How Do Private Placements Enhance Firm Value?*

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Abstract

Private placement issuers are distressed firms whose dispersed shareholders are at a disadvantage in negotiating firm policies with bondholders. We argue that private investments in public equity (PIPE) serve as a coordination mechanism that concentrates the bargaining power of equity holders and facilitates debt renegotiation with bondholders. This coordination channel is distinct from the information asymmetry or distress explanations of PIPE issuance in the previous literature. Using PIPE transactions between 1995 and 2007, we show that the odds of a private placement increase by 24% with a one standard deviation decrease in the coordinating ability of incumbent shareholders and increase by 23% with a one standard deviation increase in the concentration of debt holders. We also find that PIPE issuance reduces the odds of default by 50% and show that our coordination proxies explain the observed variation in PIPE discounts.

1 Introduction

When is a private investment in public equity (PIPE) an attractive strategy for a firm? How does a private placement of equity enhance firm value? Answering these questions will help us understand why private equity issues are typically viewed as beneficial to existing shareholders even though they result in significant dilution of their equity holdings and are offered at large discounts to market prices.

In this paper, we study the role of private placements in shifting the balance of power between equity holders and bond holders in distressed firms. Most PIPE issuers have concentrated debt holders but dispersed shareholders who are at a disadvantage in renegotiating firm policies in the face of default. Private equity issuance serves as a mechanism to concentrate the negotiating power of equity holders and improve coordination with bondholders.

In a significant departure from the extant literature on PIPEs (Wruck (1989), Hertzel and Smith (1993), Barclay, Holderness and Sheehan (2007)), we argue that private placements improve the coordinating ability of equity holders and facilitate negotiation with bondholders. We study the determinants of the decision to issue equity privately and relate private placements to stakeholders' ability to coordinate on changes in firm policies. We also assess how the equity surplus resulting from coordination improvement is divided between current equity holders and new PIPE investors.

We focus on private placements of equity by U.S. corporations between 1995 and 2007. In order to control for a firm's endogenous security and market choice, we combine a comprehensive sample of private equity issues from Sagient's PlacementTracker with data on public equity offerings from ThomsonReuters' Securities Data Corporation (SDC) and bond issues from Mergent's Fixed Income Securities Database (FISD). Our results strongly support the coordination hypothesis of PIPE issuance along several dimensions.

First, we find strong evidence that the ability of equity holders and debt holders to coordinate on firm policy is a major determinant of the decision to issue private equity. Second, we demonstrate that the average PIPE discount is negatively correlated with our measure of the coordination ability of equity holders but positively correlated with the concentration of bond holders. Third, we show that private equity issuance is highly statistically significant in predicting a reduced likelihood of default. Our results support the argument that private placements serve as a coordination mechanism that concentrates the negotiating power of equity holders and facilitates debt renegotiation with bondholders.

We measure the negotiating power of shareholders and bondholders by the Shapley value of a firm's current institutional blockholders and the Herfindahl index of its debt holders. We define Shapley value as the probability that in a randomly permuted ordering of all firm shareholders, a blockholder and her predecessors together have a majority vote but her predecessors alone do not. This definition captures the expected importance of each player in deciding firm policy through a majority vote. A low Shapley value of current shareholders suggests larger coordination benefits from adding a PIPE investor. We document that PIPE issuers have forty percent lower (pre-issuance) Shapley values than non-PIPE firms.

Our proxy for the concentration of bond claimants is the Herfindahl index of outstanding bond issues, which measures the distribution of par values of outstanding public bonds. A higher bond Herfindahl index indicates more concentrated bond claimants and lower coordination frictions in debt renegotiation. We confirm that PIPE issuers have twenty percent more concentrated blockholders than non-PIPE firms.

Following the literature on bankruptcy, we also control for liquidation costs because firms with higher liquidation costs are more likely to benefit from debt renegotiation as they lose a larger percentage of their value in default. We proxy for liquidation costs by the ratio of research and development expenditures to total assets. We show that firms with PIPE investments face more than double the liquidation costs of non-PIPE firms implying that private placement firms stand to gain more in successful debt renegotiations.

As expected, PIPE issuers are significantly more distressed than non-PIPE firms (as measured by their z-scores) and have less than one-fourth the debt capacity of their non-PIPE counterparts (as proxied by their access to public bond markets). The previous literature has also shown that firms with higher information asymmetry choose private equity issuance to correct the asymmetry problem. In order to control for a firm's endogenous choice to issue equity privately, we use propensity score matching on information asymmetry, debt capacity and predicted likelihood of default. In univariate tests, we show that our coordination variables are statistically different across PIPE and non-PIPE firms, which we take as evidence that the coordination hypothesis is distinct from the information asymmetry or distress stories previously suggested in the literature.

We use multivariate logistic regressions to estimate the likelihood of a private placement based on our proxies for bargaining power of equity and debt. Both Shapley value and bond Herfindahl index have high statistical and economic significance, which helps the model correctly classify virtually all observed PIPE investments. Controlling for information asymmetry, we show that a one standard deviation decrease in the Shapley value of current equity holders increases the odds of a private placement by 24% while a one standard deviation increases in the bond Herfindahl index raises these odds by 23%. In addition, a one standard deviation increase in liquidation costs raises the odds of a PIPE by 32%.

Any identification of the coordination channel needs to take into account the endogenous choice of PIPE issuance in terms of information asymmetry, access to public markets and default characteristics. In order to isolate our coordination hypothesis, we perform propensity-score matched estimation where we match PIPE firms to non-PIPE firms based on pre-issuance differences in information asymmetry, access to public markets and likelihood of default. This ensures that the only difference between the treated and control groups is due to their differential ability to coordinate with respect to firm policy. We find that both Shapley value and bond Herfindahl index have the expected sign and are statistically and economically significant.

We also provide some preliminary evidence on how the equity surplus resulting from coordination improvement is distributed between incumbent and new equity holders. We find that Shapley value helps explain the observed variation in the discount at which a PIPE is financed. Specifically, moving from the lowest to the highest tercile of equity bargaining power reduces the PIPE discount by one third. Controlling for information asymmetry and distress level in a regression setting confirms our conclusions.

Our univariate results also demonstrate that more concentrated bondholders are positively related to the average PIPE discount implying that PIPE investors find it easier to coordinate firm policy with a less fragmented group of bondholders. However, bond Herfindahl index is not statistically significant in the estimation of the PIPE discount. We interpret this result as evidence that bond concentration affects the choice to issue equity privately but not the specific terms at which a PIPE is issued, which results from a bargaining game between incumbent and new shareholders.

If private placements consolidate equity power and facilitate debt renegotiation, we expect that PIPE firms would be less likely to default (post issuance) than matched non-PIPE firms. In support of this hypothesis, we demonstrate that private equity issuance is highly statistically significant in predicting a reduced likelihood of default. Controlling for the typical determinants of default as well as debt capacity, we find that a one standard deviation increase in predicted PIPE decreases the odds of default in half - twice the decrease associated with a similar rise in a firm's z-score. We control for the amount of equity raised in private and public equity issuance to ensure that our conclusions are not mechanically driven by a firm's capital structure rebalancing. As before, we also control for the endogenous choice of PIPE issuance in terms of information asymmetry, access to public markets and likelihood of default by performing propensity-score matched estimation along these dimensions.

We conclude that private equity issuance serves as a mechanism to concentrate the negotiating power of equity holders and improve coordination with bondholders on firm policies.

The rest of the paper proceeds as follows. **Section 2** reviews the related academic literature. **Section 3** describes the data and introduces the main explanatory variables - Shapley value, bond Herfindahl index and liquidation costs. **Section 4** reviews the empirical evidence supporting the coordination hypothesis and additional results on the effect of PIPE issuance on default. **Section 5** discusses robustness. **Section 6** concludes.

2 Related Literature

This paper explicitly incorporates the balance of power between shareholders and bondholders in studying the determinants of the choice to issue private equity. We consider PIPE investments as a mechanism to concentrate the negotiating power of equity holders and facilitate successful coordination on firm policies with bond holders. As a result, we obtain a richer framework to study the role of private placements in financially distressed firms.

The literature on private equity issuance focuses primarily on the empirical relationship between PIPEs and firm value. PIPE investments are typically associated with an initial positive market reaction (as opposed to public equity issues) despite their significant offering discounts to current market values and high dilution of existing equity. As a result, private placements are generally viewed as beneficial to existing shareholders. The literature has provided several competing interpretations of this empirical fact.

Wruck (1989) establishes a relationship between the market's positive reaction (at announcement) to private placements and the increase in ownership concentration resulting from the investment. This is generally interpreted as evidence that changes in ownership concentration better align the interests of managers and shareholders - monitoring hypothesis. Hertzel and Smith (1993) consider the role of private placements in resolving asymmetric information problems about firm value. Their certification hypothesis takes private placements as a seal of approval by sophisticated institutional investors on the current valuation of the firm. Hertzel and Smith (1993) use cross-sectional analysis to differentiate between the above two hypotheses and find support only for their information asymmetry story.

Barclay, Holderness and Sheehan (2007) propose the entrenchment hypothesis, under which firm management uses private placements to distribute shares to investors supportive of the status quo. The authors interpret the substantial discounts associated with private placements as compensation to "the block purchasers for the consequences of their passivity" (p. 463), i.e. investors in private placements "often implicitly agree not to disturb current management" (p. 464).

All of the above papers focus on the role of large equity investors (blockholders) in addressing the agency costs and information asymmetry resulting from the separation of ownership and control. The literature on private placements has not specifically addressed the coordination costs of incumbent shareholders in their interactions with bondholders even though most PIPE issuers are distressed firms with concentrated debt holders but dispersed shareholders who are at a disadvantage in coordinating firm policy with bondholders.[1]

We consider PIPE investments as a coordination mechanism that shifts the balance of power between shareholders and debt holders in situations of financial distress. The bankruptcy literature suggests that the division of firm value in default is determined by a bargaining game between

[1] Chaplinsky and Haushalter (2010) show that over 80 percent of private placement firms have negative operating cash flows and half of them have decreasing stock prices.

shareholders and debt holders.[2] We take this argument further by claiming that private equity issues concentrate the negotiating power of equity holders and improve coordination with bondholders.

Garlappi, Shu and Yan (2007) argue that the bargaining power of equity holders determines the relationship between default probability and expected returns. They find a hump-shaped relationship between default probability and expected returns - default probability and expected equity returns are positively correlated for firms with "weak shareholder advantage" but this relationship turns negative for firms with "strong shareholder advantage". Davydenko and Strebulaev (2007) also consider the bargaining power of equity holders on debt returns by examining the role of empirical proxies for strategic default on the cross-sectional variation of credit spreads but fail to find economic significance despite "robust statistical significance".

Both papers suggest that the balance of power between shareholders and bondholders may be more important in determining equity returns than debt returns. This paper extends their intuition by considering the role of private placements in redistributing power between equity holders and debt holders.

3 Data

3.1 Data Sources

We use data on private placements between 1995 and 2007 from the *PlacementTracker* database by Sagient Research. PlacementTracker includes roughly twice as many private equity issues as SDC Platinum, an alternative database of public and private equity issuance. After excluding non-US and 144-A and Reg-S issuers, the PlacementTracker dataset includes 6442 unique firms involved in 10765 transactions.[3] The total volume of private equity issuance during the sample period was $163.86 billion - roughly one-fourth of public equity issuance.

Insert Table 1

[2] Andersen and Sundaresan (1996), Mella-Barral and Perraudin (1997) and Fan and Sundaresan (2000) formally consider the balance of power between shareholders and bondholders in dividing firm value in debt renegotiations.

[3] Reg-S PIPEs are placed with foreign institutional investors. 144-A issuances are subject to different regulatory requirements and generally not considered PIPEs.

PlacementTracker contains detailed information about the specifics of each PIPE contract. We collect data on the type of private placement, legal structure, gross proceeds, dilution, discount to market price, warrant coverage and other contract terms. Table 1 shows that the mean amount raised in a private placement equals 18% of current firm value. The average dilution of existing equity is 30% and shows a clear increasing trend during the sample period.

As in Brophy, Ouimet and Sialm (2006), we classify common stock and fixed convertible issues as traditional PIPEs. Structured PIPEs are common stock or convertibles issues with reset provisions, structured equity placements or floating convertibles. As shown in table 1, 22% of the PIPEs in the sample period are categorized as structured. We also notice a trend away from structured issues to placements with higher warrant coverage and higher amounts of capital raised, especially after 2002.[4]

We obtain quarterly accounting and stock price data from the *CRSP-Compustat Merged Database* (CCM) by first matching ticker symbols from PlacementTracker to PERMNOs using the CRSP historical file of firm names. Then, we match issuers in PlacementTracker to CCM data by PERMNOs. Matching by PERMNOs rather than issuer tickers significantly improves the match to approximately 95% of PIPE issuers. Before matching with CMM, we combine multiple PIPE transactions for a firm within each quarter, which results in 5610 firm-quarter observations.

We study the role of private placements in shifting the balance of power between equity holders and bond holders in negotiating firm policy. We compute proxies for the bargaining power of equity holders with data from *Thomson Reuters' Institutional Holdings (13F) Database*. We proxy for the bargaining power of debt holders using data on the public debt issuance of PIPE firms from the *Mergent Fixed Income Securities Database (FISD)*.

We proxy for information asymmetry using analyst coverage, trading volume and bid-ask-spread. We measure analyst coverage with data from *I/B/E/S International Inc.* and calculate trading volume and bid-ask-spread using data from *The Center for Research in Security Prices (CRSP)*.

In robustness tests, we compare private equity issues to public offerings using data from *Thom-*

[4]Chaplinsky and Haushalter (2010) demonstrate that issuers of warrant contracts achieve similar risk-adjusted returns as issuers of reset contracts. However, issuers of warrant-only contracts are in a more distressed financial condition than issuers of resets even though the latter have more volatile returns.

son Reuters' SDC Platinum. The dataset contains 4841 firm-quarter observations for 2888 unique firms. The volume of U.S. public equity issuance between 1995 and 2007 equals $689.5 billion.

3.2 Variable Definitions

3.2.1 Coordinating Ability of Equity and Debt

We consider private equity issuance as a mechanism to concentrate the bargaining power of equity holders and improve coordination with bondholders in negotiating firm policies. We hypothesize that this redistribution of power will be more valuable in firms with less concentrated equity holders but more concentrated debt claimants. In addition, we expect that firms with higher liquidation costs would benefit more from this mechanism as they stand to lose more in bankruptcy.

We measure the negotiating power of shareholders and bondholders by the Shapley value of a firm's current institutional blockholders and the Herfindahl index of its debt holders, respectively. As described in more detail in the next section, we define a shareholder's Shapley value as the probability that in a randomly permuted ordering of all firm shareholders, a blockholder and her predecessors together have a majority vote but her predecessors alone do not. In calculating a firm's total Shapley value, we sum the individual Shapley values of its current institutional investors who own more than 3% of the total outstanding shares. A low Shapley value of current shareholders suggests larger coordination benefits from adding a PIPE investor. Hence, we expect a negative correlation between a firm's Shapley value and the likelihood of a private placement.

We verify the robustness of our conclusions by constructing an alternative measure of the bargaining power of a firm's current equity holders - the institutional index. This index uses the distribution of the percentage ownership of current institutional owners and is defined as the sum of the squared percentage ownership of all blockholders (at 3% or 5%) divided by the square of total institutional ownership. Our results remain robust to this alternative measure.

Our proxy for the concentration of bond claimants is the Herfindahl index of outstanding bond issues (as in Davydenko and Strebulaev (2007)). It captures the distribution of par values of outstanding public bonds and is defined as the sum of the squared face values of all bonds divided by the square of the sum of the face values. A higher bond Herfindahl index indicates more concentrated bond claimants, which increases the need to concentrate the negotiating power of equity holders (keeping their current concentration fixed). Consequently, we expect a positive correlation between our measure of bond concentration and the incidence of private placements. In alternative tests, we proxy for debt holder concentration by the number of outstanding bond issues scaled by the value of total debt. Our results remain robust to this alternative measure.

An important motivation for debt renegotiations is to avoid the liquidation costs associated with bankruptcy. Firms with higher liquidation costs are more likely to benefit from debt renegotiation as they lose a larger percentage of their value in default. We proxy for liquidation costs by the ratio of R&D expenditures to total assets. We expect that a higher R&D ratio will be associated with higher liquidation costs. Hence, our proxy is positively correlated with the likelihood of a private placement.

3.2.2 Shapley Value as a Measure of Coordination Gains

If a coalition of players of various sizes cooperate to facilitate negotiations, how should the overall gain from coordination be shared? In a cooperative game theory setup, the Shapley value provides an answer to this question.

The total Shapley value of a firm's current shareholders provides information about the maximum relative share that a new PIPE investor can obtain. In other words, the smaller the total Shapley value of incumbent equity holders, the larger the coordination benefits that can be provided by a new blockholder. In the recent literature, the Shapley value approach has been used by Zingales (1994) and Nenova (2003) to determine the value of voting rights.

As in Milnor and Shapley (1978), we use the generalized "pivotal player" approach for infinite person games to compute the Shapley value of current shareholders who own more than 3% of a firm's total outstanding shares. In this approach, a shareholder's Shapley value is the probability that in a randomly permuted ordering of all shareholders, a blockholder and her predecessors together have a majority vote, but her predecessors alone do not. This definition captures the expected importance of each player in deciding firm policy through a majority vote.

Specifically, let $x_1, \ldots x_m$ be the major shareholders of a firm who each own fraction $w_i \in [0, 1]$ shares. $P(x)$ denotes the set of all major players $i \in M$. Let the predecessors of a major player i comprise the finite set $P(x_i)$ and the small players make up a mass of $y_i \in [0, \alpha)$, where α represents the total weight of all small shareholders. In this case, the Shapley value of player i is given by the probability ϕ_i that:

$$w(P(x_i)) + y_i \leq c \leq w(P(x_i)) + w_i + y_i, \tag{1}$$

where c is the pivotal vote (in our case, 50.01% of total shares). The total value of all shareholders - M large shareholders and an infinite number of small ones - is by definition 1:

$$\phi(M) + \Phi = 1, \tag{2}$$

where Φ is the total Shapley value of all small shareholders.

Using a simulation methodology, we compute every major shareholder's Shapley value each quarter, and then add the value of the constituents to obtain the Shapley value of all major current shareholders, $\phi(M)$, which is our proxy for the current coordination ability of present shareholders.

3.2.3 Information Asymmetry

The literature has emphasized the role of information asymmetry as a major determinant of the choice of external financing. Hertzel and Smith (1993), Chemmanur and Fulghieri (1999) and Wu (2004) argue that firms with high information asymmetry use private placements rather than public equity as a mechanism to reduce this asymmetry.

We control for the information hypothesis of private placements by following Wu (2004). We proxy for a firm's information asymmetry by using three measures - analyst coverage, trading volume and bid-ask spread. We calculate analyst coverage as the number of equity analysts following a firm (on an annual basis). Higher analyst coverage is associated with lower information costs so we expect a negative correlation between analyst coverage and the likelihood of a private placement.

We collect CRSP data on trading volume and bid-ask spreads to create our other measures of information asymmetry. We measure volume as the ratio of trading volume divided by the average number of outstanding shares over the previous two years. We expect that firms with lower volume suffer from information asymmetry to a larger extent. As a result, the expected correlation between volume and private placements is negative.

Our measure of bid-ask spread equals 100*(1-bid/ask). Firms with higher information asymmetry are expected to have wider spreads, which leads to a positive correlation between spread and the likelihood of a private placement. To address potential simultaneity concerns, we lag our volume and spread measures by a quarter. This ensures that the firm characteristics we use to predict a firm's propensity to issue equity privately or the discount at which the issuance occurs are from a period when the decision had not yet been taken. Our results are robust to changes in the number of lags.

3.2.4 Access to Public Markets

In addition to information asymmetry, a firm's access to public markets is another main determinant of the choice of external financing. Bolton and Freixas (2000) and Lemmon and Zender (2010) relate access to public markets to the firm's ability to issue public rated debt.

We control for a firm's access to public markets following the approach in Lemmon and Zender (2010). They use the cross-sectional heterogeneity in firm debt capacity to show that firms with lower debt capacity (typically small, high growth firms with lower return on assets) choose to issue equity to alleviate their financing deficits. Lemmon and Zender (2010) use a firm's predicted likelihood of having a bond rating (rather than the actual presence of a bond rating) as their primary proxy for access to public markets.

We estimate a firm's predicted probability of having a bond rating using a multinomial logit model where the dependent variable equals one if a firm has an S&P rating in a given year, and zero otherwise. We use a firm's S&P rating on its senior long-term debt from Compustat. Our explanatory variables are firm size (defined as the log of lagged firm assets), profitability (operating income before depreciation divided by lagged assets), asset tangibility (ratio of net property plant and equipment to lagged assets), market-to-book (total assets less book equity plus market equity over lagged assets), leverage (long-term debt and debt due in one year divided by lagged assets), standard deviation of daily stock returns (lagged) and firm age (log of years since first Compustat record).

Our data comes from CRSP and Compustat and covers the period 1986-2010. After excluding non-US firms, utilities (SIC codes 4900-4999) and financials (SIC codes 6000-6999), our final sample includes 70,656 firm-year observations. The model fit is consistent with the results in Lemmon and Zender (2010), with McFadden's R^2 of 54.9% and McKelvey and Zavoina's R^2 of 78.1%.

As in the previous literature, we find that larger, mature, profitable firms with higher leverage have a higher predicted probability of bond rating. Asset tangibility and the standard deviation of stock returns are negatively correlated with predicted bond rating (and insignificant in some specifications). As in Lemmon and Zender (2010), we group firms in each year into terciles based on their predicted likelihood of having a bond rating and use these terciles in our regression analysis. Our results are robust to using either raw values of predicted likelihood of bond rating or grouping the predicted likelihoods into terciles.

4 Empirical Results

4.1 Summary Statistics

We propose a new role for private placements as a coordination mechanism between equity and debt, which preserves firm value in situations of financial distress. We also argue that this channel is distinct from the information asymmetry hypothesis of private equity issuance considered in Hertzel and Smith (1993), Chemmanur and Fulghieri (1999) and Wu (2004).

Table 2 reports the pairwise correlation matrix between coordination proxies, information asymmetry measures and PIPE issues. All measures are lagged by one quarter relative to the occurrence of a private placement. The relatively low correlations between measures of coordination frictions and information asymmetry suggest that the coordination channel is separate from the information asymmetry story and may provide additional insights into the motivation to use private placements.

Shapley value has the highest negative correlation with bid-ask spread (-0.17) and the highest positive correlation with analyst coverage (0.11). Bond Herfindahl index has the highest negative correlation with analyst coverage (-0.22) and the highest positive correlation with bid-ask spread (0.19). For comparison, the information asymmetry measures have higher cross-correlations. For example, analyst coverage has the highest negative correlation with bid-ask spread (-0.29) and the highest positive correlation with volume (0.25).

Insert Table 2

Next, we describe private placement firms in more detail. Table 3 reports t-tests for differences in means (allowing for heteroskedasticity) between the average PIPE issuer and the average non-PIPE firm. The second column of table 3 presents means for PIPE firms, the third column provides the same data for their non-PIPE counterparts, and the fourth column tests for significant differences between the two samples of firms along several dimensions of interest.

Insert Table 3

Notably, PIPE issuers have forty percent lower Shapley values of current blockholders (0.10 versus 0.16 for non-PIPE firms) as well as twenty percent more concentrated blockholders (0.60 versus 0.50 for non-PIPE firms). As mentioned earlier, the smaller Shapley values of PIPE-firm shareholders suggest larger coordination benefits from adding a PIPE investor. In addition, a higher concentration of bond claimants exacerbates the need to improve coordination among equity holders by adding a new PIPE investor.

Firms with PIPE investments face significantly higher liquidation costs than non-PIPE firms (0.07 versus 0.03) as proxied by their spending on research and development. This implies that PIPE firms can gain more in successful debt renegotiations. Private placement firms also have marginally higher growth potential as proxied by their market-to-book ratios. This indicates that PIPE investments offer an attractive option to high growth firms as their shareholders stand to lose more in financial distress due to loss of growth option value.

As expected, PIPE issuers are significantly more distressed than non-PIPE firms, with an average Alman's Z-score of -2.7 versus 0.09 for their non-PIPE counterparts. Private placement firms also have significantly lower debt capacity (0.07 versus 0.28) as proxied by their ability to access public markets.

Table 3 also presents results about the three information asymmetry proxies often used in the empirical literature (for example, see Wu (2004)). Both analyst coverage and bid-ask spread have the predicted sign. Private placement firms have 23% lower analyst coverage as well as (insignificantly) wider bid-ask spreads in line with the information asymmetry hypothesis. Surprisingly, trading volume has an unexpected sign - PIPE firms have about 58% higher volume than non-PIPE firms suggesting that PIPE issuers suffer from lower information asymmetry than their non-PIPE peers. This conclusion remains unchanged if we use a different number of lags.

In order to isolate our coordination hypothesis from other competing channels that can explain the choice of PIPE issuance (such as information asymmetry or distress), we perform propensity-score matched comparison of firm characteristics across PIPE and non-PIPE firms. In the first panel table 4, we match firms on pre-treatment difference in information asymmetry and find that all three coordination measures retain high statistical significance after accounting for differences in information asymmetry between PIPE and non-PIPE firms. This is another evidence that the coordination mechanism is distinct from the information asymmetry channel.

Insert Table 4

In the second panel, we also match firms on their predicted probability of default (in addition to information asymmetry). As shown in table 3, PIPE issuers are typically very distressed firms, which may indicate that our coordination measures proxy for the likelihood of default rather than the potential gains from reduced coordination frictions. We predict default using a standard bankruptcy regression, where the dependent variable equals one if a firm experiences default or bankruptcy, and the independent variables are the log of total firm assets, EBITDA ratio (EBITDA/Assets), book leverage, Altman's z-score, and debt capacity (access to public markets).

As seen in the second panel of table 4, Shapley value, bond Herfindahl index and liquidation costs remain significantly different across PIPE and non-PIPE firms even after propensity score matching on information asymmetry and predicted default probability. The bond Herfindahl index is significant at 10%, which is a result of our small sample size.[5] If the coordination channel had no independent explanatory power, then there would have been no significant difference in coordination measures of PIPE and non-PIPE firms after controlling for the possibly endogenous characteristics such as information asymmetry and default probability. This is not the case, as seen in Table 4.

The univariate analysis so far supports the coordination hypothesis. Private placement firms have (statistically significant) forty percent lower Shapley values of current owners as well as twenty percent more concentrated blockholders. Notably, both Shapley value and bond Herfindahl index remain significantly different across PIPE and non-PIPE firms matched on information asymmetry and predicted default probability. This suggests that the coordination mechanism is distinct from the information asymmetry and distress stories previously discussed in the literature.

[5] We calculate this index with data from the Mergent Fixed Income Securities Database (FISD). Mergent FISD collects data from insurance companies which typically do not hold non-investment grade bonds due to regulatory restrictions.

4.2 PIPE as a Coordination Mechanism

Our main argument in this paper is that private equity issuance reduces coordination inefficiencies among incumbent shareholders and bondholders in the event of financial distress. A private equity placement concentrates equity ownership and improves the chances of successful renegotiations of firm policies with debt holders. This option is more valuable for firms with dispersed shareholders but concentrated debt holders since such firms gain the most by reducing coordination inefficiencies. In addition, firms with higher liquidation costs are likely to preserve more firm value if negotiations are successful.

Table 5 presents three logistic regressions that estimate the likelihood of a private placement based on several sets of independent variables. Column (1) reports results using only our coordination proxies - Shapley value of current blockholders, bond Herfindahl index and liquidation costs. All explanatory variables are lagged by one quarter relative to the occurrence of a private placement. We include year-fixed effects and cluster observations by firm.

Insert Table 5

As seen in column (1), firms with lower Shapley values of current owners, higher bond concentration and higher liquidation costs are more likely to issue equity privately. A low Shapley value of current shareholders suggests larger coordination benefits from adding a PIPE investor. A higher bond concentration implies lower coordination frictions in debt renegotiation while higher liquidation costs suggest larger gains from avoiding default. Our measures are significant at 1% and successfully classify virtually all of the observed PIPE investments. The overall R^2 of the regression is 23.4%.[6]

All three coordination proxies also have very high economic significance. A one standard deviation increase in Shapley value decreases the odds of a private placement by 32.6% while a one standard deviation increase in bond concentration increases the odds of a private placement by 59.0%. In addition, a one standard deviation increase in our proxy for liquidation costs raises the odds of a PIPE by 37.3%.

[6] The McKelvey and Zavoina R^2 best approximates the R^2 obtained by fitting the linear regression model on the underlying latent variable.

Column (2) includes asymmetric information proxies as additional controls. Our coordination proxies retain high statistical and economic significance. A one standard deviation increase in Shapley value decreases the odds of a private placement by 23.8% while a one standard deviation increase in bond concentration increases the odds of a private placement by 23.2%. In addition, a one standard deviation increase in liquidation costs raises the odds of a PIPE by 32%. Analyst coverage is the only highly significant information asymmetry variable. Trading volume and bid-ask spread have only marginal statistical and economic significance.

Column (3) adds predicted probability of default (in addition to information asymmetry). Shapley value remains significant at 5% while bond concentration is significant at 10%. As expected, predicted default probability is highly statistically and economically significant.

The interpretation of our results could be affected by endogeneity concerns about the choice of financing in terms of information asymmetry, access to public markets and default determinants. In order to isolate our coordination hypothesis, we perform propensity-score matched logistic regressions, which we report in the robustness section. We match PIPE firms to non-PIPE firms based on pre-issuance differences in information asymmetry, access to public markets and likelihood of default. Both Shapley value and bond Herfindahl index have the expected sign and remain statistically and economically significant confirming that coordination channel has independent explanatory power.

4.3 Division of Coordination Gains

The above analysis discusses what channels affect the decision to issue private equity. In this section, we analyze how incumbent and new equity holders divide the surplus realized by coordination improvement. Specifically, we test whether coordination proxies can help explain the observed variation in the discounts at which private equity is issued. These additional tests can corroborate further the coordination hypothesis we propose in this paper.

We start with Figures 1 and 2 to gain some insights into the relationship between our coordination measures and the mean PIPE discount. Figure 1 shows in a non-parametric setting that as the Shapley value of current owners increases, the discount offered in a PIPE transaction drops from -11% to -6%. This positive correlation between Shapley value and PIPE discount is a direct result of the negative relationship between Shapley value and the need for a PIPE investment, as described in the previous section.

We expect that the concentration of bondholders determines the need to issue equity privately but does not directly impact the PIPE discount, which is a result of a bargaining game between current and new equity holders. Even so, Figure 2 documents a clear negative correlation between our measure of bond concentration and PIPE discount, especially for higher levels of the bond Herfindahl index. This comes from the fact that a high bond concentration increases the need for a PIPE investment, which is negatively correlated with the discount. Figure 2 also shows a dramatic increase in PIPE discount when bond holders are almost oligopolistic.

Next, we discuss the variation of the average PIPE discount with our coordination measures. In order to provide sharper predictions, we focus only on the tercile of most distressed firms. We divide our sample of PIPE issuers into terciles based on Shapley value, bond Herfindahl index and liquidation costs and calculate the average percent discount to closing market value for each tercile.

Table 6 reports t-tests for difference in means allowing for heteroskedasticity. We see that our main measure for the bargaining power of a firm's current shareholders - Shapley value - is significantly correlated with the observed PIPE discount. PIPE issuers with low bargaining power of current blockholders (low Shapley value) issue equity at a higher discount. The difference in mean discounts between the two terciles is 4.46%. Given that the mean discount of the tercile with highest Shapley Value is approximately 13.4%, this is a 33% reduction in the mean discount between the high and low Shapley value terciles.

Insert Table 6

Bond concentration has the expected direction - a more concentrated group of bondholders increases the need for a private equity issue implying a higher discount. However, both bond Herfindahl index and liquidation costs do not show significant differences between observations in the high and low terciles. We are not surprised that the division of coordination surplus between equity holders is not very sensitive to bondholder concentration and liquidation costs. While bondholder concentration and liquidation costs help determine whether a firm would benefit from a private equity issue, the division of equity surplus between incumbent shareholders and new PIPE investors should not depend directly on bondholders.

Table 7 reports the results of three multivariate regressions to estimate the average PIPE discount as a function of the bargaining power of current shareholders. In Column (1), we include Shapley value as the only explanatory variable. We see that Shapley value is significantly positively correlated with the observed discount. An increase of Shapley value from 0 to 1 increases the discount by 11%.

Insert Table 7

Column (2) includes information asymmetry variables. Controlling for information asymmetry reduces the explanatory power of Shapley value to 5% but it retains its high statistical significance. Analyst coverage has the highest statistical significance of the three information asymmetry measures but only one-third the explanatory power of Shapley value. Column (3) adds a binary variable that identifies distressed firms based on Altman's Z-Score (Z-Score <1.1). We see that Shapley value retains its high explanatory power.

This section offers further support for our coordination hypothesis. We find that Shapley value helps explain the observed variation in the discount at which a PIPE is issued. Our univariate results also demonstrate that a more concentrated group of bondholders is positively related with the average PIPE discount. However, bond Herfindahl index is not statistically significant in the estimation of the PIPE discount. We interpret this result as evidence that bond concentration affects the choice to issue equity privately but not the specific terms at which a PIPE is issued.

4.4 PIPE and Default Likelihood

If private placements consolidate equity power and facilitate debt renegotiation, we expect that PIPE firms would be less likely to default (post issuance) than matched non-PIPE firms. To test this hypothesis, we use data on both bankruptcies and bond defaults in the period 1995-2007 from the Mergent Fixed Income Securities Database (FISD). Our analysis uses only firms with FISD bond data, i.e. firms with outstanding bond issues and a non-zero probability of default.

Table 8 reports three bankruptcy prediction models. Column (1) estimates a multivariate logistic regression of default, where the dependent variable equals one if a firm experiences default or bankruptcy, and zero otherwise. We include standard covariates used in bankruptcy prediction - the log of total firm assets, EBITDA ratio (EBITDA/Assets), market leverage, Altman's z-score and debt capacity (predicted access to public bond markets). All independent variables are lagged by one quarter. We use a firm's z-score and debt capacity tercile ranks (instead of their raw values) in order to account for the fact that their definition already includes leverage. We cluster observations by firm.[7]

Column (1) confirms the standard result that a firm's likelihood of default is decreasing in its size, profitability, and z-score but increasing in book leverage and debt capacity. All covariates are highly statistically significant. The R^2 of the model is 23.1%. The regression correctly classifies 87.2% of defaults but has a low positive predictive ability of only 30.3%.

Insert Table 8

Column (2) of table 8 estimates a two-stage logistic regression, where the first stage predicts the probability of private equity issuance (PIPE) using the three coordination proxies (Shapley value of current equity owners, bond Herfindahl index and liquidation costs). This first step is the OLS equivalent to the logit regression in table 5. OLS ensures that our estimates are consistent and unbiased. We include year fixed effects and cluster observations by firm in the first stage. The second stage uses predicted PIPE issuance along with the covariates from Column (1) to predict default. We bootstrap standard errors in the second stage.

Private equity issuance is highly statistically and economically significant in predicting a reduction in firm default post issuance. We find that a one standard deviation increase in predicted PIPE decreases the odds of default in half. In fact, predicted PIPE issuance has the highest economic significance compared to the typical bankruptcy predictors. For example, a one standard deviation increase in a firm's z-score decreases the odds of firm default by 25.7%. The McKelvey & Zavoina's R^2 of the regression is 24%. In addition, the inclusion of predicted PIPE improves not only the overall percent of correctly classified observations to 91% but also the positive predictive ability of the model to 44%.

In Column (3), we also control for the amount of equity raised in private and public equity issuance to ensure that our conclusions are not mechanically driven by the firm's capital structure rebalancing. The statistical and economic significance of predicted PIPE issuance is unchanged.

[7] In unreported results, we choose alternative proxies for size, profitability and leverage. We also include industry fixed effects. The results remain substantially unchanged.

The results of the default prediction regressions demonstrate that private equity issuance plays an important role in facilitating debt renegotiations and reducing the probability of default in PIPE firms. In order to isolate our coordination hypothesis from alternative information asymmetry and default stories, we perform propensity-score matched logistic regressions, which we report in the robustness section. We match PIPE firms to non-PIPE firms based on pre-issuance differences in information asymmetry, access to public markets and likelihood of default. Our conclusions remain qualitatively and quantitatively the same.

5 Robustness

The previous literature has emphasized the role of information asymmetry and access to public markets as major determinants of the choice of external financing. Any identification of the coordination channel needs to take into account the endogenous choice of PIPE issuance in terms of information asymmetry, access to public markets and default characteristics. In order to establish the coordination hypothesis, we perform propensity-score matched estimation where firms are matched based on firm characteristics capturing competing channels. These matched regressions turn the odds against us in finding any effect across firms identical in terms of multiple factors affecting the choice of securities and markets.

Table 9 presents two propensity score matched logistic regressions. Column (1) matches on asymmetric information measures. Both Shapley value and bond Herfindahl index have the expected signs and are statistically significant at five percent. A one standard deviation increase in Shapley value decreases the odds of a private placement by 14.1% while a one standard deviation increase in bond concentration increases the odds of a private placement by 13.3%. All information asymmetry measures are statistically significant but only analyst coverage has high economic significance (14.4% change in odds).

Insert Table 9

Column (2) reports propensity-score matched regressions on information asymmetry and predicted default probability. In this regression, Shapley value is statistically significant at one percent but bond Herfindahl index loses statistical significance due to the inclusion of predicted default likelihood. A one standard deviation increase in Shapley value decreases the odds of a private placement by 20%, more than the economic significance of all information asymmetry variables combined.

Table 10 reports the results of several propensity-score matched logistic regressions predicting default. The dependent variable equals one if a firm experiences default or bankruptcy, and zero otherwise. The first stage predicts the probability of private equity issuance as in Table 5, where we use the coordination proxies as instruments. The second-stage is a propensity-score matched estimation controlling for information asymmetry characteristics, probability of default and equity injection.

Column (1) matches on pre-issuance differences in terms of asymmetric information. Predicted PIPE issuance is statistically significant at 1%. A one standard deviation increase in predicted PIPE decreases the probability of default by 20%. Column (2) matches on pre-treatment differences in asymmetric information and predicted default probability (estimated with standard bankruptcy prediction regression controlling for access to public markets). Here, a one standard deviation increase in predicted PIPE decreases the probability of default by 28%.

Column (3) matches on pre-issuance differences in predicted default probability and amount of raised equity (in private or public issues). We control for the amount of equity raised to ensure that our conclusions are not mechanically driven by a firm's capital structure rebalancing. The inclusion of the amount of equity infusion improves the economic significance of predicted PIPE - a one standard deviation increase in predicted PIPE decreases the probability of default by 60%.

Column (4) adds back information asymmetry proxies as additional control variables. Predicted PIPE remains highly statistically and economically significant. Even after controlling for information asymmetry, probability of default and amount of equity injection, one standard deviation increase in predicted PIPE reduces the odds of firm default by 67%. Given that the number of observations in Column (4) is small, the results point to the strength of the coordination channel.

In unreported results, we exclude firms that have never raised equity via private issues or secondary equity offerings. The literature suggests that firms that rely on equity financing may be different from firms that rely on other forms of financing. Including the before-mentioned controls, we confirm that the coordination mechanism remains economically and statistically significant in this restricted sample.

6 Conclusion

We study the circumstances in which a private investment in public equity (PIPE) is an attractive strategy for a firm. We argue that private equity issues concentrate the negotiating power of equity holders and facilitate coordination on firm policy with bondholders.

We demonstrate that the option to issue equity privately is more valuable for firms with a dispersed shareholder base, concentrated public debt claimants and high costs of liquidation. Using a comprehensive dataset of PIPE transactions in the United States between 1995 and 2007, we show that the odds of a private placement increase by 24% with a one standard deviation decrease in the coordinating ability of incumbent shareholders and increase by 23% with a one standard deviation increase in the concentration of debt holders. In addition, a one standard deviation increase in liquidation costs raises the odds of a PIPE by 32%.

We also study the division of coordination surplus between (new and old) equity holders. Consistent with the coordination hypothesis, we find that firms with less concentrated shareholders and more concentrated bondholders place private equity at deeper discounts to current market prices. Moving from the lowest to the highest tercile of equity bargaining power reduces the average PIPE discount by one third.

Finally, we find that firms that have issued equity privately have a much lower probability of default post-issuance. Controlling for the typical determinants of default as well as debt capacity, we find that a one standard deviation increase in predicted PIPE decreases the odds of default in half.

We conclude that private placements facilitate coordination on firm policy between shareholders and bondholders and reduce the likelihood of default of PIPE issuers.

7 Appendix: Model

This section introduces a two-period theoretical framework which motivates our empirical inferences. In the model, an entrepreneur can choose between defaulting or issuing private equity when her payoff is negative. Attracting a private investor with a lower cost of effort in choosing firm policy benefits the incumbent equity holder even after sharing a fraction of the firm with the PIPE investor. Under certain conditions, the debt holders will also prefer a PIPE over immediate liquidation of the firm. In this setup, the incumbent equity holder has the additional strategic option of issuing private equity, which improves her ability to coordinate with bondholders and enhances firm value.

7.1 Agents and Investment Opportunities

Assume a risk-neutral world. An entrepreneur owns a firm with a single project, which generates x dollars if successful (with probability q), and 0 dollars otherwise. The project needs a unit investment at date 0, and no further investment at date 1. A public signal about project quality ϵ is observed at date 1. The project outcome is realized at date 2. (Figure **??** describes the timeline of the model.)

At date 0, the entrepreneur invests \$1, μ from her own pocket, and $1-\mu$ financed with debt. She expects that the project will be successful with probability q_0, which determines project quality. The debt holder operates in a perfectly competitive credit market, with an expected return of 0. The lender gets return r on the amount lent if the project is successful. If the project fails, the lender can liquidate the firm for λ, where $1-\lambda > 0$ is the deadweight loss.

We also make the following assumptions:

$$\begin{aligned} 0 &\leq \lambda \leq 1 \leq r \leq x \\ 0 &< r \leq xq_0 \end{aligned} \tag{3}$$

The first assumption is simply that a successful project pays the equity holder x, which is more than what the debt holder gets, $1 \leq r \leq x$. In addition, the return to the entrepreneur in case of failure is lower than the return to the debt holder, $0 \leq \lambda$. The liquidation value of the firm λ is lower than the return to the debt holder from a successful project, i.e. $\lambda \leq r$.

The second assumption implies that the project has an expected positive net present value for both the debt holder and entrepreneur.

7.2 Finance

Private (PIPE) investors and lenders (debt providers) are the only sources of external finance in this economy.[8] At date 1, the entrepreneur reassesses the quality of the project based on the realized public signal ϵ, i.e. $q_1 = q_0 + \epsilon$. Assume that ϵ is bounded to ensure that $0 < q < 1$, and has an expectation of 0.

The entrepreneur has technology available to her at a cost α_E per period to improve the firm's prospects.[9] The private investors also have a technology that costs α_P per period, where $\alpha_P < \alpha_E$. Effort by stakeholders improves the quality of the project, which is decreasing in the cost of effort, i.e. $q(\alpha)$ is decreasing in α ($q_\alpha < 0$), with $\alpha \in \{\alpha_P, \alpha_E\}$.

The optional financing process at date 1 is as follows. The entrepreneur can go to either the private investor or the debt providers, and take additional financing in exchange for claims to project cash flow to be realized at date 2. In what follows, we determine the optimal strategy of the entrepreneur given the assessed quality of the project, q_1.

7.3 Payoff of the Agents

If the project is unsuccessful, the lender liquidates the firm for payoff λ, and if the project is successful, he receives return r on investment $1 - \mu$, i.e. $(1 - \mu)(1 + r)$. At date 0, the expected cash-flow of the equity claim, $V_{e,0}$, is:

$$V_{e,0} = (q_0(\alpha_E)x - (1 - \mu)(1 + r)) - 2\alpha_E, \quad (4)$$

where the first term represents the payoff to the entrepreneur (net of debt) and the second term represents her cost of auditing the project.

[8] Adding public equity investors does not change any of the results as long as public equity investors also have high effort costs similar to those of the incumbent equity owners.

[9] This technology could take the form of exerting effort by choosing optimal firm policy after researching the firm's choice set of policies.

7.4 PIPE under Distress

On date 1, an additional signal ϵ is realized about the probability of success of the project. Given the updated project quality q_1, it may be the case that $V_{e,1} \leq 0$, i.e. the expected payoff of the entrepreneur is negative:

$$V_{e,1} = (q_1(\alpha_E)x - (1-\mu)(1+r)) - 2\alpha_E < 0 \tag{5}$$

To save the cost of effort α_E in the next period, the equity holder may choose to default. In case of default, the debt holder liquidates the firm for λ, which he keeps.

However, another possibility exists if inviting a PIPE investor is an option. A PIPE investor may be willing to run the firm in the next period, and improve the chances of success of the project to $q_1(\alpha_P)$, since $\alpha_P < \alpha_E$ and the probability of success is decreasing in the cost of effort. This option increases the expected payoff of the equity holder (entrepreneur) even after sharing a fraction $1-\phi$ of the firm with the PIPE investor.

Without loss of generality and for simplicity, we assume that the PIPE investor enters the contract costlessly. If the payoffs of the PIPE investor and the equity holder are positive, then inviting a PIPE investor and giving him a fraction $1-\phi$ of the equity holder's share is a better option for the equity holder than default, i.e. $\exists\{\alpha_P, \phi\}$ s.t.:

$$\begin{aligned} (1-\phi)(q_1(\alpha_P)x - (1-\mu)(1+r)) - \alpha_P &> 0 \\ \phi(q_1(\alpha_P)x - (1-\mu)(1+r)) - \alpha_P &> 0, \end{aligned} \tag{6}$$

where the first feasibility condition is for incumbent equity holders (entrepreneur) and the second is for PIPE investors.

The feasibility constraint for the debt holder in this case is that the total expected payoff, given the revised probability, is greater than or equal to the debt holder's return from liquidating the firm at date 1, which yields the following condition:

$$\mu \leq 1 - \frac{\lambda}{1+r}. \tag{7}$$

Thus, the debt holder will also prefer a PIPE investment over immediate liquidation if the firm does not have too much leverage, where the threshold is decreasing in the recovery rate. Consequently, a PIPE provides a Pareto optimal solution under certain circumstances.

In this three-party bargaining game, equity holders always have a choice between debt and private equity issuance. Hence, lower bankruptcy costs (higher λ due to higher collaterizability of assets, for example) give incumbent shareholders more bargaining power - ϕ - against PIPE investors. That is, equity holders have an outside option of going to a lender when the liquidation value of the firm is higher.

7.5 Empirical Implications

The above model suggests that a PIPE investment provides a valuable option to equity holders to unlock firm value through a reduction in coordination costs among stakeholders. Another important point we make is that equity holders can only exercise this option if debt holders agree to it since there is partial transfer of control from equity to debt holders in distress (see Aghion and Bolton (1992), Dewatripont and Tirole (1994), and Gorton and Kahn (2000) for control based theories).

The model generates the following empirical implications about the ability of each party to coordinate with others:

(P1) The PIPE option is more valuable for firms with dispersed shareholders who find it hard to coordinate the choice of firm policy. In the empirical tests, we use Shapley value to capture the ability of incumbent equity holders to coordinate.

(P2) The PIPE option is more feasible in firms whose debt holders have lower costs of coordination, allowing them to come to an agreement with equity holders. In the empirical tests, we use bondholders' Herfindahl index to capture the ability of incumbent bond holders to coordinate.

(P3) Firms with higher liquidation costs benefit more from PIPE investments, since such firms offer higher incentives to equity holders to work together towards an agreement. In the empirical tests, we use the ratio of research and development costs to assets as a proxy for liquidation costs.

(P4) Higher concentration of incumbent equity blockholders increases their bargaining power against new PIPE investors, since they themselves could coordinate with debt holders about firm policy in the absence of new PIPE investors.

References

[1] Aghion, Philippe, and Patrick Bolton, 1992, An incomplete contracts approach to financial contracting, Review of Financial Studies 59 (3), 473-494.

[2] Anderson, Ronald, and Suresh Sundaresan, 1996, Design and valuation of debt contracts, Review of Financial Studies 9 (1), 37-68.

[3] Barclay, Michael, Clifford Holderness and Dennis Sheehan, 2007, Private placements and managerial entrenchment, Journal of Corporate Finance 13, 461-484.

[4] Bolton, Patrick, and Xavier Freixas, 2000, Equity, bonds and bank debt: Capital structure and financial market equilibrium under asymmetric information, Journal of Political Economy 108, 324-351.

[5] Brophy, David, Paige Ouimet, and Clemens Sialm, 2006, Hedge funds as investors of last resort?, Review of Financial Studies 22 (2), 541-574.

[6] Chaplinsky, Susan, and David Haushalter, 2010. Financing under extreme risk: Contract terms and returns to private investments in public equity, Review of Financial Studies 23(7), 2789-2820.

[7] Chemmanur, Thomas, and Paolo Fulghieri, 1999, A theory of the going-public decision, Review of Financial Studies 12, 249-279.

[8] Davydenko, Sergei, and Ilya Strebulaev, 2007, Strategic actions and credit spreads: An empirical investigation, Journal of Finance 62, 2633-2671.

[9] Dewatripont, Mathias, and Jean Tirole, 1994, A theory of debt and equity: Diversity of securities and manager-shareholder congruence, Quarterly Journal of Economics 109 (4), 1027-1054.

[10] Fan, Hua, and Suresh Sundaresan, 2000, Debt valuation, renegotiation, and optimal dividend policy, Review of Financial Studies 13 (4), 1057-1099.

[11] Garlappi, Lorenzo, Tao Shu, and Hong Yan, 2007, Default risk, shareholder advantage, and stock returns, Review of Financial Studies 21 (6), 2743-2778.

[12] Gorton, Gary, and James Kahn, 2000, The design of bank loan contracts, Review of Financial Studies 13 (2), 331-364.

[13] Hertzel, Michael, and Richard Smith, 1993, Market discounts and shareholder gains from placing equity privately, Journal of Finance 48, 459-486.

[14] Lemmon, Michael, and Jaime Zender, 2010, Debt capacity and tests of capital structure theories, Journal of Financial and Quantitative Analysis, 45 (5), 1161-1187.

[15] Mella-Barral, Pierre, and William Perraudin, 1997, Strategic debt service, Journal of Finance 52, 531-556.

[16] Milnor, J.W. and L.S. Shapley, 1978, Values of large games II: Oceanic Games, Mathematics of Operations Research 3(4), 290-307.

[17] Nenova, Tatiana, 2003, The value of corporate voting rights and control: A cross-country analysis, Journal of Financial Economics 68, 325-351.

[18] Wruck, Karen, 1989, Equity ownership concentration and firm value: Evidence from private equity financings, Journal of Financial Economics 23, 3-28.

[19] Wu, YiLin, 2004, The choice of equity-selling mechanisms, Journal of Financial Economics 74, 93-119.

[20] Zingales, Luigi, 1994, The value of the voting right: A study of the Milan stock exchange experience, Review of Financial Studies 7, 125-148.

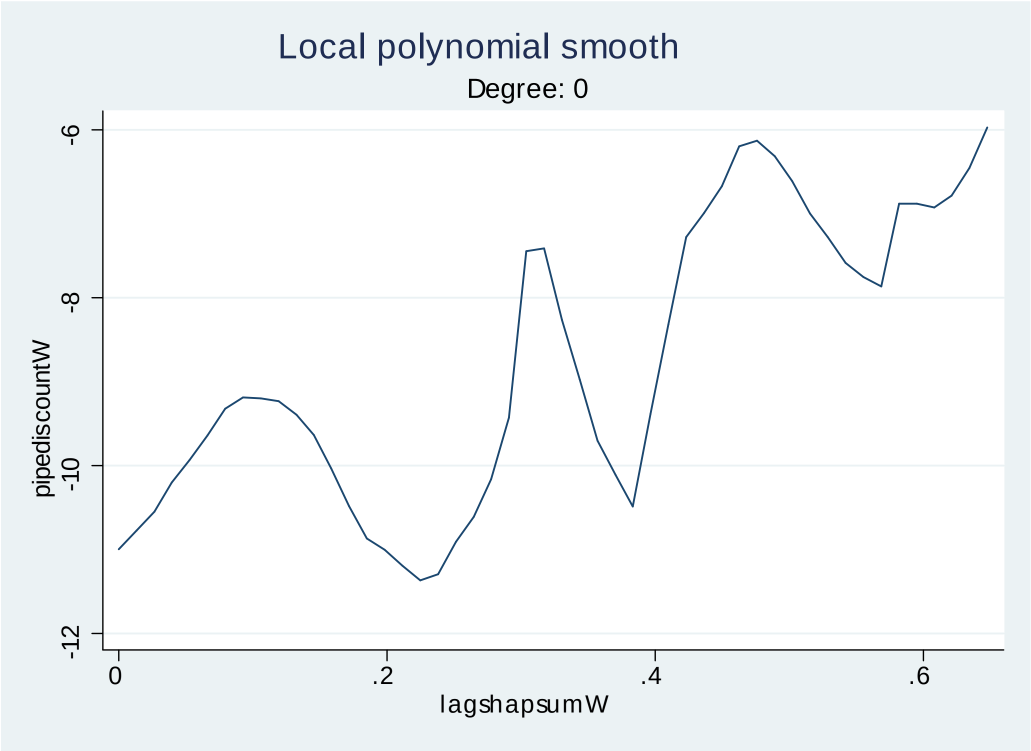

Figure 1: PIPE discount as a function of Shapley value

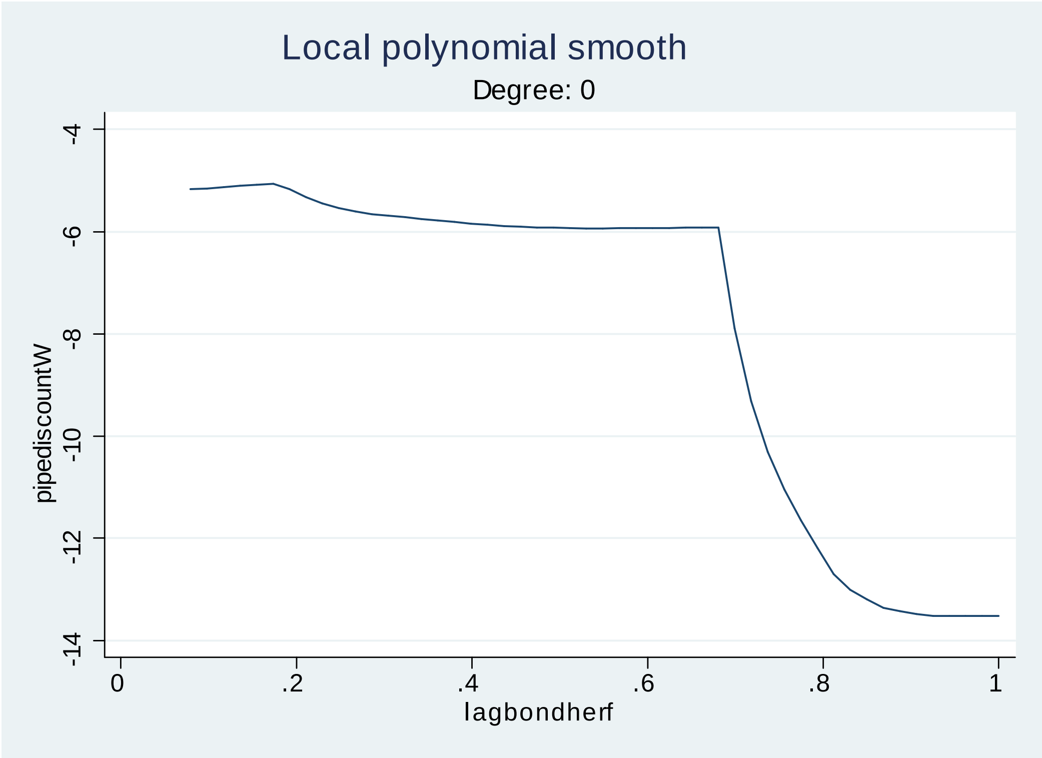

Figure 2: PIPE discount as a function of bond Herfindahl index

Figure 3: Model Timeline

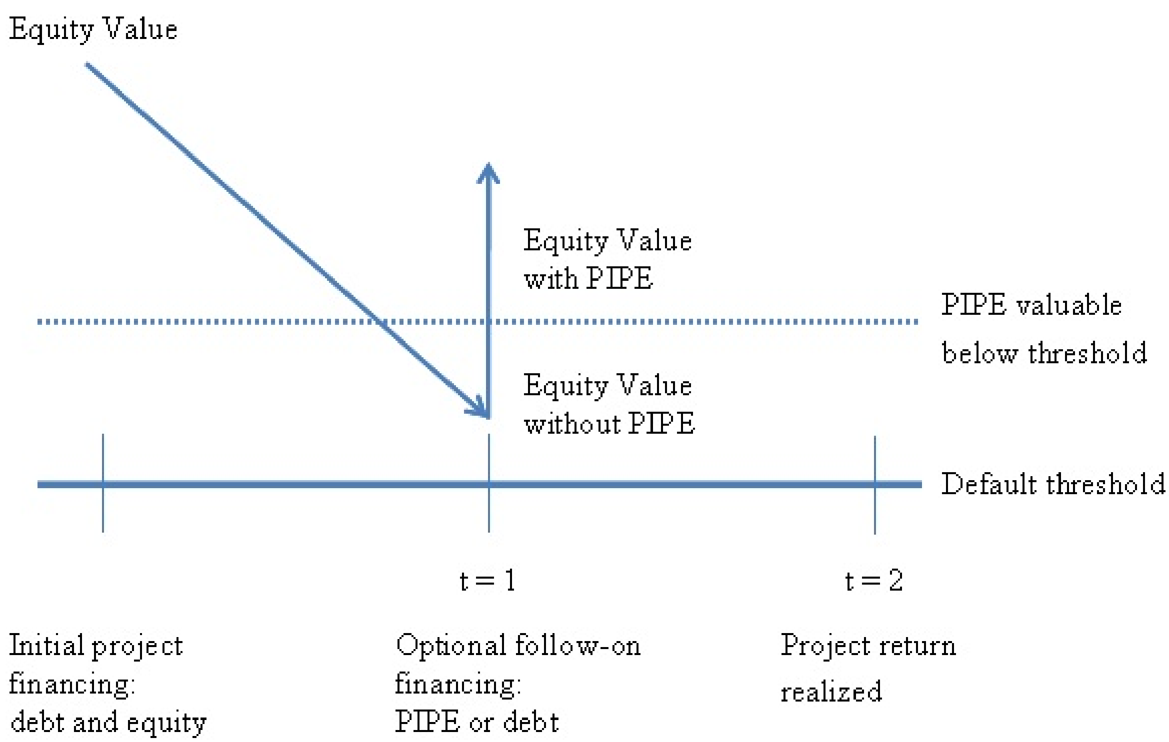

Table 1: Private Placement Transactions: 1995-2007

Distribution of private placements in PlacementTracker database by year. Excludes non-US, 144-A and Reg-S issuers. Structured PIPEs are common stock or convertibles with reset provisions, structured equity placements or floating convertibles. Percentage proceeds to market value, dilution, warrant coverage and structured are winsorized at 5%.

Year	Issues	Proceeds, $Bil	Proceeds to MV %	Dilution %	Warrants %	Structured %
1995	114	1.33	10.10	13.68	4.19	30.70
1996	306	4.08	12.67	18.39	8.71	52.94
1997	456	4.75	13.57	18.06	7.01	57.24
1998	440	3.00	11.41	15.72	7.96	55.23
1999	691	10.30	12.87	18.64	13.59	28.08
2000	1,254	24.40	12.64	20.41	21.84	31.26
2001	1,036	14.60	15.90	27.03	16.08	21.91
2002	756	12.10	20.01	28.92	14.73	15.34
2003	880	11.60	17.35	26.40	20.60	6.70
2004	1,285	13.70	16.90	31.02	29.48	12.45
2005	1,325	16.90	24.71	43.16	31.77	15.16
2006	1,346	22.40	24.28	43.83	38.11	15.97
2007	876	24.70	21.41	42.57	30.72	11.19
Total	10,765	163.86				
Mean	828	12.60	17.87	30.07	23.06	21.95

Table 2: Correlation Matrix of Coordination and Information Asymmetry Proxies

Pairwise correlation between coordination proxies and information asymmetry measures. Coordination proxies include Shapley value, bond Herfindahl index, and liquidation costs. Information asymmetry variables include analyst coverage, trading volume and bid-ask spread. All measures are lagged by one quarter relative to the occurrence of a private placement.

	PIPE	Shapley	Bond Herf	Liq Cost	Analysts	Volume	Spread
PIPE	1.0000						
Shapley Value	-0.0427	1.0000					
Bond Herfindahl (BH)	0.0180	-0.0073	1.0000				
Liquidation Costs	0.0882	-0.0723	0.0930	1.0000			
Analyst Coverage	-0.0486	0.1123	-0.2180	-0.1014	1.0000		
Volume	0.0547	0.0950	0.0036	0.0449	0.2508	1.0000	
Bid-Ask Spread	0.0003	-0.1708	0.1948	0.0323	-0.2854	-0.1625	1.0000

Table 3: Comparison of PIPE and non-PIPE firms

Two-sample t-tests with unequal variances. Stars denote standard statistical significance. Coordination proxies include Shapley value, bond Herfindahl index, and liquidation costs. Information asymmetry variables include analyst coverage, trading volume and bid-ask spread. Debt capacity is proxied by a firm's predicted likelihood of having a bond rating.

Variable	PIPE	No PIPE	Difference	Std Error
Shapley Value	0.109	0.157	-0.047***	0.002
Bond Herfindahl Index	0.592	0.494	0.098***	0.015
Liquidation Costs	0.073	0.029	0.044***	0.002
Analyst Coverage	1.309	1.695	-0.386***	0.019
Trading Volume	18.710	11.812	6.898***	0.375
Bid-Ask Spread	2.982	2.971	0.011	0.063
Market-to-book	2.882	2.733	0.149*	0.100
Altman's Z-score	-2.711	0.088	-2.798***	0.039
Debt Capacity	0.066	0.280	-0.215***	0.003

Table 4: Propensity Score Matching on Information Asymmetry and Likelihood of Default

Propensity score matching for pre-treatment differences after standardized bias correction. Coordination proxies include Shapley value, bond Herfindahl index, and liquidation costs. Information asymmetry variables include analyst coverage, trading volume and bid-ask spread. Predicted default probability is based on standard bankruptcy regression with an added proxy for debt capacity (predicted bond rating). Stars denote standard significance levels

	Matching on information asymmetry					
	Sample	PIPE	No PIPE	Difference	Std Error	T-Stat
Shapley Value	Unmatched	0.158	0.211	-0.053***	0.005	-10.20
	Matched	0.158	0.209	-0.051***	0.007	-9.22
Bond Herfindahl Index	Unmatched	0.574	0.474	0.100***	0.028	3.64
	Matched	0.574	0.519	0.0565*	0.031	1.68
Liquidation Costs	Unmatched	0.041	0.011	0.030***	0.003	10.04
	Matched	0.041	0.016	0.025***	0.005	4.92

	Matching on information asymmetry and predicted default					
	Sample	PIPE	No PIPE	Difference	Std Error	T-Stat
Shapley Value	Unmatched	0.160	0.223	-0.063***	0.005	-11.58
	Matched	0.160	0.211	-0.051***	0.005	-6.71
Bond Herfindahl Index	Unmatched	0.560	0.459	0.101***	0.026	3.82
	Matched	0.560	0.502	0.058*	0.026	1.69
Liquidation Costs	Unmatched	0.048	0.017	0.031***	0.002	14.14
	Matched	0.048	0.028	0.020***	0.006	2.92

Table 5: Logistic Estimation of PIPE Issuance with Coordination Proxies

Multivariate logistic regressions of the choice of PIPE (Dependent variable: PIPE = 1/0) Column (1) reports results using only coordination proxies (Shapley value, bond Herfindahl & liquidation costs). Column (2) includes asymmetric information proxies as additional controls. Column (3) adds predicted default probability estimated with standard bankruptcy regression controlling for debt capacity (predicted bond rating). Standard errors are clustered by firm.

	(1)	(2)	(3)
Constant	-8.519***	-18.406***	-19.222***
	(0.959)	(0.821)	(0.773)
Shapley Value	-2.205***	-1.525**	-1.663***
	(0.076)	(0.733)	(0.680)
Bond Herfindahl Index	1.430***	0.675**	0.735*
	(0.262)	(0.294)	(0.386)
Liquidation Costs	13.133***	11.385***	6.250***
	(2.055)	(1.667)	(1.201)
Analyst Coverage		-0.501***	-0.314***
		(0.105)	(0.116)
Trading Volume		0.003*	0.002**
		(0.002)	(0.001)
Bid-Ask Spread		0.054	-0.032
		(0.037)	(0.087)
Predicted Default Probability			14.889***
			(1.375)
Year Fixed Effects	Yes	Yes	Yes
McKelvey & Zavoina R^2	23.4%	37.5%	39.2%
Correctly Classified %	99.3%	99.3%	99.2%
No. Obs	32840	22477	15522

Table 6: Variation of PIPE Discount with Coordination Proxies

Percent discount to closing market value at PIPE issuance by coordination proxy terciles.
Includes only lowest Altman's Z-Score tercile observations, i.e. Z-score less than 1.1.
T-tests for difference in means (unequal variances). Stars denote standard significance levels.

	Mean	Std. Error	Difference	Std. Error
Shapley Value Low Tercile	-13.443	0.424	-4.462***	0.677
Shapley Value High Tercile	-8.980	0.528		
Bond Herfindahl Index Low Tercile	-4.958	1.953	1.540	2.384
Bond Herfindahl Index High Tercile	-6.498	1.367		
Liquidation Costs Low Tercile	-11.999	1.071	-0.714	1.126
Liquidation Costs High Tercile	-11.286	0.348		

Table 7: Estimation of PIPE Discount to Market Price

OLS regressions of the discount to closing market price at which PIPE offerings transact. Column (1) reports results using only Shapley value. Column (2) adds asymmetric information variables. Column (3) includes an indicator for distressed firms (z-score less than 1.1). Standard errors are clustered by firm. Stars denote standard significance levels.

	(1)	(2)	(3)
Constant	-27.791***	-37.132***	-33.770***
	(1.912)	(0.596)	(0.895)
Shapley Value	10.867***	4.825***	5.251***
	(1.504)	(1.629)	(1.630)
Analyst Coverage		1.780***	1.620***
		(0.335)	(0.322)
Trading Volume		-0.014**	-0.011**
		(0.006)	(0.006)
Bid-Ask Spread		-0.258*	-0.219*
		(0.137)	(0.134)
Distressed Firm			-3.451***
			(0.793)
Year Fixed Effects	Yes	Yes	Yes
R^2	10.99%	8.95%	10.52%
No. Obs	2513	1093	1093

Table 8: Logistic Estimation of Post-PIPE Default

Multivariate logit regression (column 1) and instrumental logit regressions (columns 2 and 3). The dependent variable equals one if a firm is in bankruptcy or default, and zero otherwise. Column (1) includes standard default prediction independent variables - log of total assets, EBITDA over assets, market leverage, Altman's z-score and debt capacity. Clustered st. errors. Column (2) adds (predicted) PIPE, which has been instrumented by our three coordination cost proxies (Shapley value, bond Herfindahl index and liquidation costs). Bootstrap st. errors. Column (3) uses predicted default probability (as in column (1)) and amount of equity raised.

	(1)	(2)	(3)
Constant	-1.171**	-0.116	-3.917***
	(0.476)	(0.175)	(0.524)
Private Placement (Instrument)		-68.950***	-52.786***
		(4.054)	(15.583)
Log(Assets)	-0.361***	-0.436***	
	(0.066)	(0.023)	
EBITDA/Assets	-4.299***	-10.858***	
	(1.420)	(0.851)	
Book Leverage	0.603**	0.438***	
	(0.246)	(0.118)	
Z-Score Tercile	-0.499***	-0.412***	
	(0.149)	(0.041)	
Debt Capacity Tercile	0.937***	0.802***	
	(0.149)	(0.067)	
Predicted Default Probability			10.255***
			(2.787)
Amount of Equity Raised			2.716**
			(1.393)
McKelvey & Zavoina's R^2	15.3%	24.0%	24.4%
McFadden's R^2	8.6%	11.6%	13.2%
No. Obs	39039	23064	485

Table 9: Propensity-Score Matched Estimation of PIPE Issuance

Propensity score matched logistic regressions of the choice of PIPE (Y = PIPE = 1/0). Column (1) matches on pre-treatment differences in terms of asymmetric information. Column (2) matches on pre-treatment differences in terms of asymmetric information and predicted default probability estimated with standard bankruptcy prediction regression controlling for access to public markets. Stars denote standard significance levels.

	(1)	(2)
Constant	-4.939***	-6.585***
	(0.204)	(0.327)
Shapley Value	-0.857**	-1.215***
	(0.407)	(0.473)
Bond Herfindahl Index	0.399**	0.234
	(0.197)	(0.258)
Analyst Coverage	-0.157**	-0.032
	(0.064)	(0.084)
Trading Volume	0.005***	0.002***
	(0.001)	(0.001)
Bid-Ask Spread	0.050**	-0.095**
	(0.023)	(0.046)
Predicted Default Probability		12.760***
		(0.914)
McKelvey & Zavoina R^2	2.8%	18.8%
McFadden R^2	1.2%	10.4%
No. Obs	42130	25820

Table 10: Propensity-Score Matched Estimation of Post-PIPE Default

Propensity score matched predictive default regressions (Y = Default or Bankruptcy =1/0) Column (1) matches on pre-treatment differences in terms of asymmetric information. Column (2) matches on pre-treatment differences in terms of asymmetric information and predicted default probability estimated with standard bankruptcy prediction regression controlling for access to public markets. Column (3) matches on pre-treatment differences in predicted default probability and amount of raised equity in private vs. public issues. Column (4) adds back information asymmetry proxies as additional control variables.

	(1)	(2)	(3)	(4)
Constant	-1.976***	-2.946***	-3.917***	-2.974***
	(0.067)	(0.102)	(0.452)	(0.727)
Private Placement (Instrument)	-22.074***	-33.572***	-52.786***	-66.423***
	3.739	(4.319)	(15.390)	(23.579)
Analyst Coverage	-0.575***	-0.475***		-0.608**
	(0.030)	(0.038)		(0.245)
Trading Volume	0.017***	0.014***		0.012
	(0.001)	(0.002)		(0.009)
Bid-Ask Spread	0.169***	0.133***		0.065
	(0.014)	(0.017)		(0.124)
Predicted Default Probability		7.679***	10.255***	10.406***
		(0.483)	(2.303)	(3.309)
Amount of Equity Raised			2.716*	1.198
			(1.463)	(1.991)
McKelvey & Zavoina's R^2	13.0%	19.3%	24.4%	18.4%
McFadden's R^2	7.5%	11.5%	13.2%	33.3%
No. Obs	22266	16144	485	373