The Arrow-Lind Theorem Revisited:
Ownership Concentration and Valuation[*]

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Abstract

According to Arrow and Lind (1970), as the net returns of an investment are shared by increasingly many shareholders, the risk premium for the respective shareholders vanishes and the aggregate of these premiums approaches zero. We test Arrow and Lind's hypothesis of relationship between ownership concentration and perceived risk. We find strong and robust results that investors value higher companies and managers are more likely to invest in fixed assets and hold less cash in companies with dispersed ownership. Both results are interconnected: investors' lower liquidity premiums and managers' risk-neutral behavior contribute to higher valuations.

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It continues to be true that "one of the problems which has plagued those attempting to predict the behavior of capital markets is the absence of a body of positive microeconomic theory dealing with conditions of risk" (Sharpe 1964). Our understanding of risk, nonetheless, has substantially evolved. The capital asset pricing model (CAPM) of Sharpe (1964), Lintner (1965), and Mossin (1966) predicts that an asset's expected return is proportional to the risk premium on the market portfolio and the beta coefficient of the asset relative to the market portfolio. The intertemporal CAPM (Merton 1973) acknowledges that investors hedge against shortfalls in consumption or changes in future investment opportunities.

In Ross's (1976) arbitrage pricing theory (APT), an asset price equals the expected end of period price discounted at the rate implied by a multi-factor linear function of theoretical market indices, where sensitivity to changes in each factor is represented by a factor-specific beta coefficient.

Patterns in average stock returns not explained by the CAPM, ICAPM, or APT are called 'anomalies.' Fama and French (1993) show that anomalies largely disappear when expected returns are adjusted by three factors: (a) the excess return on a broad market portfolio, (b) the difference between the return on a portfolio of small stocks and large stocks, and (c) the difference between the return on a portfolio of high-book-to-market stocks and low-book-to-market stocks. Comparing to CAPM, the three-factor model (FF3F) adjusts downward for small capitalization and value (high book-to-market ratio or P/B) stock outperformance.

The CAPM, its extensions, and the Fama-French three-factor model are based on rational expectations assumptions: homogeneous investors care about mean return and variance of the same assets; markets are frictionless, i.e., there are no transaction costs; and investors are price-takers, i.e., each investor has a small endowment relative to overall investors' wealth.

Holmström and Tirole (2001) develop an alternative approach to asset pricing based on corporations' desire to hoard liquidity, which gained momentum in recent years due to the financial crisis and governments' response (Holmström and Tirole 2011). Their liquidity-based asset pricing model (LAPM) suggests the distribution of wealth—within the corporate sector and between the corporate sector and the consumers—and the composition of savings are determinant to the corporate demand for liquid assets and, thereby, interest rates.

Harris and Raviv (1993), Kandel and Pearson (1995), and (Odean 1998) point to differences in opinions about fundamentals as the leading explanation for trading volume in asset

markets.

Limited attention has been paid to the relationship between ownership concentration, risk perception, and valuation. Previous studies focused on management (insider) ownership and institutional breadth. In a 1980 cross-section of 371 large Fortune 500 firms, Morck, Shleifer, and Vishny (1988) found evidence that the relationship between management ownership and market valuation of firms behaves nonmonotonically: valuation increases, then declines, and finally rises slightly as insider ownership rises. Basing on data from mutual fund holdings, Chen, Hong, and Stein (2002) showed that low breadth—i.e., when few investors have long positions—signals that that prices are high relative to fundamentals. Cho (1998) proved that corporate value affects ownership structure, but not vice versa, and put into question the assumption that ownership structure is exogenously determined.

Prevailing asset pricing theories black-box the interrelation between the structure of the demand-side of valuation—investors—and the risk-taking behavior of managers. Using novel investor-level data on ownership structure, we test this relationship in the light of the consigned to oblivion Arrow and Lind's (1970) theorem of public investments.

1 Ownership Concentration, Risk Premium, and Valuation

According to the Arrow-Lind theorem (Arrow and Lind 1970, further, we will refer to this article by 'A-L'), "as the net returns of an investment of a given size are shared by increasingly many individuals, the risk premium for the respective individuals vanishes and, more importantly and perhaps surprisingly, the aggregate of these premiums for all individuals also approaches zero" (Fisher 1973, 772).

On a side note,[1] Arrow and Lind commented that "if each stockholder's share in the firm is a small component of his income, the cost of risk-bearing to him will be very small" (A-L 376). It then follows that "if managers were acting in the interest of the firm's shareholders, they would essentially ignore risks and choose investments with the highest expected returns" (A-L 376). Thus according to A-L, the more dispersed the shareholder structure is, the more risk neutral managers should behave.

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[1] A-L paper was focused on the social discount rate and public (governmental) investments, not corporate finance and asset pricing.

On the one hand, shareholders with small stakes in companies value them at lower risk premium and, on the other hand, managers in companies with less concentrated ownership enjoy more discretion and are less risk averse in selecting projects. Therefore, there are two channels of interaction between ownership concentration and corporate valuation:

(a) *Small individual stock positions, more stock liquidity $\longrightarrow$ lower premium, higher valuation*
Idiosyncratic events have lower impact on diversified portfolios: small stock positions are easier to sell without negatively affecting price. Thus, investors demand lower liquidity premium for firms with less concentrated ownership.

(b) *Small individual stock positions, more managerial discretion $\longrightarrow$ lower required return cut-off, less idle cash holdings, more investment projects, higher valuation*
Managers who enjoy more discretion behave risk neutral: screen projects at a lower discount rate (invest more and more promptly) and hold less idle cash in companies with less concentrated ownership.

(c) *Investors' posteriors about lower managerial risk aversion $\longrightarrow$ higher valuation*
Investors in companies with dispersed ownership know managers behave risk neutral and value them accordingly.

Highly valued companies yield below average returns if sold off, hence investors do not keep large stock holdings. This is in line with Cho (1998), but only as a second-order clientele effect.

We formulate the following research hypotheses:

Hypothesis 1 *Lower ownership concentration leads to higher firm valuation.*

Hypothesis 2 *Lower ownership concentration leads to higher managerial discretion.*

Figure 1 illustrates the interaction of ownership concentration, managerial behavior, and firm valuation implied by the Arrow-Lind theorem.

2   Data and Empirical Results

In this section we show empirical evidence supporting the applicability of A-L theorem to corporations. We demonstrate in our sample that firm value (captured by different measures of
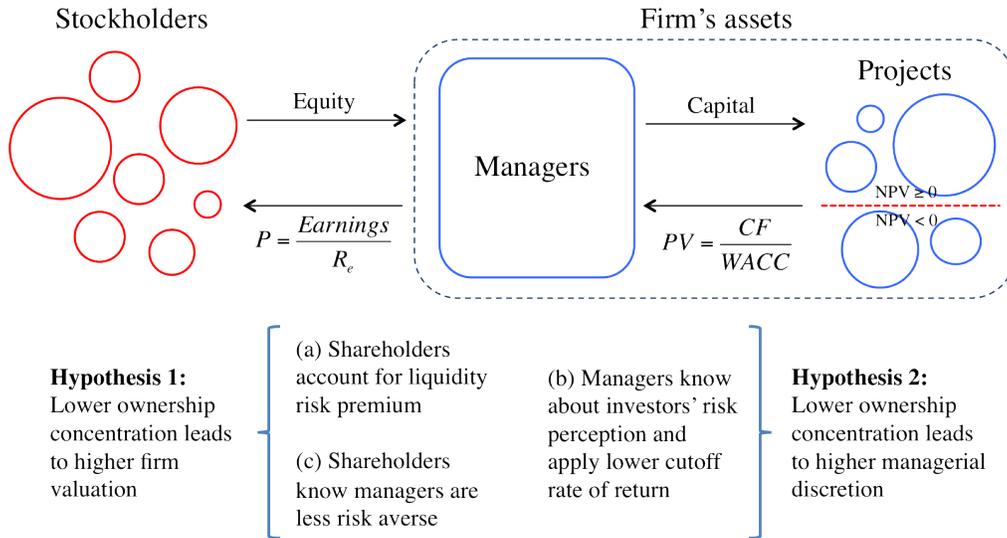
Stockholders

Firm's assets

Projects

Equity

Managers

Capital

$P = \dfrac{Earnings}{R_e}$

$PV = \dfrac{CF}{WACC}$

NPV ≥ 0

NPV < 0

Hypothesis 1:
Lower ownership
concentration leads
to higher firm
valuation

(a) Shareholders
account for liquidity
risk premium

(c) Shareholders
know managers are
less risk averse

(b) Managers know
about investors' risk
perception and
apply lower cutoff
rate of return

Hypothesis 2:
Lower ownership
concentration leads
to higher managerial
discretion

Figure 1: This figure presents the interaction of ownership concentration, managerial behavior, and firm valuation.

P/E ratio) and managerial discretion proxies as measures of risk aversion are in part determined by a company's ownership structure.

P/E ratio is undoubtedly a noisy signal of risk appraisal by investors. We believe, however, it is well-suited to our purpose. Because we are interested in the predictable effects of a firm's ownership structure on its value, it seems natural to look at the cross-sectional relationship between ownership and value, focusing on alternative measures of P/E.

In order to properly study the effect of a company's ownership structure on its P/E ratio, we need to control for other variables potentially impacting the P/E ratio. In particular, we hold constant firm's leverage ratio and size, as these characteristics have been shown in the literature to affect firm's valuation. Size seems to be an important factor attributed to P/E ratios (Jaffe, Keim, and Westerfield 1989). Previous research indicates that two important factors affecting the variation of the company P/E ratios are growth and risk. Growth is traditionally measured as the change in net earnings, and risk as the market beta. Therefore, if we make a claim that company risk is captured in the P/E ratio, we need to control for the effect of the earnings growth and beta. An early paper by Beaver and Morse (1978) demonstrated that earnings growth is for most part negatively correlated with the P/E ratio. They measured the earnings growth as the percentage change of earnings per share in the year immediately preceding their measure of the P/E ratio. The relationship was negative in sixteen

out of nineteen years of analysis. Beaver and Morse (1978) also noted that the relationship between the P/E ratio and the stock's beta can be both positive and negative. Craig, Johnson, and Joy (1987) showed in their study that the accounting method mattered for the level and dynamics of the P/E ratio. Alford (1992) studied the cross-sectional distribution of P/E ratios and found that industry is an important variable affecting the P/E ratio.

Specific (idiosyncratic) risk is normally measured by the company's beta. We prefer, however, to work with P/E ratios instead for a simple reason. As we only have quarterly data, we would not have enough observations to construct reliable time-varying estimates of beta in the sample period. If we believe that the P/E ratio captures the company's present value, then it is determined by present earnings and a discount rate containing both risk and expected growth. Thus, holding other things constant, we can estimate time-varying risk from P/E ratios.

The data sample used in the analysis comprises ownership data of companies listed on NYSE, AMEX or Nasdaq, and comes from Thomson Reuters Institutional (13f) Holdings database, and Compustat. The sample period is 1980-2011, with quarterly data winsorized at 1% level to exclude outliers. Table (1) presents summary statistics of the firms in the sample. Firm-quarter observations span from 24 to 308 thousand. The difference in the number of observations comes from source limitations.

We use four different measures of the P/E ratio on a firm level: 1) trailing twelve months P/E ratio, defined as the market value of the company at the end of the quarter divided by the net income of the firm for the most recent 12-month (four-quarter) period; 2) unlevered P/E ratio, trailing twelve months; 3) the Shiller P/E ratio, aka Cyclically-Adjusted Price Earnings ratio (CAPE) or Normalized P/E ratio, calculated as the ratio of the inflation-adjusted market value at the end of a given period over the prior ten-year trailing mean of inflation-adjusted earnings; 4) forward P/E ratio, using I/B/E/S consensus analyst forecast of earnings over the next year instead of net income.[2] On average, firms showed share price ranging from 12 to 20 times earnings, depending on the P/E ratio considered.

For testing managerial discretion, we used for proxies: gross fixed assets growth, cash holdings over assets, acid test ratio defined as current assets minus inventories over current

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[2] Appendix A describes the different measures of P/E ratio.

liabilities, and debt structure defined as debt in current liabilities over long-term debt. The average firm grew 4% annually, had cash holdings of 2% of assets, could cover 2.4 times current liabilities with near-liquid assets, and had short-term debt almost equal to long-term debt.

Any institutional investment manager who exercises discretion over \$100 million or more is obligated to file form 13f, pursuant to Section 13(f) of the Securities Exchange Act of 1934. On average firms had five equivalent shareholders (inverse of HHI), 71 institutional owners who owned 36% of the shares. Only in 2% of the firms in the sample the top five investors had more than 50% of the shares and in 8% of the firms of the sample the top ten investors had more than 50% of the shares.

Our control variables show average assets equaled \$327 million, financed in one fifth with debt. Annual earnings growth was 22% and calculated return on equity was 13%.

2.1 Investors' Perspective: Value and Liquidity Risk Premium

We run panel data regressions with firm-level fixed effects and report standard errors corrected for heteroskedasticity and autocorrelation. Table (2) demonstrates results on regressions coefficients from the following regression specification:

$$\left(\frac{P}{E}\right)_{i,t+1} = a_0 + a_1\text{HHI}_{i,t} + a_2\text{Inst. ownership}_{i,t} + \text{controls} + e_{i,t}, \tag{1}$$

where i indicates a firm, t is our time variable, Inst. ownership$_{i,t}$ is the percentage of outstanding shares held by institutional investors from Thomson Reuter's 13f database, and HHI$_{i,t}$ is ownership concentration measured by the Herfindahl-Hirschman Index defined as:

$$\text{HHI}_{i,t} = \sum_{j=1}^{N_{i,t}} s_{i,t,j}^2, \tag{2}$$

where $N_{i,t}$ is the number of owners of firm i's shares at time t and $s_{i,t,j}^2$ is the percentage ownership in company i at time t of owner j. Controls include: natural logarithm of firm's assets, earnings growth defined as EPS_{t-1}/EPS_{t-2}, and return on equity with calculated betas. We include year and industry effects. Data is from Thomson Reuters.

We run regressions for the percentage of institutional ownership, number of institutional investors, and top five (ten) voting power as a dummy variable equal to one if five (ten) largest institutional owners have over 50% of outstanding shares. The percentage of institutional ownership and number of institutional owners present similar explanatory power as the

Herfindahl-Hirschman Index of ownership concentration. Top five voting power has no signifi-
cance and top ten voting power has significance only the Shiller P/E. We thus dropped these
variables from our analysis.[3]

In more detail, table (2) demonstrates results of a panel data regression of firm-level P/E
ratio on firm's controls, including earnings growth dynamics and assets. Presented regressions
take into account fixed effects on the firm level. We report a strong and robust relationship
between firm's ownership concentration, measured by the Herfindahl-Hirschman Index, and
firm's valuation for all measures of P/E. Negative and statistically significant estimates of
ownership concentration validates A-L and suggest lower idiosyncratic risk—a premium for
liquidity—ownership dispersed. Lower and less significant forward P/E coefficients may point
to the fact that analysts do not take into account ownership concentration for their forecasts.

All measures of P/E are also positively correlated with shares owned by institutional
investors, number of institutional shareholders, and return on equity based on calculated betas.
Lagged earnings growth has an effect for P/E ratios, only non-significant for the Shiller P/E.
Assets size shows inconsistency of sign and significance in estimates, suggesting other channels
of causality between assets size and valuation.

We test, analogously to Morck, Shleifer, and Vishny (1988), for a non-monotonic relation-
ship between ownership concentration and valuation, controlling for ownership concentration
levels by quintiles. The results of the regression models are presented in panel A of table
(3). When broken by quintiles of HHI, we find that ownership concentration has a significant
impact on the company valuation only in the trailing and unlevered P/E middle quintiles, and
Shiller P/E lower and middle quintiles. Therefore HHI is a significant metric *between*, but not
so *within* quintiles of ownership concentration.

This insight is corroborated by testing the relationship between ownership concentration
and valuation, controlling for time periods: 1980s, 1990s, 2000s, 2004-2007, and 2008-2011.
The results of the regression models are presented in panel B of table (3). We find that
ownership concentration had a significant impact on the company valuation in all periods (with
the exception of the 1980s and 1990s for the forward P/E). After disentangling the financial
pre-crisis years 2004-2007 and post-crisis years 2008-2011, concentration becomes significant

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[3] See on-line supplement with detailed ancillary regressions data available at: http://ssrn.com/abstract
=2200137.

for pre-crisis 2004-2007 forward P/E. A possible explanation points to the fact that analysts offloaded valuations for during the crisis.

2.2 Managers' Perspective: Required Return and Managerial Discretion

It is costly and impractical for dispersed shareholders to control managers. Managers who enjoy discretion would show less conservative management and risk averse behavior. Particularly, they would tend to "empire building," i.e., invest in fixed assets at a higher rate, hold less cash as a safety buffer for eventual stockholders' claims, and reveal a more aggressive operational strategy (lower acid test ratio and higher short-term to long-term debt).

Table (4) shows results of regressions of managerial discretion proxies[4] on ownership concentration and controls. We find strong evidence that managers of companies with more concentrated ownership show structural risk aversion: they are prone to invest less in fixed assets and hold more cash. Their overall operational risk aversion, however, measured by the acid test ratio and short/long-term debt structure, has no correlation with ownership concentration.

Regression results of managerial discretion proxies by ownership concentration quintiles are shown in panel A and by periods of time in panel B of table (5). Fixed assets growth is negatively correlated with ownership concentration in all but the top quintile and for all periods. When disentangled by pre-crisis (2004-2007) and post-crisis (2008-2011), this relationship vanishes: coefficients are close to zero and non-significant. Cash holdings are negatively correlated with ownership concentration measured by the HHI at all quintiles and for all analyzed periods but pre-crisis bonanza years 2004-2007.

Two proxies of managerial discretion show estimates contrary to our predictions: acid test ratio and short/long-term debt structure. The acid test ratio decreases with ownership concentration for all but top quintile and for all periods but 1980s. Debt structure estimates are unstable when broken into ownership concentration quintiles and are driven by strong estimates of one period—1990s. We disregard short/long-term debt structure as a reliable proxy of managerial discretion.

Our results suggest that managers in companies with concentrated ownership are only structurally conservative, but ambiguously operational risk averse. A plausible explanation

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[4] See Appendix A for the definition of managerial discretion proxies.

is that managers have (tacit) consent to take operational risky positions as these are easily reversible in case of distress.

3 Robustness Tests

Panel data regressions with firm-level fixed effects and report standard errors were checked and corrected for heteroskedasticity and autocorrelation. Further checks include reverse causality and stock liquidity.

3.1 Reverse Causality

One of our concerns is that the ownership structure, and consequently our concentration measure, is not exogenous. Demsetz and Lehn (1985) show evidence that ownership structure, investment, and value are in fact endogenous. With an ampler and more detailed database, we also check Cho's (1998) statement that corporate value affects ownership structure, but not vice versa. This would contradict our findings that ownership concentration has an effect on several measures of corporate value.

Panel data regressions presented in the earlier tables of this study assumed the ownership structure as given exogenously. We circumvent the problem of possible endogeneity between corporate ownership and value by using lagged values of regressors. We run a three-stage least squares regression, where we assume the possibility of endogeneity between corporate valuation, and ownership structure. Results are presented in table (6). The formal representation of the simultaneous equations is as follows:

$$\left(\frac{P}{E}\right)_{i,t} = a_0 + a_1\mathrm{HHI}_{i,t} + \mathrm{controls} + e_{i,t} \tag{3}$$

$$\mathrm{HHI}_{i,t} = b_0 + b_1\left(\frac{P}{E}\right)_{i,t} + b_2\mathrm{Liquidity}_{i,t} + b_3\mathrm{Market\ Value}_{i,t} + b_3 Size_{i,t} + e_{i,t}, \tag{4}$$

where $\mathrm{Liquidity}_{i,t} = Cash/Assets$. We control for industry effects. Our results contradict Cho's (1998) finding that the ownership structure does not affect the corporate value after controlling for endogeneity. Panel A of table (6) shows the results from equation (3), where four different measures of P/E ratio were used as dependent variables, controlling for earnings growth, size, and leverage. Coefficients on the HHI index are all negative as predicted and for the most part highly significant. Panel B of table (6) focuses on the reverse situation, where

HHI index is the dependent variable. Trailing, Shiller, and forward P/E ratios have negative and highly significant coefficients. We find a strong and robust relationship in which corporate value has an effect on ownership concentration and vice versa. The relationship is simultaneous and reciprocal.

3.2 Stock Liquidity

We build on the literature initiated by Demsetz (1968), followed by Amihud and Mendelson (1989), and Pastor and Stambaugh (2003) in studying the effect of stock liquidity on the corporate value. Demsetz (1968) points out that a larger number of shareholders causes a narrower bid-ask spread. We do not postulate in this paper that a relationship between ownership structure, concentration ratios, and bid-ask spreads is exogenous. We conduct the analysis in two steps. First, we simply add bid-ask spreads as a liquidity measure to our previous regressions with lagged regressors. Table (7) shows results of the regressions. Bid-ask spreads are not significant to company valuation. The relationship between the P/E ratios and the Herfindahl index remains negative and highly significant for three out of four proposed measures of valuation. Only the coefficient on the forward P/E ratio is not significant, however the point estimate remains negative.

Next, we allow the possibility that the relationship between stock liquidity and ownership concentration is endogenous, and perform a three-stage least squares analysis. Results are shown in table 8. This relates directly to the results presented before in table table (6), and the reasoning for assuming the endogenous relationship remains the same. The results with the liquidity measure and endogeneity remain similar to those in table (6). Bid-ask spreads do not influence valuation measures nor ownership concentration. We conclude that higher P/E ratios are not necessarily the effect of higher liquidity captured by bid-ask spreads, but lower risk perception from less ownership concentration.

4 Discussion

It is debatable whether the outperformance tendency of small capitalization and value stocks is due to market efficiency or market inefficiency. On the efficiency side, the outperformance is generally explained by the excess risk that value and small cap stocks face as a result of their higher cost of capital and greater business risk. On the inefficiency side, the outperformance is

explained by market participants mispricing the value of these companies, which provides the excess return in the long run as the value adjusts. Marring the two views, small cap and value outperformance can be partly endogenized by investors' appraised liquidity risk and managers' risk aversion.

Among financial analysts, the APT is seen as a "supply-side" model, since its beta coefficients reflect the sensitivity of the underlying asset to economic factors that cause structural changes in assets' expected returns. Managers' discretion and risk aversion affects firms' sensitivity to shocks and profitabilities.

On the other side, the CAPM is considered a "demand side" model. Its results arise from a maximization problem of each investor's utility function and from the resulting market clearing (investors are considered to be the "consumers" of the assets). A sudden shock leading to a need of liquidity would asymmetrically affect returns on large and small stock holdings. Thus, in equilibrium prices should reflect liquidity premiums.

5   Concluding Remarks

Results presented in this paper show that firms' value is positively correlated with ownership dispersion by several widely-used valuation measures, across all quintiles of ownership concentration and periods of time, as predicted by Arrow and Lind's (1970) theorem. Managers know investors with small stakes denote lower perceived risk related to their investment—maybe due to lower required liquidity premium—and thus behave more risk neutral structurally: increase fixed assets more rapidly and hold less idle cash. Operationally, however, managers behave more conservatively, the less concentrated ownership is.

Our analysis suggests that valuations models can be enhanced by incorporating measures of ownership concentration. On the policy side, exchange commissions and supervisory agencies may foster real-time fillings on stock holdings. Wide availability of data on stock holdings and ownership concentration may contribute substantially to improve market efficiency.

Appendix A   Definitions

The **Herfindahl-Hirschman Index** is a measure of concentration widely used in industrial organization, competition law and antitrust, and technology management. It is defined as the sum of the squares of the market shares over firms within the industry, where the market shares are expressed as fractions. The result is proportional to the average market share, weighted by market share. It ranges from 0 (for a a huge number of very small firms) to 1 (a single monopolistic producer). Increases in the Herfindahl-Hirschman Index generally indicate a decrease in competition and an increase of market power, whereas decreases indicate the opposite. We used the Herfindahl-Hirschman Index defined as:

$$\text{HHI}_{i,t} = \sum_{j=1}^{N_{i,t}} s_{i,t,j}^2, \tag{5}$$

where $N_{i,t}$ is the number of owners of company i's shares at time t and $s_{i,t,j}^2$ is the percentage ownership in company i at time t of the owner j, to measure ownership concentration. The inverse of HHI gives the hypothetical number of shareholders in the firm provided all had equal number of shares.

We use four measures of **P/E ratio**:[5]

1. *Twelve-Month Trailing P/E ratio* is defined as the market value of the company at the end of the quarter divided by the net income of the firm for the most recent twelve-month (four-quarter) period. It is the one most often cited in newspapers and other stock tables. This measure of earnings has the disadvantage of looking backward while the stock market is often looking forward, trying to predict future trends.

2. *Unlevered P/E ratio* is calculated with formula:
$$\left(\frac{P}{E}\right)_{unlev} = \frac{\text{Market Capitalization}_{i,t}/(1 - D_{i,t}/(D_{i,t} + E_{i,t}))}{\sum_{j=0}^{11}(\text{Earnings}_{i,t-j} + \text{Interest Expense}_{i,t-j})} \tag{6}$$

Since P/E is higher when the firm has lower leverage, to ensure that P/E ratios of companies with different leverage are comparable analysts often calculate unlevered P/E ratio, which adjusts P/E ratios by undoing the effect of leverage (Leibowitz 2002).

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[5] We thank Denys Glushkov from WRDS for providing the extensive procedure for calculating the P/E ratios in SAS.

3. The *Shiller P/E ratio*, aka Cyclically-Adjusted Price Earnings Ratio (CAPE) or Normalized P/E Ratio (Shiller 2005), is a long-term version of P/E, which is calculated as the ratio of the inflation-adjusted market value at the end of a given period over the prior long-run (e.g., ten-year) trailing mean of inflation-adjusted earnings. The main reason behind the use of this measure is that it smoothes out the extreme peaks and valleys in earnings, giving a better framework for thinking about future earnings power. For example, the Shiller P/E ratio is less susceptible to being thrown out of line by the depressed earnings that are sometimes reported as the economy is emerging from a recession.

4. *Forward P/E ratio* uses consensus analyst forecast of earnings over the next year instead of net income. The primary advantage of this P/E version is that it, arguably, does a better job aligning the price (the discounted value of future income stream) with the forward-looking measure of earnings (such as analyst consensus forecast) as opposed to backward-looking, already reported, earnings that are no guarantee for the future earnings. This measure, however, may be sensitive to analyst forecasts bias (Das, Levine, and Sivaramakrishnan 1998) and analyst herding (Trueman 1994).

We use four proxies of **managerial discretion**:

1. *Fixed assets growth* measures the percentage increase in gross value of plant, property, and equipment, i.e., the manager's propensity for "empire building"

$$\text{Fixed Assets growth}_{i,t} = \frac{\text{Fixed Assets}_{i,t} - \text{Fixed Assets}_{i,t-1}}{\text{Fixed Assets}_{i,t-1}} \qquad (7)$$

2. *Cash holdings* over assets measures the company's safety cushion

$$\text{Cash holdings}_{i,t} = \frac{\text{Cash}_{i,t}}{\text{Assets}_{i,t}} \qquad (8)$$

3. *Acid test ratio*, aka Quick ratio to Cash ratio, measures the ability of a company to use its near cash to retire its current liabilities immediately. Near cash include those current assets that presumably can be quickly converted to cash at close to their book values. The acid test ratio should be one or higher, however this varies widely by industry. In general, the higher the ratio, the greater the company's liquidity (i.e., the better able to

meet current obligations using liquid assets)

$$\text{Acid test ratio}_{i,t} = \frac{\left(\text{Current Assets}_{i,t} - \text{Inventory}_{i,t}\right)}{\text{Current Liabilities}_{i,t}} \tag{9}$$

4. *Debt structure*, i.e., short-term vs. long-term debt, controlling for leverage measures the riskiness of the financing structure

$$(\text{Short/Long})_{i,t} = \frac{\text{Short-term Debt}_{i,t}}{\text{Long-term Debt}_{i,t}} \tag{10}$$

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Table 1: This table summary statistics of P/E measures, ownership concentration, managerial discretion, institutional ownership, and controls. We use four measures of the P/E ratio: 1) twelve-month trailing P/E ratio, defined as the market value of the company at the end of the quarter divided by the net income of the firm for the most recent 12-month (four-quarter) period; 2) unlevered P/E ratio; 3) the Shiller P/E ratio, aka Cyclically-Adjusted Price Earnings ratio (CAPE) or Normalized P/E ratio, calculated as the ratio of the inflation-adjusted market value at the end of a given period over the prior ten-year trailing mean of inflation-adjusted earnings; 4) "Forward" P/E ratio, using I/B/E/S consensus analyst forecast of earnings over the next year instead of net income. Cash holdings are measured over assets. Acid test is defined as current assets minus inventories over current liabilities, and short-term debt is defined as Compustat's debt in current liabilities. Return on equity is given as $R_E = r_f + \beta_E(r_m - r_f)$, where β_E is the annual beta, r_m is annualized return on S&P500, and r_f is one-month Treasury bill rate. HHI is the Herfindahl-Hirschman Index of ownership concentration. Top five voting power is a dummy variable equal to one if the five largest institutional owners have over 50% of outstanding shares. Top ten voting power is defined analogously. Data is from Thomson Reuters. Sample period is 1980-2011, with quarterly data winsorized at 1% level.

Summary Statistics

Variable	Mean	St.dev.	Min	Max	N
Trailing P/E	12	23.41	-40.5	67.64	295208
Unlevered P/E	12.8	22.09	-37.3	64.40	292707
Shiller P/E	19.65	34.53	-55.87	106.3	157735
Forward P/E	14.12	11.88	-10.09	44.49	223112
Fixed assets growth	0.04	0.06	-0.05	0.21	143080
Cash holdings	0.02	0.05	0	0.20	269855
Acid ratio	2.37	2.23	0.48	9.12	234659
Short/long-term debt	0.91	1.82	0	7.39	225153
HHI	0.22	0.24	0.03	0.93	308866
Institutional ownership	0.36	0.28	0.01	0.9	308866
Number of inst. owners	71.48	86.14	2	314	308866
Top five voting power	0.02	0.14	0	1	308866
Top ten voting power	0.08	0.27	0	1	308866
Ln(assets)	5.79	2.07	2.35	9.66	308758
Leverage	0.19	0.17	0	0.55	286578
Earnings growth	0.22	0.9	-0.33	3.14	295794
Equity beta	0.86	0.67	-3.37	6.32	24446
Return on equity	0.13	0.04	-0.55	0.39	24360

Firm Valuation Measures

	Trailing	Unlevered	Shiller	Forward	Trailing	Unlevered	Shiller	Forward
Constant	5.30	14.17*	7.38	20.70***	11.84***	15.55***	18.20***	18.22***
	(0.79)	(2.30)	(0.67)	(6.97)	(9.51)	(14.18)	(7.95)	(28.47)
HHI	-6.82***	-5.34***	-16.13***	-1.35*	-7.23***	-5.60***	-17.21***	-1.56**
	(-6.54)	(-6.08)	(-7.69)	(-2.45)	(-6.99)	(-6.42)	(-8.25)	(-2.83)
Ln(assets)	0.94***	0.49***	2.28***	-0.18*	0.61***	0.14	1.30***	-0.43***
	(5.98)	(3.48)	(7.72)	(-2.25)	(4.26)	(1.08)	(4.87)	(-5.90)
Leverage	-5.62***	1.45	-11.14***	-1.43***	-4.64***	1.80*	-9.13***	-0.91*
	(-6.51)	(1.53)	(-6.29)	(-3.31)	(-5.61)	(2.01)	(-5.43)	(-2.17)
Return on equity	30.10***	32.00***	46.42***	20.28***	30.09***	31.89***	45.90***	20.32***
	(4.60)	(6.00)	(4.50)	(7.34)	(4.60)	(5.98)	(4.44)	(7.35)
ΔEPS_{t+1}	0.08**	0.08***	0.04	0.03**	0.08**	0.08***	0.04	0.03**
	(3.15)	(4.10)	(1.25)	(2.67)	(3.16)	(4.19)	(1.32)	(2.73)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	No	No	No	No
Observations	9403	9365	5157	8264	9403	9365	5157	8264
Overall R^2	0.08	0.12	0.16	0.23	0.05	0.06	0.07	0.13

Table 3: This table presents P/E regressions on ownership concentration, broken down by Herfindahl-Hirschman Index quintiles denoted by (1)-(5) in Panel A and by periods: 1980s, 1990s, 2000s, 2004-2007, and 2008-2011 in Panel B. Dependent variables are P/E ratios. We only present the coefficient on the ownership concentration (HHI). Not reported controls as in table (2). We include year and industry effects. Data are quarterly from Thomson Reuters.

Panel A: Firm Valuation Measures by Quintiles of HHI

	1	2	3	4	5
Trailing P/E	-49.48	-36.54	-36.64**	-5.60	-2.20
	(-1.85)	(-1.43)	(-2.60)	(-0.68)	(-1.22)
Observations	3841	3841	3841	3841	3841
Overall R^2	0.15	0.12	0.10	0.13	0.11
Unlevered P/E	-43.38	-49.79*	-24.27*	6.04	-1.24
	(-1.89)	(-2.45)	(-2.12)	(0.98)	(-0.78)
Observations	3912	3912	3912	3912	3912
Overall R^2	0.21	0.19	0.16	0.16	0.12
Shiller P/E	-169.28***	-170.81***	-99.51***	-20.26	1.27
	(-4.34)	(-4.89)	(-4.77)	(-1.76)	(0.38)
Observations	2661	2661	2661	2661	2661
Overall R^2	0.24	0.18	0.19	0.20	0.26
Forward P/E	10.36	-15.51	-1.09	-0.39	-1.95
	(0.96)	(-1.43)	(-0.18)	(-0.10)	(-1.58)
Observations	3835	3835	3835	3835	3835
Overall R^2	0.28	0.24	0.21	0.23	0.26
Year effects	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes

Panel B: Firm Valuation Measures by Periods

	1980s	1990s	2000s	2004-2007	2008-2011
Trailing P/E	-3.73***	-10.41***	-9.30***	-9.50***	-9.74***
	(-2.62)	(-6.58)	(-7.33)	(-4.32)	(-4.17)
Observations	2048	4373	8158	3042	2700
Overall R^2	0.10	0.12	0.11	0.11	0.14
Unlevered P/E	-4.39***	-5.45***	-7.62***	-8.20***	-7.91***
	(-3.84)	(-4.05)	(-6.77)	(-4.25)	(-3.76)
Observations	2020	4355	8027	2997	2641
Overall R^2	0.16	0.15	0.15	0.15	0.20
Shiller P/E	-17.16**	-13.81***	-18.28***	-16.24***	-15.28***
	(-2.93)	(-4.81)	(-9.08)	(-4.68)	(-3.92)
Observations	348	2556	5199	1969	1780
Overall R^2	0.38	0.21	0.20	0.20	0.22
Forward P/E	-0.27	-1.58	-3.21***	-0.71	-3.10*
	(-0.39)	(-1.76)	(-4.21)	(-0.60)	(-2.37)
Observations	1764	3586	6866	2649	2303
Overall R^2	0.33	0.22	0.17	0.23	0.17
Year effects	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes

Table 4: This table presents regressions of managerial discretion proxies on ownership concentration and controls. Dependent variable are gross fixed assets growth, cash holdings over assets, acid test ratio, and debt structure. Acid test is defined as current assets minus inventories over current liabilities, and short-term debt is defined as Compustat's debt in current liabilities. Controls include: natural logarithm of firm's assets, leverage, and earnings growth up to three periods ahead defined as $\Delta EPS_{t+n} = EPS_{t+n}/EPS_{t+n-1}$, where $n = 1, 2, 3$. We only report the coefficient on EPS_{t+1}. We include year and industry effects in the first four columns, the other four include year but no industry effects. Data is from Thomson Reuters.

Managerial Discretion Proxies

	Fixed Assets	Cash	Acid Test	Short/Long	Fixed Assets	Cash	Acid Test	Short/Long
Constant	0.07	-0.03	3.66***	2.13	0.08***	0.04*	3.71***	1.79***
	(1.39)	(-0.48)	(6.24)	(1.89)	(5.59)	(1.98)	(27.88)	(7.38)
HHI	-0.03*	0.11***	-0.11	0.08	-0.03*	0.10***	-0.11	0.19
	(-2.21)	(4.44)	(-1.28)	(0.43)	(-2.19)	(4.13)	(-1.33)	(1.10)
Ln(assets)	-0.00	0.00	-0.16***	-0.13***	-0.00**	0.01	-0.19***	-0.11***
	(-1.66)	(1.05)	(-9.76)	(-4.63)	(-2.92)	(1.93)	(-11.61)	(-4.29)
Leverage	-0.00	0.01	-1.42***	-0.59***	-0.00	0.00	-1.50***	-0.70***
	(-0.21)	(0.58)	(-17.49)	(-3.93)	(-0.37)	(0.04)	(-18.40)	(-4.84)
Return on equity	-0.19**	0.68***	0.24	-0.20	-0.18**	0.69***	0.23	-0.12
	(-3.14)	(9.88)	(0.66)	(-0.25)	(-2.91)	(10.08)	(0.64)	(-0.15)
ΔEPS_{t+1}	0.00	-0.00*	0.00	-0.00	0.00	-0.00*	0.00	-0.00
	(0.90)	(-2.13)	(0.47)	(-0.44)	(1.12)	(-2.06)	(0.41)	(-0.40)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	No	No	No	No
Observations	6917	3967	11159	11995	6917	3967	11159	11995
Overall R^2	0.17	0.18	0.22	0.05	0.14	0.08	0.20	0.01

Table 5: This table presents regressions of managerial discretion proxies on ownership concentration, broken down by Herfindahl-Hirschman Index quintiles denoted by (1)-(5) in Panel A and by periods: 1980s, 1990s, 2000s, 2004-2007, and 2008-2011 in Panel B. Dependent variables are managerial discretion proxies. We only present the coefficient on the ownership concentration (HHI). Not reported controls as in table (4). We include year and industry effects. Data is from Thomson Reuters.

Panel A: Managerial Discretion Proxies by Quintiles of HHI

	1	2	3	4	5
Fixed assets growth	-0.28***	-0.18***	-0.08*	- 0.05**	-0.00
	(-3.33)	(-2.76)	(-2.15)	(-3.05)	(-0.67)
Observations	24828	24828	24828	24828	24828
Overall R^2	0.10	0.09	0.07	0.05	0.04
Cash holdings	1.46***	1.22***	0.61***	0.18***	0.09***
	(11.92)	(9.46)	(7.11)	(3.26)	(4.26)
Observations	13959	13959	13959	13959	13959
Overall R^2	0.20	0.18	0.16	0.13	0.12
Acid test ratio	-1.87*	-2.47***	-1.89***	-0.87***	0.03
	(-2.40)	(-3.34)	(-3.97)	(-3.72)	(0.40)
Observations	37308	37308	37308	37308	37308
Overall R^2	0.20	0.21	0.18	0.15	0.09
Short/long-term debt	0.99	1.50	1.43	-0.96	-0.06
	(0.47)	(0.88)	(1.41)	(-1.74)	(-0.32)
Observations	38495	38495	38495	38495	38495
Overall R^2	0.03	0.03	0.02	0.01	0.02
Year effects	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes

Panel B: Managerial Discretion Proxies by Periods

	1980s	1990s	2000s	2004-2007	2008-2011
Fixed assets growth	-0.02***	-0.03***	-0.02***	-0.00	-0.00
	(-4.53)	(-5.88)	(-4.88)	(-0.09)	(-0.69)
Observations	16737	43887	43379	11968	18247
Overall R^2	0.08	0.05	0.07	0.05	0.06
Cash holdings	0.10**	0.19***	0.41**	0.02	0.41**
	(2.78)	(8.70)	(3.10)	(0.36)	(2.77)
Observations	1885	2528	20483	12205	1968
Overall R^2	0.03	0.04	0.01	0.03	0.01
Acid test ratio	1.11***	-0.72***	-0.61***	-1.00**	-0.61
	(2.75)	(-5.68)	(-3.69)	(-2.90)	(-1.71)
Observations	16349	42149	41234	11390	17185
Overall R^2	0.04	0.04	0.06	0.14	0.11
Short/long-term debt	-0.93	2.53	-15.71	-50.78	-8.89
	(-0.79)	(0.51)	(-0.69)	(-0.76)	(-0.62)
Observations	15055	35593	34419	9578	14400
Overall R^2	0.02	0.01	0.00	0.01	0.00
Year effects	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes

Table 6: This table presents results from the first stage of the three-stage least squares regressions. We assume the possibility of an endogenous relationship between the P/E ratio and the Herfindahl-Hirschman index (HHI). The formal representation of the simultaneous equations is presented in equations (3) and (4). We control for industry effects. Data are quarterly from 1980 to 2011.

Endogeneity Check				
Panel A: dependent variable P/E	Trailing	Unlevered	Shiller	Forward
Constant	5.22	61.76***	37.56*	23.98***
	(0.64)	(5.58)	(2.30)	(4.98)
HHI	-21.63**	-43.01***	-52.29***	-32.49***
	(-3.12)	(-6.64)	(-4.37)	(-5.93)
Ln(assets)	0.51	-0.27	0.23	0.21
	(1.40)	(-0.78)	(0.41)	(1.22)
Leverage	-0.43	5.84***	-1.07*	-4.33***
	(-1.42)	(6.37)	(-2.15)	(-8.59)
ΔEPS_{t+1}	-0.00	0.00	-0.00	-0.00
	(-0.60)	(0.77)	(-0.74)	(-0.37)
Panel B: dependent variable HHI				
Trailing P/E	-0.02**			
	(-2.63)			
Unlevered P/E		0.04		
		(1.61)		
Shiller P/E			-0.01**	
			(-3.12)	
Forward P/E				-0.01***
				(-9.88)
Constant	0.58	-0.35	0.75***	0.37***
	(1.89)	(-0.46)	(4.26)	(7.22)
Ln(assets)	-0.02	-0.13**	-0.02*	-0.02***
	(-1.05)	(-2.71)	(-2.56)	(-20.27)
Cash holdings	0.00	0.00*	0.00	0.00***
	(1.70)	(2.24)	(1.95)	(11.13)
Market cap	0.00	0.00***	0.00*	0.00***
	(1.78)	(6.17)	(2.48)	(8.00)
Industry effects	Yes	Yes	Yes	Yes
Observations	40439	40134	29365	34536

Table 7: This table presents results from panel data regressions after we control for liquidity effects defined by bid-ask spread. All other controls are defined as in table (2). We do not include the return on equity among the control variables. Year and industry effects are included. Data are quarterly from Thomson Reuters and cover 1980-2011.

Liquidity Check

	Trailing	Unlevered	Shiller	Forward	Trailing	Unlevered	Shiller	Forward
Constant	6.31	3.13	-34.83	26.62**	-5.39	-7.75*	7.68	14.72***
	(0.72)	(0.36)	(-1.36)	(3.07)	(-1.48)	(-2.18)	(1.11)	(6.45)
HHI	-4.63**	-4.78**	-12.37**	-0.58	-4.58**	-4.62**	-11.38**	-0.38
	(-3.07)	(-3.22)	(-3.02)	(-0.56)	(-3.16)	(-3.23)	(-2.84)	(-0.37)
Bid-ask spread	0.10	0.00	0.10	0.30	0.10	0.01	0.10	0.34
	(0.52)	(0.02)	(0.38)	(1.06)	(0.53)	(0.04)	(0.41)	(1.17)
Ln(assets)	1.96***	2.07***	0.47	-0.31	2.33***	2.53***	0.79	-0.39
	(4.24)	(4.48)	(0.39)	(-0.95)	(6.79)	(7.36)	(0.88)	(-1.62)
Leverage	-7.32**	-6.90**	-6.15	-9.31***	-8.32***	-7.83***	-4.62	-7.95***
	(-3.21)	(-2.64)	(-0.89)	(-4.70)	(-3.87)	(-3.22)	(-0.74)	(-4.49)
ΔEPS_{t+1}	-0.03	-0.04	0.05	0.01	-0.03	-0.04	0.05	0.01
	(-0.86)	(-1.17)	(0.55)	(0.51)	(-0.80)	(-1.12)	(0.54)	(0.56)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	No	No	No	No
Observations	10097	10091	3062	3111	10097	10091	3062	3111
Overall R^2	0.04	0.05	0.06	0.09	0.02	0.03	0.01	0.06

Table 8: This table presents results from panel data regressions after we control for liquidity effects defined by bid-ask spread.

Liquidity Check—Endogeneity

Panel A: dependent variable P/E	Trailing	Unlevered	Shiller	Forward
Constant	-43.07	-85.46	-23.00	78.40**
	(-1.00)	(-1.72)	(-0.58)	(3.03)
HHI	62.37*	66.93*	16.77	-58.34*
	(2.07)	(2.09)	(0.42)	(-2.19)
Ln(assets)	6.71*	6.78*	4.46	-3.67*
	(2.14)	(2.05)	(1.32)	(-2.25)
Leverage	-27.64*	-10.36	-43.36**	0.65
	(-2.25)	(-0.84)	(-2.64)	(0.11)
Bid-ask spread	0.05	-0.00	0.06	0.90
	(0.21)	(-0.00)	(0.22)	(0.54)
ΔEPS_{t+1}	-0.05	-0.03	-0.05	0.14*
	(-0.58)	(-0.51)	(-0.44)	(2.05)
Panel B: dependent variable HHI				
Trailing P/E	-0.02			
	(-1.50)			
Unlevered P/E		0.04		
		(0.15)		
Shiller P/E			-0.00	
			(-1.83)	
Forward P/E				0.00
				(0.60)
Constant	3.84	-5.82	0.64*	0.40
	(1.77)	(-0.13)	(2.10)	(1.59)
Bid-ask spread	-0.00	0.00	-0.00	-0.00
	(-0.19)	(0.06)	(-0.09)	(-0.05)
Cash holdings	-0.45*	0.11	-0.21*	0.82***
	(-2.14)	(0.02)	(-2.10)	(3.39)
Market cap	0.00*	-0.00	0.00**	0.00
	(2.16)	(-0.19)	(3.11)	(1.60)
Ln(assets)	-0.11***	-0.09	-0.08***	-0.05**
	(-6.26)	(-1.09)	(-6.43)	(-2.77)
Industry effects	Yes	Yes	Yes	Yes
Observations	498	497	293	139