependent variables. The sample covers an average of 218 non-financial lessee firms taken from Standard & Poor's (S&P) 100, S&P 400 and S&P 600 over the period of 2006-2010. Variable definitions are included in the Appendix. Industry and year dummies are included in all models, but not tabulated. The estimation is by two-step GMM and only the results of second stage are presented for brevity. The instruments used for OLR are Fixed Asset Ratio and EIndex Dummy. T-statistics reported below the slope coefficients and indicated in parentheses for significant coefficients. The *indicates significant at 10%, ** significant at 5% and *** significant at 1% respectively. The estimation period is from 1974-2006. The number of firm-year observations and R^2 along with the Sargan statistic, for overidentification test, is also reported.

	Expected Sign	(1) NHR_{it}	(2) FHR_{it}
OLR^*_{it}	-	-0.0228**	-0.006*
		(-1.9867)	(-1.8076)
$BASPRD_{it-1}$	+	0.023*	
		(1.76)	
$ILLIQ_{it-1}$	+		0.004
			1.2894
$MSIC_{it-1}$	-	-0.2971	-0.1835*
		(-0.6406)	(-1.6623)
DR_{it-1}	+	0.0969***	0.0133*
		(3.3812)	(1.9261)
DC_{it-1}	-	-0.0794	-0.0069
		-1.321	-0.4841
RD_{it-1}	+	0.1463*	0.0049
		(1.9083)	0.2711
$SIZE_{it-1}$	+	0.001	-0.0016***
		0.4997	(-3.2350)
AGE_{it-1}	+	0.0022	0.0011
		0.5176	1.1471
Q_{it-1}	+	0.0031	0.0014*
		0.8212	(1.6699)
$VOLA_{it-1}$	+	0.069	0.0045
		0.6318	0.1745
MZ_{it-1}	-	0.0048	0.0008
		1.3601	0.9108

$FOREIGN_{it-1}$	+	0.013	0.0037*
		1.4634	(1.7722)
$TAXRATE_{it-1}$	-	-0.0343*	-0.0080*
		(-1.7340)	(-1.7338)
Constant		0.0227	0.0237
		0.3301	1.4457
Observations		875	875
R-squared		0.19	0.08

Overidentification test of all instruments:

H0: the instruments are valid

- Sargan Statistic: 0.595 1.584
- Chi-sq(1) P-value 0.440 0.282

Weak identification test:

Ho: equation is weakly identified

- Cragg-Donald Wald F statistic 24.18 24.71
- Critical Value(10% maximal IV size) 19.93 19.93

Table VIII
Simultaneous Equation of Regressions of Notional Hedge Ratio and Leasing

This table reports simultaneous equation regression results with notional hedge ratio and operating lease ratio as the dependent variables. The sample covers an average of 218 non-financial lessee firms taken from Standard & Poor's (S&P) 100, S&P 400 and S&P 600 over the period of 2006-2010. Variable definitions are included in the Appendix. Industry and year dummies are included in all models, but not tabulated. The estimation is by 3-stage least squares and only the results of last stage are presented for brevity. T-statistics reported below the slope coefficients and indicated in parentheses for significant coefficients. The * indicates significant at 10% , ** significant at 5% and *** significant at 1% respectively. The number of firm-year observations and R^2 values for each model are also reported in the table
.

		(1)		(2)
VARIABLES	**EXP. SIGN**	**NHR_{it}**	**EXP. SIGN**	**OLR_{it}**
OLR^*_{it}	-	-0.0442**		
		(-1.9849)		
NHR^*_{it}			-	-1.9607**
				(-2.2732)
$ILLIQ_{it-1}$	+	0.009*	+	0.0274
		(1.7342)		0.2486
DR_{it-1}	+	0.1210***	-	-0.0725
		(6.4355)		(-0.5965)
DC_{it-1}	-	-0.0437	-	-0.9735***
		-1.3401		(-20.9286)
RD_{it-1}	+	0.0387		
		1.0483		
$SIZE_{it-1}$	+	0.0013	-	-0.0042
		1.0706		-0.9406
AGE_{it-1}	+	-0.0024	-	-0.012
		-0.8646		-1.4560
Q_{it-1}	+	0.0066***	+	0.0135*
		(3.1499)		(1.727)
$VOLA_{it-1}$	+	-0.0914*		
		(-1.9274)		
MZ_{it-1}	-	-0.0040*	-	-0.0373***
		(-1.738)		(-6.1909)
$FOREIGN_{it-1}$	+	0.0187***		
		2.7983		
$TAXRATE_{it-1}$	-	-0.0348**	-	-0.1111**
		(-2.1486)		(-2.0047)

FAR_{it-1}			+	0.2872***
				(7.8143)
EID_{it-1}			+	0.0119
				1.3634
CONSTANT		-0.002		0.5541***
		(-0.0672)		(5.8379)
Observations		879		879
R-squared		0.11		0.21

Table IX
Simultaneous Equation of Regressions of Fair Value Hedge Ratio and Leasing

This table reports simultaneous equation regression results with fair value hedge ratio and operating lease ratio as the dependent variables. The sample covers an average of 218 non-financial lessee firms taken from Standard & Poor's (S&P) 100, S&P 400 and S&P 600 over the period of 2006-2010. Variable definitions are included in the Appendix. Industry and year dummies are included in all models, but not tabulated. The estimation is by 3-stage least squares and only the results of last stage are presented for brevity. T-statistics reported below the slope coefficients and indicated in parentheses for significant coefficients. The * indicates significant at 10% , ** significant at 5% and *** significant at 1% respectively. The number of firm-year observations and R^2 values for each model are also reported in the table

		(1)		(2)
VARIABLES	**EXP. SIGN**	**FHR_{it}**	**EXP. SIGN**	**OLR_{it}**
OLR^*_{it}	-	-0.001*		
		(-1.7369)		
FHR^*_{it}			-	-0.4096**
				(-1.9826)
$BASPRD_{it-1}$	+	0.002	+	0.0829
		1.2532		(1.8584)*
DR_{it-1}	+	0.0075*	-	-0.2739***
		(1.8133)		(-5.2719)
DC_{it-1}	-	-0.0054	-	-1.0224***
		-0.7589		(-21.3466)
RD_{it-1}	+	-0.0053		
		-0.6163		
$SIZE_{it-1}$	+	-0.0008***	-	-0.0141***
		(-2.8577)		(-4.0217)
AGE_{it-1}	+	0.0009	-	-0.0013
		1.439		-0.1365
Q_{it-1}	+	0.0007	+	0.0064
		1.5018		1.0721
$VOLA_{it-1}$	+	-0.0087		
		-0.7888		
MZ_{it-1}	-	0.0008	-	-0.0410***
		1.5009		(6.4424)
$FOREIGN_{it-1}$	+	0.0048***		
		(3.0441)		

$TAXRATE_{it-1}$	-	-0.0098***	-	-0.1258**
		(-2.7134)		(-2.0890)
FAR_{it-1}			+	0.3275***
				(12.0653)
EID_{it-1}			+	0.0173*
				(1.8594)
CONSTANT		0.0142**		0.7371***
		(2.0685)		(9.9588)
Observations		879		879
R-squared		0.03		0.29

Appendix 3: Variable Definitions

Hedging Variables

- NHR = Notional value of both interest and currency derivatives scaled with lease adjusted total assets.
- FHR = Fair value of both interest and currency derivatives scaled with lease adjusted total assets.
- HD = Hedging dummy equal to 1 if either fhr or nhr is greater than zero else equal to 0.

Leasing Variable

- Operating Lease Ratio (OLR) = (rental expenses plus present value of future rental commitments and present value of the thereafter portion) / (rental expenses + present value of future rental commitments and present value of the thereafter portion + Total Assets).

Financial Constraints

- AGE = ln(1+difference between that year and the year of incorporation)
- SIZE = ln(Sales).

Information Frictions

- BASPREAD = yearly average of difference between daily closing bid and ask prices reported as a percentage of midpoint of bid ask quotes.
- ILLIQ = yearly average of ratio of daily absolute return to the dollar trading volume on that day.

Other Control Variables

- DR = long-term debt/ lease adjusted total assets.
- DC (debt capacity) = (cash holdings + 0.715 × receivables + 0.547 × inventory + 0.535 × net PPE)/ total assets.
- EIndex = Sum of points by assigning one point for each of the six components of the index that the firm has viz. staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes, and super majority requirements for mergers and charter amendments
- FAR = net PPE/ lease adjusted total assets.
- Foreign = foreign sales/total sales
- Modified Altman's Z-score (MZ) = 3.3× (Pretax Income/Total Assets) +1.0 × (Net Sales/Total Assets) + 1.4× (Retained Earnings/Total Assets) + 1.2×(Current Assets–Current Liabilities)/(Lease Adjusted Total Assets).
- MSIC = Ratio of value of restricted stock granted during the year to total compensation
- Q = market value of lease adjusted total assets/ book value lease adjusted of total assets.
- RND = R&D expenditure/ Lease adjusted total assets.
- TAXRATE = ratio of tax expense to pretax income.
- VOLA = standard deviation of EBITDA over the five years preceding the given sample year.