Does shareholder coordination matter? Evidence from private placements*

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Abstract We propose a new role for private investments in public equity (PIPEs) as a mechanism to reduce coordination frictions among existing equity holders. We establish a causal link between the coordination ability of incumbent shareholders and PIPE issuance. This result obtains even after controlling for alternative explanations such as information asymmetry and access to public markets. Improved equity coordination following a private placement leads to favorable debt renegotiations within one year of issuance. Mitigating coordination frictions among shareholders ultimately decreases the odds of firm default in half.

JEL classification: G32, G33, G34

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1. Introduction

Private investments in public equity (PIPEs) involve the unregistered sale of publicly traded securities such as common or preferred stock and convertibles to a small group of sophisticated private investors. Despite their more complex contract structure, frequently including reset provisions and warrants, PIPEs have become an increasingly important means of raising equity for troubled firms with limited access to the public equity market. As a result, the share of private placements in secondary equity issuance has increased from 4% in 1995 to 27% in 2007.[1]

One of the most puzzling features of private equity placements is their positive announcement return. For example, the (-3, 1) cumulative average daily return during 1995–2007 is +2.12%. This positive price reaction contrasts with the negative announcement returns of secondary equity offerings (SEOs) and implies that PIPEs are viewed by the market as beneficial to existing shareholders. This is even more surprising considering that the average private equity placement is offered at a large discount to current market prices (13% in our sample period) and results in significant dilution of the holdings of incumbent equity holders (26% on average in 1995–2007).[2]

The existing literature has provided several competing interpretations of the positive announcement effect of PIPEs. Wruck (1989) establishes a relation between the market's positive reaction to private placements and the increase in ownership concentration following PIPE issuance. She interprets the positive price effect of PIPEs as evidence that changes in ownership concentration better align the interests of managers and shareholders. Hertzel and Smith (1993) consider the role of private placements in resolving asymmetric information problems about firm value. They view a private issue as a seal of approval by sophisticated

[1]The total volume of private equity issuance during the sample period was $164 billion versus $715 billion of public equity offerings (see Table 1).

[2]Hertzel, Lemmon, Linck, and Rees (2002) discuss the positive price effect of private placements and their negative long-run performance. Huson, Malatesta, and Parrino (2010) investigate the recent decline in the PIPE discount.

institutional investors on the current valuation of a firm.[3]

Typical PIPE issuers are troubled firms with more dispersed shareholders and more concentrated debtholders than the average firm. Building on the Wruck (1989) contribution, this paper argues that PIPE issuance allows dispersed equity holders to concentrate their control rights by bringing in a new blockholder with a large incentive to improve firm value. However, unlike the Wruck (1989) emphasis on improved monitoring reducing agency conflicts within the firm, we focus on an alternative channel whereby private placements serve as a mechanism to mitigate coordination frictions among existing equity holders in their choice of firm policy.

A distressed firm is likely to experience a shift of control rights from equity to debt, in which case any change in existing firm policy could require negotiations between equity holders and debtholders. We claim that PIPE issuance improves the coordination ability of equity holders and facilitates negotiations of firm policy with debtholders. We focus on debt renegotiation as a specific example of a major policy, which benefits from improved ability of a firm's stakeholders to come to an agreement.[4] Debt renegotiations are especially important for private placement firms because of their high level of distress and reduced ability to access public markets.

Two main contributions of this paper deserve attention. First, we use instrumental variables (IV) analysis to establish a causal link between the coordination ability of incumbent equity owners and PIPE issuance. This result obtains even after propensity score matching on alternative explanations of private equity issuance. Second, we show the effect of the coordination channel on a firm's post-issuance debt renegotiation and default likelihood. Reduced coordination frictions among shareholders following PIPE issuance substantially

[3]Both Hertzel and Smith (1993) and Wu (2004) provide cross-sectional evidence at odds with the Wruck (1989) monitoring hypothesis. Barclay, Holderness, and Sheehan (2007) interpret the PIPE discount as compensation to investors for their implicit support of management entrenchment.

[4]The coordination hypothesis we propose builds on previous theoretical work, which considers the role of debt contracts in transferring state-contingent control rights to creditors (e.g., Aghion and Bolton, 1992; and Dewatripont and Tirole, 1994). Recent empirical work has explored the importance of control right dynamics for firm policy (see Chava and Roberts, 2008; and Nini, Smith, and Sufi, 2009).

decrease the odds of default of PIPE firms compared with matched controls. PIPE issuers are also more likely to experience favorable debt renegotiations resulting in lower interest spreads and larger loan principals within one year of issuance.

Our empirical approach aims to differentiate the coordination channel proposed in this paper from the information asymmetry and monitoring hypotheses in the existing literature. Ideally, we would be able to conduct a randomized experiment in which firms with different coordination ability of incumbent equity holders are randomly chosen to issue equity in the secondary public market (SEO) or to private investors (PIPE). In the absence of such randomization, we need to effectively control for the potential selection bias resulting from the effect of firm characteristics (such as information asymmetry, access to public markets, and distress) on the choice of equity financing.

We use propensity score matching techniques to reduce the confounding effects of firm attributes on the mode of equity issuance. We look for conditioning variables among the firm characteristics suggested by alternative explanations of private equity issuance. Specifically, we compare each PIPE issuer to its SEO counterparts in terms of pretreatment differences in information asymmetry, access to public markets, and predicted default probability. Our propensity score analysis corrects for selection bias in terms of observable characteristics that could affect the decision to issue private equity. We also use instrumental variables analysis to address potential self-selection concerns in terms of unobservable firm heterogeneity.

Our measure for shareholder concentration directly reflects the level of coordination necessary to reach a decision based on shareholder voting. We use a firm's total Shapley value to proxy for existing coordination frictions among incumbent equity holders. The Shapley value captures the relative importance of each voting shareholder in terms of her expected ability to have a pivotal vote in changing firm policy.[5] A low Shapley value of current shareholders suggests larger coordination benefits from adding a PIPE investor. Our univariate results show that PIPE issuers have 51% lower Shapley values of incumbent equity than

[5]Using Shapley value instead of alternative measures such as total institutional ownership also differentiates our coordination mechanism from the Wruck (1989) monitoring hypothesis.

their non-PIPE counterparts.

To account for the pre-issuance balance of power between equity holders and debtholders, we also measure a firm's concentration of public debt claimants by the Herfindahl Index of its bond issues. This proxy captures the distribution of par values of outstanding bonds. A higher bond Herfindahl Index indicates more concentrated bondholders, which increases the benefit of improving the coordination ability of a firm's equity holders. We observe that PIPE firms have 33% more concentrated bondholders than SEO firms.

Our first set of results shows that both the coordination ability of a firm's incumbent equity holders (measured by their Shapley value) and the concentration of its public debtholders (proxied by the bond Herfindahl Index) are highly statistically significant in predicting PIPE issuance. Using a comprehensive US sample of private equity placements and secondary equity offerings between 1995 and 2007, we show that a firm experiences a 38% increase in the odds of a private placement with a one standard deviation decrease in the coordination ability of its shareholders. In addition, we observe a 20% increase in the odds of a private placement with a one standard deviation increase in the concentration of a firm's debtholders.

Using the initial-year industry Shapley value as an instrument for the firm-specific Shapley value of an issuer, we establish a causal relation between a firm's equity holder coordination and PIPE issuance. This causal link remains significant even after propensity score matching on other determinants of the choice of external financing such as information asymmetry and access to public markets. Our results demonstrate that the coordination mechanism plays an important role in explaining the choice to issue private equity.

How do current shareholders and new PIPE investors share the surplus realized by coordination improvement? We find that a one standard deviation increase in the Shapley value of incumbent equity holders decreases the discount offered to PIPE investors by 14%. This result implies a statistically and economically significant relation between the benefits of reducing equity coordination costs and the discount that new PIPE investors receive.

We also show that high bond concentration increases the gains from improved equity coordination. Firms with above-median bond concentration have 6% higher PIPE discounts compared with firms with below-median bond concentration. These additional tests provide compelling evidence in support of the coordination hypothesis we propose in this paper.

Our second set of results demonstrates that private equity issuance is highly significant in predicting a reduced likelihood of default even after propensity score matching on the typical determinants of default as well as information asymmetry and amount of capital infusion. We instrument PIPE issuance by our two coordination proxies (Shapley value and bond Herfindahl Index) and find that a one standard deviation increase in predicted PIPE decreases the odds of default in half. In fact, PIPE issuance has higher economic significance than any of the common bankruptcy predictors including Z-score.

To provide direct evidence that PIPE firms improve their financial health post-issuance, we examine whether private placements facilitate debt renegotiation in practice. We use difference-in-differences analysis to estimate the probability of favorable debt renegotiation within one year of PIPE issuance. Compared with firms matched on size, equity coordination, and distress, PIPE firms participate in fewer loan amendments following issuance but achieve a 40% higher incidence of favorable outcomes such as lower interest spreads and larger principals. Our empirical results provide strong evidence that improved equity coordination after PIPE issuance raises a firm's likelihood of a favorable debt modification.

The rest of the paper proceeds as follows. Section 2 describes the data and introduces our coordination proxies as well as our main controls. Section 3 reviews the empirical evidence supporting the coordination hypothesis. Section 4 relates private placements to reduced default and favorable debt renegotiation. Section 5 discusses robustness tests. Section 6 concludes.

2. Data and variable definitions

2.1. Data sources

This study uses data on US private equity placements between 1995 and 2007 from the PlacementTracker database by Sagient Research. After excluding foreign, 144-A, and Regulation-S (Reg-S) issuers, the PlacementTracker data set includes 6,442 unique firms involved in 10,765 transactions.[6] PIPE issuance has become a vital source of equity financing for most firms. The total volume of private equity issues during the sample period is $163.86 billion, compared with $714.54 billion of public equity offerings. As seen in Table 1, the share of private placements in secondary equity issuance has increased from 4% in 1995 to 27% in 2007.

Insert Table 1

PlacementTracker contains detailed information about the terms 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 specifics. Table 1 reports the percentage dilution of existing equity defined as one minus the ratio of old equity to the sum of old and new equity. The average dilution of existing equity is 30% and does not vary significantly between 1995 and 2007. The mean discount to market price is 13% but shows a decreasing trend during the sample period. Huson, Malatesta, and Parrino (2010) relate the decrease in the PIPE discount (especially in the latter part of the period) to changes in the characteristics of PIPE issuers and the contracting environment.

As in Brophy, Ouimet, and Sialm (2006), we classify common stock and fixed convertible issues as traditional PIPEs. Structured PIPEs are common stock or convertible issues with reset provisions, structured equity placements, or floating convertibles. As seen in Table 1, 22% of the PIPEs in the sample period are categorized as structured. We also observe a

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

trend away from structured issues to placements with higher warrant coverage, especially after 2002.[7]

We obtain quarterly accounting and stock price data from the Center for Research in Security Prices (CRSP)/Compustat Merged Database by first matching ticker symbols from PlacementTracker to PERMNOs (permanent security identification numbers) using the CRSP historical file of firm names. Then, we match issuers in PlacementTracker to CRSP/ Compustat data by PERMNOs. Matching by PERMNOs instead of issuer tickers significantly improves the match to approximately 95% of PIPE issuers. Many private placements consist of multiple tranches within several weeks of each other. To make them comparable to SEOs, we combine multiple PIPE transactions for a firm within a quarter, which results in 5,610 firm-quarter PIPE observations.

We calculate our measure for pre-issuance equity holder coordination (Shapley value) using institutional ownership data from Thomson Reuters Institutional Holdings (13F) database. (Subsection 2.2 discusses Shapley value and its relevance in the context of this paper.) We proxy for the bargaining power of debtholders by calculating a Herfindahl Index of outstanding public bond issues using data from Mergent Fixed Income Securities Database (FISD).

To study the effect of PIPE issuance on debt renegotiation, we collect data on bank loan facilities and amendments from Thomson Reuters LPC's Dealscan database. The data consist of private loans made by bank and nonbank lenders to US corporations.[8] The basic unit of observation in Dealscan is a loan facility. We obtain the original terms of all bank loans by PIPE firms in the period 1995–2007 and track changes in their maturity, interest spread, and loan amount for one year after PIPE issuance.

Our main control group in most tests consists of all firms with SEOs during the sample period. We obtain data on public equity issues from Thomson Reuters Securities Data Com-

[7]Chaplinsky and Haushalter (2010) show that issuers of warrant contracts achieve similar risk-adjusted returns as issuers of reset contracts. However, issuers of warrant-only contracts are more distressed whereas issuers of resets have more volatile returns.

[8]We merge Dealscan to Compustat data using the Roberts Dealscan–Compustat Linking Table from Wharton Research Data Services (WRDS). See Chava and Roberts (2008) for further information.

pany (SDC) Platinum. The data set contains 4,841 firm-quarter observations for 2,888 unique firms. In robustness tests, we also compare PIPE issuers to the average CRSP/Compustat firm.

We control for a firm's information asymmetry, distress level, and access to public markets as alternative explanations of PIPE issuance. Following Wu (2004), we proxy for information asymmetry using analyst coverage, trading volume, and the ratio of research and development (R&D) expense to total firm assets. We measure analyst coverage with data from Thomson Reuters I/B/E/S and trading volume using data from CRSP. We calculate a firm's access to public markets and predicted default probability using data from CRSP and Compustat. See the Appendix for all variable definitions and data sources.

2.2. Shapley value and equity coordination

We consider private equity issuance as a mechanism to improve the coordination ability of equity holders and facilitate their negotiation of firm policy with bondholders. This coordination hypothesis builds on previous theoretical work, which examines the role of debt contracts in transferring state-contingent control rights to creditors (e.g., Aghion and Bolton, 1992; and Dewatripont and Tirole, 1994). A distressed firm experiences a shift of control rights from equity to debt, in which case any change in existing firm policy typically requires negotiations between equity holders and debtholders. This paper uses the context of private placements to study the steps that incumbent equity holders take to improve their coordination ability and strengthen their control rights.

Recent empirical work has explored the importance of control right dynamics on firm policy. Chava and Roberts (2008) show that loan covenant violations transfer control rights to debtholders who subsequently cause a reduction in firm investment. Nini, Smith, and Sufi (2009) demonstrate that conflicts of interest between creditors and borrowers have a significant impact on a firm's investment policy. We hypothesize that PIPE issuance allows incumbent equity holders to concentrate their control rights by bringing in a new blockholder

with a large incentive and ability to improve firm value. In particular, we suggest that favorable renegotiations of debt policy are easier to achieve in firms whose equity holders have lower coordination frictions.

We measure the coordination ability of existing shareholders by the Shapley value of current institutional blockholders.[9] Other measures such as total institutional ownership or number of blockholders do not directly reflect the level of coordination necessary to reach a decision and suffer from alternative interpretations as proxies for information asymmetry or institutional monitoring.

Consider the following example. Compare firm A, whose three equity holders have 49%, 49%, and 2% ownership stakes, with firm B, whose shareholders hold 51%, 47%, and 2% equity stakes. In firm A, two equity holders have to vote together to reach a majority, and there are three such combinations. Hence, the Shapley value of the 2% stakeholder in firm A is 1/3 (same as the Shapley values of the other two equity holders). The Shapley value of the 2% shareholder in firm B is zero because the 51% stake holder has full control and a Shapley value of one. Alternative proxies for shareholder concentration such as the Herfindahl Index do not directly measure the control rights of shareholders.[10] For instance, the Herfindahl Index of firm A is almost identical to that of firm B: 0.4806 versus 0.4814.

As in Milnor and Shapley (1978), we use the generalized pivotal player approach for infinite-person games to compute the Shapley values of a firm's institutional blockholders who own at least 3% of its outstanding shares. In this approach, an equity holder's Shapley value is the probability that in a randomly permuted ordering of all shareholders, the equity holder 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.

[9] In the recent literature, the Shapley value approach has been used by Zingales (1994) and Nenova (2003) to determine the value of voting rights.

[10] A bond Herfindahl Index is an appropriate measure of public debt concentration because a simple bondholder majority is generally not sufficient to reach a decision due to the more complex features of bond contracts.

Specifically, let $x_1, \ldots, x_m$ be the major shareholders of a firm who each own a fraction $w_i \in [0, 1]$ shares. M is the total number of major shareholders. $P(x_i)$ denotes the finite set of major shareholders $x_1, \ldots, x_{i-1}$ who are the predecessors of player i, where $i \in M$. Let the small players preceding major player i 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 Shapley value of all shareholders of the firm (M large shareholders and an infinite number of small ones) is by definition one:

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

where Φ is the total Shapley value of all small shareholders.[11]

Using a simulation methodology, we compute the Shapley values of all major shareholders each quarter and then add the individual Shapley values to obtain the total Shapley value of a firm, $\phi(M)$, which is our proxy for the coordination ability of its current shareholders.

By definition, the Shapley value captures the importance of each voting shareholder in terms of her expected ability to have a pivotal vote in changing firm policy. The total Shapley value of a firm's current shareholders provides information about the maximum relative voting 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 a new blockholder can bring. Hence, we expect a negative correlation between a firm's Shapley value and the likelihood of a private placement.

Gertner and Scharfstein (1991) show that dispersed public debt could lead to holdout problems and inefficient liquidations. Consequently, having more concentrated public debt

[11]The definition of Shapley value does not require the presence of small players with mass y. A firm could be entirely composed of major shareholders who behave in a strategic manner.

increases the potential benefits of improving equity coordination. We measure the concentration of a firm's public debt claimants by the Herfindahl Index of bond issues (as in Davydenko and Strebulaev, 2007). Debt Herfindahl Index captures the distribution of par values of a firm's 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.[12] We expect a positive correlation between our measure of debt concentration and the incidence of private placements.

2.3. Information asymmetry and access to public markets

Our empirical approach aims to differentiate the coordination hypothesis proposed in this paper from other explanations 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 instead of public equity as a mechanism to reduce this asymmetry. In addition, Bolton and Freixas (2000) and Lemmon and Zender (2010) relate access to public markets to a firm's ability to issue public-rated debt.

We use propensity score matching techniques to reduce the confounding effects of firm attributes on the choice of external financing. A propensity score index allows us to compare each PIPE issuer with its SEO counterparts in terms of pre-issuance differences in information asymmetry, access to public markets, and predicted default probability.

Specifically, we control for the information hypothesis of private placements with three frequently used measures of information asymmetry: analyst coverage, trading volume, and R&D ratio (as in Wu, 2004). Analyst coverage is the number of equity analysts following a firm on an annual basis. We expect a negative correlation between analyst coverage and the likelihood of a private placement. Trading volume is the ratio of trading volume from CRSP divided by the average number of outstanding shares over the previous two years. Firms with lower volume are more likely to issue private equity. R&D ratio is research and

[12] In terms of concentration, bank debt can be viewed as a limiting case of bond debt. Most loan facilities are originated by loan syndicates whose lead arranger eliminates most coordination frictions among debt holders.

development expenditures to total assets from Compustat. We expect that the R&D ratio is positively correlated with the likelihood of a private placement. All information asymmetry measures are lagged to address potential simultaneity concerns.

We also take into account a firm's access to public markets by estimating its predicted probability of having a long-term bond rating. Lemmon and Zender (2010) use the cross-sectional heterogeneity in 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. Following their approach, we use a firm's predicted likelihood of having a bond rating (not the actual presence of a bond rating) as a proxy for its access to public markets.

We estimate a firm's predicted probability of having a bond rating using a multinomial logit model, in which the dependent variable equals one if a firm has a Standard & Poor's (S&P) rating in a given year and zero otherwise. 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). We group firms in each year into terciles based on their predicted likelihood of having a bond rating and use these terciles in our default analysis.[13]

Most PIPE issuers are distressed firms. In most tests, we control for a firm's level of distress by estimating its predicted probability of default. As seen in Table 8, we predict default using a standard bankruptcy regression, in which the dependent variable equals one if a firm experiences default or bankruptcy, and the independent variables are the log of total firm assets, earnings before interest, taxes, depreciation, and amortization (EBITDA) ratio

[13]Our data come from CRSP and Compustat and cover the period 1986-2010. 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%.

(EBITDA/Assets), book leverage, Altman's Z-score, and debt capacity [calculated following the approach of Lemmon and Zender (2010)].

In sum, our propensity score analysis allows us to differentiate the coordination hypothesis from alternative explanations of the choice of financing by correcting for selection bias in terms of observable firm characteristics. We also use instrumental variables analysis to address potential self-selection concerns resulting from unobservable firm heterogeneity.

3. Empirical results

3.1. The PIPE sample

The coordination hypothesis we propose regards private placements as a mechanism to reduce coordination frictions among existing equity holders in their choice of firm policy. This channel is more valuable for firms with dispersed shareholders and concentrated debtholders because such firms gain the most by reducing coordination costs. In this subsection, we present some preliminary univariate evidence that differentiates the coordination mechanism from the information asymmetry and limited market access explanations of PIPE issuance.

Table 2 reports the pairwise correlation matrix between coordination proxies, information asymmetry measures, and PIPE issuance. All variables are lagged by one quarter relative to the occurrence of a private placement. Our measure of equity coordination frictions (Shapley value) has the highest negative correlation with R&D ratio (-0.07) and the highest positive correlation with analyst coverage (0.11). Our proxy for bond concentration (Debt Herfindahl Index) has the highest negative correlation with analyst coverage (-0.22) and the highest positive correlation with R&D ratio (0.09). The relatively low correlations between coordination proxies and information asymmetry measures suggest that the coordination mechanism could provide additional insights into the motivation to issue private equity.

Insert Table 2

Table 3 describes PIPE firms in more detail. It reports t-tests for differences in means between PIPE issuers and two sets of control firms. Panel A uses our main control group consisting of firms with SEOs, and Panel B uses all firms in the CRSP/Compustat universe. Columns 2 and 4 report the 25th and 75th percentiles of the variables of interest. Columns 5 and 6 show differences in means between PIPE issuers and control firms, with their respective standard errors.

Insert Table 3

The first interesting observation from Panel A is that PIPE issuers have 51% lower equity Shapley values (0.11 versus 0.22 for SEO firms). A low Shapley value of current institutional blockholders suggests larger coordination benefits from adding a PIPE investor. Also, PIPE issuers have 33% more concentrated debtholders (0.59 versus 0.44 for SEO firms). A high concentration of bond claimants implies greater benefits from improved equity holder coordination. The comparison with the average CRSP/Compustat firm (presented in Panel B of Table 3) confirms these findings. Private placement firms have 31% lower coordination of incumbent equity (0.11 versus 0.16 for non-PIPE firms) and 20% higher debt concentration (0.59 versus 0.49 for non-PIPE firms).

The majority of PIPE issuers are distressed firms. As seen in Panel A, the 75th percentile of PIPE Z-scores is lower than the 25th percentile of SEO Z-scores. In fact, 82% of all PIPE firms in the sample period have Z-scores lower than the mean SEO Z-score. The average Z-score of PIPE issuers is -2.71 versus 0.27 for their SEO counterparts. PIPE firms are likely to experience a shift in control rights from equity to debt due to their high distress levels.[14]

Panel A of Table 3 also presents a comparison of PIPE and SEO firms in terms of information asymmetry. Private placement firms have significantly higher R&D ratios (0.07 versus 0.02) and lower analyst coverage (1.31 versus 2.02), suggesting higher information asymmetry. The difference in trading volumes between PIPE and SEO firms is marginally

[14]The average interest coverage (EBIT/Interest Expense) of PIPE issuers is 2.18 versus 11.87 for their SEO counterparts. About 80% of all PIPE firms in the sample period have interest coverage lower than 1.

statistically significant but not economically significant.

We use a firm's predicted likelihood of having a bond rating to control for its debt capacity (i.e., access to public markets). As seen in Table 3, private placement firms have 81% lower debt capacity (0.07 versus 0.37) than SEO firms. In fact, the 75th percentile of debt capacity of PIPE issuers is lower than the 25th percentile of debt capacity of SEO firms. We control for debt capacity in our multivariate analysis by including it as an additional covariate in predicting an issuer's probability of default.

In Table 4, we report results of propensity score matching on pretreatment differences in information asymmetry and predicted probability of default. We proxy for information asymmetry by R&D expense ratio, analyst coverage, and trading volume. We predict default by a standard bankruptcy regression using firm-level characteristics, including debt capacity.

Insert Table 4

Panel A of Table 4 compares PIPE issuers with SEO firms, and Panel B uses all CRSP/ Compustat firms as a control group. Both Shapley value (measuring equity coordination frictions) and bond Herfindahl Index (proxying for debt concentration) remain significantly different across PIPE and non-PIPE firms after propensity score matching on information asymmetry and predicted default probability. If the coordination channel had no independent explanatory power, we should have observed no significant differences in the coordination measures of PIPE and non-PIPE firms. The evidence in Table 4 suggests that the coordination mechanism is distinct from the information asymmetry and limited market access explanations of private equity issuance.

The univariate analysis so far supports the coordination hypothesis. Relative to their SEO counterparts, private placement firms have 51% lower coordination among incumbent equity holders as well as 33% more concentrated debtholders. Notably, both Shapley value and bond Herfindahl Index remain significantly different between PIPE and non-PIPE firms matched on information asymmetry and predicted default probability.

3.2. The coordination hypothesis

The literature has examined the choice of private equity issuance in terms of information asymmetry and access to public markets. We propose a new role for private equity placements as a mechanism to reduce coordination frictions among incumbent equity holders in their negotiations with debtholders. In this subsection, we establish that the coordination channel plays an important role in explaining the choice to issue private equity, even after taking into account the information asymmetry and market access hypotheses.

Fig. 1 plots the incidence of private placements as a function of the (lagged) Shapley value of equity holders. The plot establishes a clear negative relation between Shapley value and the number of private equity issues. In fact, most PIPEs are issued by firms with low Shapley values reflecting the low ability of their incumbent equity holders to coordinate. These firms gain the most by attracting a new PIPE investor with a concentrated stake.

Insert Figure 1

In Fig. 2, we plot the average change in a firm's Shapley value after PIPE issuance as a percentage of the starting Shapley value one quarter before issuance. Here, the x-axis is the mean Shapley value one quarter before PIPE issuance, and the y-axis is the mean percentage change in Shapley value after issuance. We observe that the change in Shapley value is positive. As expected, firms with the lowest Shapley values before issuance see the largest percentage increase in their Shapley values after issuance.

Insert Figure 2

We also study the evolution of Shapley value following a private placement. The mean percentage increase in Shapley value from the quarter before to the quarter after issuance is 48.92%, with little variation in the subsequent quarters. The increase in Shapley value is very persistent in the year after issuance, implying that PIPE investors are not just short-term

liquidity providers.

Table 5 continues our tests of the coordination hypothesis in a multivariate setting. We estimate the probability of PIPE issuance as a function of our measures for equity coordination frictions and debt concentration. Column 1 uses information asymmetry proxies (R&D ratio, analyst coverage, and trading volume) as well as predicted default probability estimated by a standard bankruptcy regression on firm-level characteristics (as in Column 1 of Table 8). Both information asymmetry and distress are important in determining the choice to issue private equity confirming findings in the previous literature.

Insert Table 5

Columns 2 and 3 report results of multivariate logistic regressions predicting PIPE issuance with our coordination proxies: Shapley value (equity coordination frictions) and bond Herfindahl Index (debt concentration). Column 2 restricts the comparison sample to SEO firms, and Column 3 uses all CRSP/Compustat firms. All explanatory variables are lagged by one quarter relative to the occurrence of a private placement. We include year fixed effects and cluster standard errors by firm.

The results in Table 5 demonstrate that firms with lower Shapley values of equity owners and higher debt concentration are more likely to use private equity placements. The regressions in Columns 2 and 3 produce similar results: Equity Coordination is significant at 1%, and Debt Herfindahl Index is significant at 5% in the SEO sample and 1% in the full sample. A low Shapley value of current shareholders suggests larger coordination benefits from adding a new PIPE investor. A higher bond concentration increases the need to improve the coordination ability of incumbent equity by PIPE issuance. Consequently, a private placement shifts the balance of power between shareholders and debtholders in PIPE firms.

Both coordination proxies also have very high economic significance. Based on the restricted comparison of PIPE issuers with SEO firms (Column 2), a one standard deviation increase in equity Shapley value decreases the odds of a private placement by 30% and a

one standard deviation increase in debt concentration increases these odds by 33%. Of the other explanatory variables, only predicted default probability has high economic significance. Some of the information asymmetry variables lose statistical significance after the inclusion of the coordination proxies.

Fig. 3 plots the estimated probability of PIPE financing conditional on the issuer's lagged Shapley value (as in Column 2 of Table 5). We focus on firms with Shapley values less than 25%, which represent about 90% of the total PIPE sample. We observe again a definite negative relation between the probability of PIPE issuance and the coordination ability of incumbent equity holders. Intuitively, the higher the need to reduce coordination costs, the bigger the benefits from bringing in a PIPE blockholder.

Insert Figure 3

To differentiate the coordination channel from alternative hypotheses of private equity issuance, we perform propensity score matched logistic regressions, in which we first match PIPE firms to non-PIPE firms based on pretreatment differences in information asymmetry and predicted default probability (controlling also for access to public debt markets). Our propensity score analysis corrects for selection bias in terms of observable characteristics.

Columns 4 and 5 of Table 5 present our propensity score matched regression results. Both Shapley value and bond Herfindahl Index have the expected signs and are highly statistically and economically significant. Based on the restricted comparison of PIPE issuers with SEO firms (Column 4), a one standard deviation increase in Shapley value decreases the odds of a private placement by 38% and a one standard deviation increase in bond concentration increases these odds by 20%. None of the information asymmetry or default variables is significant, implying that the matching procedure is successful in minimizing the differences between our treatment and control groups in terms of these characteristics.

Our previous analysis has not addressed the role of management in the decision to issue private equity. Dispersed equity holders could lack the ability to come to an agreement, in

which case a private placement is impossible without the help of management. In Section 5, we examine the role of managerial ownership and incentives in PIPE issuance using the delta and vega of Chief Executive Officer (CEO) stock and option holdings. We find that managerial incentives have a positive effect on the probability of PIPE issuance in distressed firms and confirm our results in this setting (see Table 10 for details).

To establish a clear causal relation between a firm's equity holder coordination and PIPE issuance, we also conduct an instrumental variables analysis. In the spirit of Laeven and Levine (2009), we use the initial year (i.e., 1995) mean industry Shapley value as an instrument for the firm-specific Shapley value of an issuer. Using the initial year industry Shapley value also mitigates any simultaneity concerns. We verify that the mean industry Shapley value is a valid instrument. Intuitively, it is correlated with a firm's Shapley value but is unlikely to directly affect the propensity of PIPE financing except through its indirect effect on an individual firm's Shapley value. Thus, both the inclusion and exclusion restrictions are satisfied by this instrument.

In Table 6, we replicate Table 5 using the mean industry Shapley value at the start of the sample period as an instrument. The high statistical and economic significance of Shapley value confirms the causal effect of equity coordination on the probability of PIPE issuance.

Insert Table 6

Our multivariate results provide strong evidence that the coordination mechanism is an important determinant of a firm's choice to issue equity in a private placement. The propensity score matched estimation suggests that the coordination channel is distinct from the alternative hypotheses discussed in the literature. In addition, our instrumental variables analysis confirms that unobservable firm attributes do not seem to be driving our results.

3.3. The PIPE discount: division of coordination gains

How do current owners and new PIPE investors share the surplus realized by coordination improvement? In this subsection, we analyze whether coordination proxies can help explain the observed variation in the discounts, at which private equity is issued.

In addition to providing further evidence in support of the coordination hypothesis, our study of the PIPE discount helps address potential self-selection concerns in terms of unobservable firm characteristics not controlled for in our propensity score estimation. The discount is determined by a bargaining game between old and new owners, which takes into account unobservable firm attributes. The higher the benefits incumbent equity holders expect from PIPE issuance, the larger the discount they are willing to offer to new PIPE investors. If improved equity holder coordination is one of the potential benefits of a private placement, then the coordination proxies should explain (some of) the variation in the PIPE discount.

Panel A of Table 7 presents a univariate comparison of PIPE discounts between firms with high and low levels of the coordination proxies. We divide the sample of PIPE issuers into those with below- and above-median Shapley value and bond Herfindahl Index, respectively. We then report t-tests for differences in the mean discounts for low and high values of each measure. This analysis focuses on the most distressed firms (i.e., firms in the lowest tercile of Altman's Z-score).

Insert Table 7

Panel A of Table 7 shows that the PIPE discount varies significantly with our measure for equity coordination. PIPE issuers with low coordination ability of current blockholders (low Shapley values) issue equity at higher discounts. The difference in the mean discount between the samples with low and high equity coordination is about 5%. Given that the mean discount of the low Shapley value group is approximately 18.4%, this implies a 27% reduction in the discount between the two groups. In addition, we see a 52% increase in the discount when going from the sample with low debt concentration to the group with high

debt concentration. This suggests that high bond concentration increases the benefits from improved equity coordination.

Panel B of Table 7 reports the results of four multivariate regressions estimating the average PIPE discount as a function of equity coordination and debt concentration. We cluster standard errors by firm and include year fixed effects. The base regression in Column 1 demonstrates that Shapley value is significantly negatively correlated with the observed discount. A one standard deviation increase in Shapley value decreases the offering discount by 14%. In terms of the average dollar discount of \$54.70 million, this represents \$7.66 million lower discount.

Column 2 includes an indicator for high debt concentration as an explanatory variable, which is statistically and economically significant. Firms with above-median debt concentration have 6% higher discounts compared with firms with below-median debt concentration.

Columns 3 and 4 add controls that could impact the determination of the PIPE discount. We include an indicator for firm distress, which identifies distressed issuers as those with below-median Altman's Z-score. We also control for the amount of capital proceeds as proportion of current firm value and the percentage of an offering covered by warrants. Shapley value retains its strong statistical and economic significance. The magnitude of the effect is also robust to these additional controls. A one standard deviation increase in Shapley value decreases the PIPE discount by 13% (based on the regression in Column 4).

Our examination of the PIPE discount offers further support for the coordination hypothesis. We find that Shapley value as a measure of equity coordination helps explain the observed variation in the offering discount. In addition, we provide evidence that high debtholder concentration increases the PIPE discount.

4. Firm default

4.1. Reduced default probability

The coordination hypothesis claims that private placements improve the coordination ability of equity holders and facilitate negotiations with debtholders. If this is the case, we expect a reduced post-issuance default likelihood of PIPE issuers compared with matched non-PIPE firms, even after controlling for their information asymmetry and default probability. To test this hypothesis, we use data on both bankruptcies and bond defaults in the period 1995–2007 from Mergent FISD. Data availability restricts our analysis to firms with FISD bond data.

Table 8 reports five bankruptcy prediction models. They estimate multivariate logistic regressions of default, in which 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), book leverage, Altman's Z-score, and debt capacity (predicted access to public bond markets). All independent variables are lagged by one quarter. We use the tercile ranks of a firm's Z-score and debt capacity (instead of their raw values) because both Z-score and debt capacity already use leverage in their estimation. We cluster standard errors by firm and include year fixed effects.[15]

Insert Table 8

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 8.6%.

Fig. 4 plots the change in predicted default probability following PIPE issuance versus the change in the issuer's equity holder coordination (measured by Shapley value). We find that the higher the change in Shapley value, the greater is the reduction in the default

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

probability of the issuer. Given that the unconditional probability of default is about 16%, PIPE financing reduces this probability by 25%, which is highly economically significant.

Insert Figure 4

Columns 2 and 3 of Table 8 estimate instrumental logistic regressions, in which the first stage predicts the probability of private equity issuance using equity coordination (measured by Shapley value) and debt concentration (proxied by bond Herfindahl Index). We also estimate in a first-stage regression a firm's information asymmetry by its analyst coverage, trading volume, and R&D ratio. Both first-stage regressions use ordinary least squares (OLS), which ensures that our estimates are consistent and unbiased. We include year fixed effects and cluster observations by firm in the first-stage regressions.

Column 2 of Table 8 includes PIPE and SEO firms, and Column 3 looks at all CRSP/ Compustat firms. As additional controls we use the standard bankruptcy covariates from Column 1 and the amount of equity raised (in a PIPE or an SEO). We control for the amount of capital infusion to ensure that our conclusions are not mechanically driven by a firm's capital structure rebalancing. We find that the predicted PIPE covariate is significant at 1%. Its economic significance is also very high. A one standard deviation increase in predicted PIPE leads to a 96% decrease in the odds of default (in Column 2). The economic significance of predicted PIPE is higher than any of the other explanatory variables including Z-score. A one standard deviation increase in Z-score reduces the odds of default by only 25%.

Columns 4 and 5 present propensity score matched logistic estimation in which PIPE firms are first matched to either SEO firms or all firms based on pre-issuance differences in information asymmetry, predicted default probability, and access to public markets. Predicted PIPE issuance remains statistically and economically significant. When compared with our main control group of SEO firms, the odds of default decrease by 48% for a one standard deviation increase in the likelihood of PIPE issuance. Also, none of the information

asymmetry or default variables is significant, implying that the matching procedure is successful in minimizing the differences between our treatment and control groups with respect to the aforementioned characteristics.

The results of the default prediction regressions demonstrate that private equity issuance plays an important role in reducing the probability of default of PIPE firms, even after controlling for their information asymmetry and default probability. In the next subsection, we examine whether private placements facilitate debt renegotiations in practice and provide evidence that improved equity coordination post-issuance raises a firm's likelihood of favorable debt modifications.

4.2. Bank debt and loan renegotiation

As discussed in Franks and Sussman (2005), concentrated bank debt creates a trade-off. On the one hand, it could reduce the lenders' incentives to restructure a distressed firm (so-called lazy banking hypothesis). On the other hand, more concentrated bank debt makes the lenders vulnerable to strategic renegotiation by the firm (known as the soft banking hypothesis). We find results consistent with both hypotheses.

To study the effect of private debt on PIPE issuance, we focus on the ratio of private debt to the sum of private and public debt.[16] We create an indicator variable *High Ratio of Bank Debt* equal to one if a firm is in the top tercile in terms of its bank debt ratio. Our sample consists of the intersection of firms in Mergent FISD and LPC's Dealscan. Table 9 presents our results.

Insert Table 9

High bank debt is negatively correlated with PIPE issuance. This is consistent with the lazy banking hypothesis, i.e., the seniority of bank debt makes a lender less likely to work with a distressed firm, which reduces the coordination benefits of PIPE issuance. However,

[16]Most private debt is syndicated. A lead arranger bank has substantial decision power even though it could be providing only a fraction of the total financing. Consequently, private debt can be viewed as very concentrated.

the interaction effect between high bank debt and incumbent equity coordination is also negative and highly statistically significant. We interpret this result as evidence that a high ratio of bank debt (i.e., high likelihood of strategic debt renegotiation with lenders according to the soft bank hypothesis) increases the benefits of improving equity coordination. The results below confirm that PIPE issuance leads to favorable debt renegotiations within one year of a private placement.

To provide direct evidence that PIPE firms improve their financial health post-issuance, we examine whether private placements facilitate debt renegotiation in practice. We expect that the improved coordination of equity holders following a private placement manifests itself in better renegotiation outcomes. Specifically, we compare the debt modifications of PIPE and control firms matched on size (total assets), equity coordination (Shapley value), and distress level (Altman's Z-score) and look for favorable outcomes in terms of maturity, interest spread, and debt amount.

Unlike bond agreements that have a very low frequency of renegotiations, about three-quarters of bank loans are modified before their maturity (see Roberts and Sufi, 2009). We use bank loan data from Thomson Reuters LPC's Dealscan for the period 1995–2007. We include only facilities whose terms are modified within a year of PIPE issuance. For firms with multiple PIPE issues, we consider only their first private placement.

As discussed in Roberts and Sufi (2009), the most common renegotiation outcomes are maturity extensions (57% of their sample), amount increases (56%), and changes in spreads (55%). Following their approach, we classify favorable loan modifications as those that result in a decrease in interest spread without a decrease in loan amount or an increase in loan amount without an increase in spread. Unfavorable loan modifications are those that result in an interest spread increase without an increase in loan amount or a decrease in amount without a decrease in spread.

Panel A of Table 10 presents results of t-tests for differences in means between PIPE and matched control firms. Column 3 reports differences in the loan terms of PIPE firms before

and after the private placement. PIPE firms have fewer loan amendments post-issuance (significant at 1%). However, they are more likely to achieve favorable changes in loan terms (significant at 5%) and reduce their interest spreads (significant at 1%). PIPE issuers improve their likelihood of achieving a favorable outcome by 28% within one year of issuance.

Insert Table 10

Column 5 presents a similar comparison of PIPE firms after issuance and matched non-PIPE firms. PIPE issuers have a one-third higher likelihood of favorable debt renegotiations and experience statistically significant decreases in spreads and increases in loan amounts (both significant at 5%). The univariate results in Panel A suggest that PIPE issuance improves a firm's likelihood of a positive loan modification, resulting in a lower interest spread and a larger loan principal.

Panel B of Table 10 presents a difference-in-differences analysis, in which control firms are assigned a random (placebo) issuance date in the sample period. Columns 1 and 2 compare the average renegotiation outcomes of PIPE and control firms in the year before issuance. Columns 3 and 4 present loan changes in the year after issuance. Column 5 reports the difference-in-differences comparison between PIPE and matched firms before and after issuance. Confirming the univariate results, we find that PIPE issuers are much more successful in achieving favorable revisions of interest spreads (significant at 1%). In terms of the 36% unconditional probability of a favorable amendment, PIPE firms have a 40% higher probability of a positive outcome compared with their matched peers.

Both the univariate results and the difference-in-differences analysis suggest that PIPE issuance leads to favorable debt renegotiations within one year of a private placement. These loan modifications are generally associated with favorable changes in interest spreads and loan principals.

5. Robustness analysis

Our analysis differentiates the coordination mechanism from other explanations of the choice of external financing such as information asymmetry and access to public markets. We use propensity score matching techniques to correct for selection bias in terms of observable firm attributes. These conditioning variables come from the alternative hypotheses of private equity issuance in the existing literature. Specifically, we compare each PIPE issuer with its SEO counterparts in terms of pretreatment differences in information asymmetry, access to public markets, and predicted default probability.

The propensity score estimation does not take into account omitted variables that could influence an investor's choice to buy the private equity of a specific firm. Consequently, we conduct an IV analysis, in which we use the initial year mean industry Shapley value as an instrument for the firm-specific Shapley value of an issuer. The high statistical and economic significance of the (instrumented) Shapley value suggests that unobservable firm attributes do not seem to be a significant concern in our analysis.

We also address potential issues of unobserved heterogeneity by studying the PIPE discount. This discount is a result of a bargaining game between incumbent equity holders and new investors and takes into account firm attributes unobservable to the econometrician but observable by the agents. If improved equity holder coordination is not one of the potential benefits of a private placement, then we should not be able to explain the PIPE discount by the variation in our coordination proxies. However, we find a high correlation between the PIPE discount and Shapley value.

Two additional robustness tests support our conclusions. First, we examine cases in which a private equity issue is a part of a debt renegotiation package. In that case, a PIPE might be in anticipation of or a precondition to getting the support of debtholders in avoiding default, which implies reverse causality. Using information on bond issues from Mergent FISD and loan facilities and amendments from LPC's Dealscan, we find that a PIPE is a part of a renegotiation package in less than 2% of all transactions. In unreported

results, we reestimate the probability of PIPE issuance as a function of equity coordination and debt concentration, excluding PIPEs with a debt contract in the 60-day window around the private placement. The exclusion of these packaged PIPE deals has virtually no effect on the estimated coefficients. We conclude that PIPE issues are not typically part of a packaged renegotiation with debtholders, which mitigates concerns of reverse causality in our estimation.

Second, we study the role of management in the decision to issue private equity. Dispersed equity holders could lack the ability to come to an agreement, in which case a private placement is impossible without the help of management. To measure management's incentives for shareholder maximization, we use the CEO incentive measures from Kalpathy (2009), who applies the method in Core and Guay (2002).The incentive-alignment measures are CEO delta and CEO vega. CEO delta measures the change in the value of a manager's stake (including equity and options) for a given change in stock price. CEO vega captures the sensitivity of managerial wealth to stock return volatility.[17] We observe that PIPE firms have higher CEO delta and vega (significant at 1%) than comparable firms suggesting that PIPE managers have higher incentives to maximize shareholder value.

In Table 11, we add controls for managerial incentives in the regressions predicting PIPE issuance. We define two dummy variables (*High CEO Delta* and *High CEO Vega*) to indicate whether a CEO is in the top tercile of the respective measure for managerial incentives. PIPE firms are compared with SEO firms in the first three columns and to all firms in the next three columns. The interaction effect between CEO delta and predicted default is positive and highly economically significant. This implies that managerial incentives have a positive effect on the probability of PIPE issuance conditional on the firm being distressed. However, we also find that high CEO delta is negatively correlated with PIPE issuance. This intuitive result suggests that CEOs with higher incentives are unconditionally less likely to support

[17]Due to changes in disclosure rules in 2006, we can use a firm's detailed reports of executive options in 2006 and 2007. For 1995–2005, we define CEO delta following the approximation approach in Core and Guay (2002).

a private placement.

Insert Table 11

6. Conclusion

In this paper, we study the circumstances in which a private investment in public equity is an attractive strategy for a firm. We argue that private equity issues improve the coordination ability of equity holders and facilitate negotiation of firm policies with debtholders.

We demonstrate that the option to issue equity privately is more valuable for firms with a dispersed shareholder base and concentrated public debt. Using a comprehensive data set of PIPE transactions in the United States between 1995 and 2007, we establish a strong causal link between the coordination ability of incumbent equity owners and PIPE issuance. This result obtains even after propensity score matching on the alternative explanations of private equity issuance in the existing literature. In addition, we find that the PIPE discount is directly proportional to the coordination gains expected by incumbent shareholders following the addition of new PIPE investors.

We also show the effect of the coordination channel on a firm's post-issuance debt renegotiation and default likelihood. PIPE issuance is highly significant in predicting a reduced likelihood of default. Controlling for the typical determinants of default, we find that a one standard deviation increase in predicted PIPE decreases the odds of default in half. We also provide direct evidence of favorable debt renegotiations within one year of issuance resulting in lower interest spreads and larger loan principals.

We conclude that private placements facilitate coordination of policy decisions between the shareholders and bondholders of financially distressed firms and reduce their likelihood of default.

Appendix

Table A1
Data definitions

Variable	Definition	Data sources
Equity Shapley Value	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.	Thomson Reuters Institutional Holdings
Bond Herfindahl Index	Sum of the squared face values of all outstanding bonds divided by the square of the sum of the face values.	Mergent Fixed Income Securities Database
Analyst Coverage	Number of analysts following a firm on an annual basis.	I/B/E/S International
Trading Volume	Trading volume divided by the average number of outstanding shares over the previous two years.	CRSP
R&D ratio	Research and development expenditures/total firm assets.	Compustat
Altman's Z-score	(3.3 × pre-tax income plus sales) + 1.3 × retained earnings + [1.2 × (current assets minus current liabilities)/assets].	Compustat
Debt Capacity	Predicted probability of having a long-term bond rating estimated by a multinomial logit, with a dependent variable equal to one if a firm has an Standard and Poor's rating and independent variables firm size (log of lagged firm assets), profitability (operating income before depreciation/lagged assets), asset tangibility (property, plant and equipment/lagged assets), market to book (assets less book equity plus market equity/ lagged assets), leverage (long-term debt and debt due in one year/ lagged assets), lagged standard deviation of daily stock returns, and firm age (log of years since first Compustat record).	CRSP and Compustat
Predicted Default	Predicted probability of default estimated by a logistic regression, in which the dependent variable equals one if a firm suffers default or bankruptcy, and the independent variables are log of firm assets, earnings before interest, taxes, depreciation, and amortization/assets, book leverage, Altman's Z-score, and debt capacity.	CRSP and Compustat
CEO Delta	Change in the value of a manager's stake (including equity and options) for a given change in stock price (see Kalpathy, 2009).	ExecuComp
CEO Vega	Sensitivity of managerial wealth to stock return volatility (see Kalpathy, 2009).	ExecuComp

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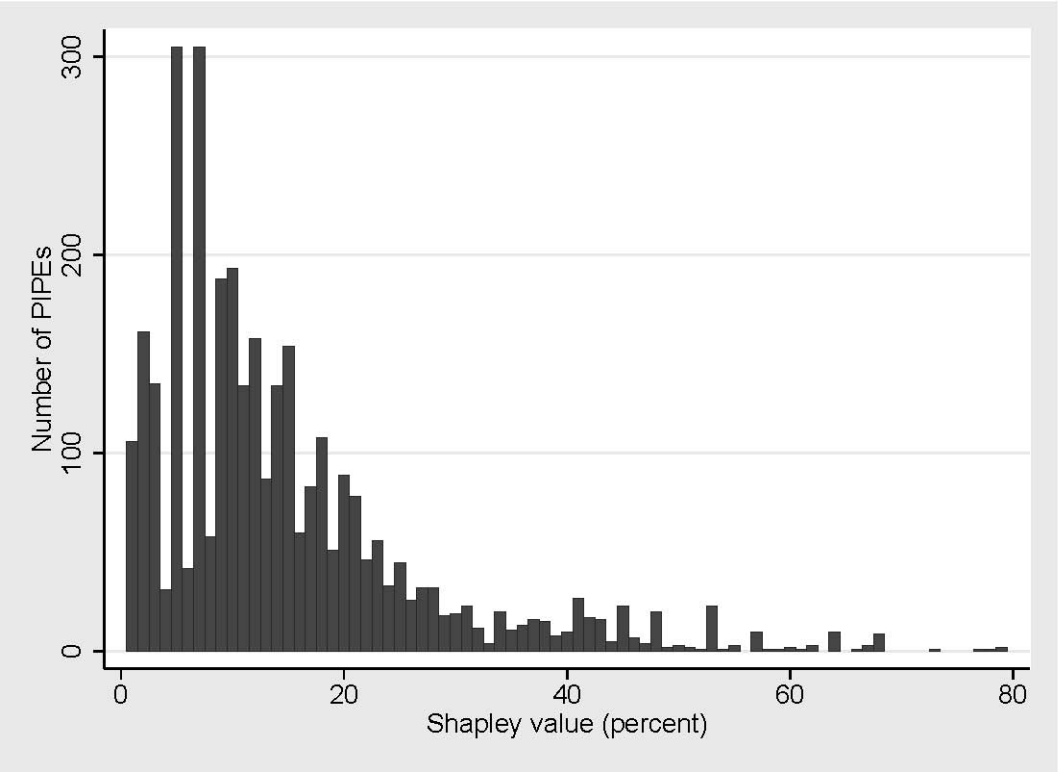

Fig. 1. Private investment in public equity (PIPE) issues and incumbent equity coordination. This figure plots the incidence of PIPE issues with respect to the coordination ability of incumbent equity holders, measured by the Shapley value of current institutional owners. The Shapley value captures the probability that a blockholder's vote will be pivotal in reaching a majority decision. The plot excludes PIPE issuers with Shapley values lower than 1%.

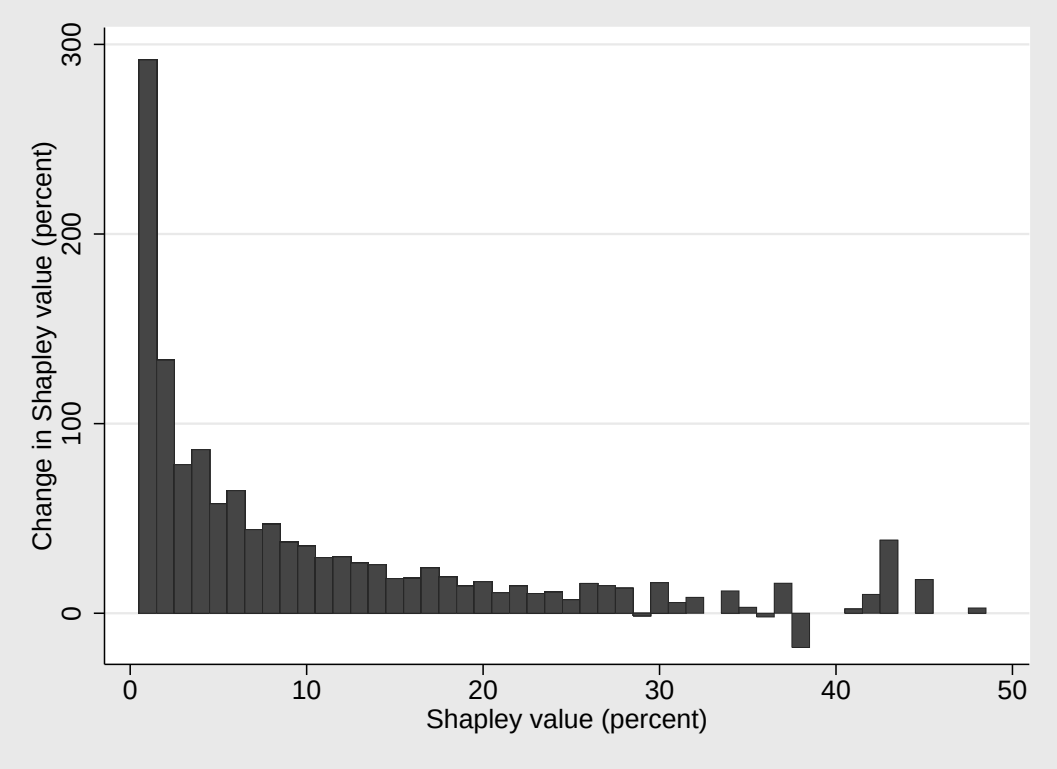

Fig. 2. Change in Shapley value following PIPE issuance. This figure shows the average change in a firm's Shapley value following a PIPE issue. The Shapley value measures the coordination ability of a firm's incumbent equity holders in reaching a majority decision. The reference quarter is the quarter before the private placement. The x-axis is the mean Shapley value before PIPE issuance; the y-axis is the mean percentage change in Shapley value after PIPE issuance.

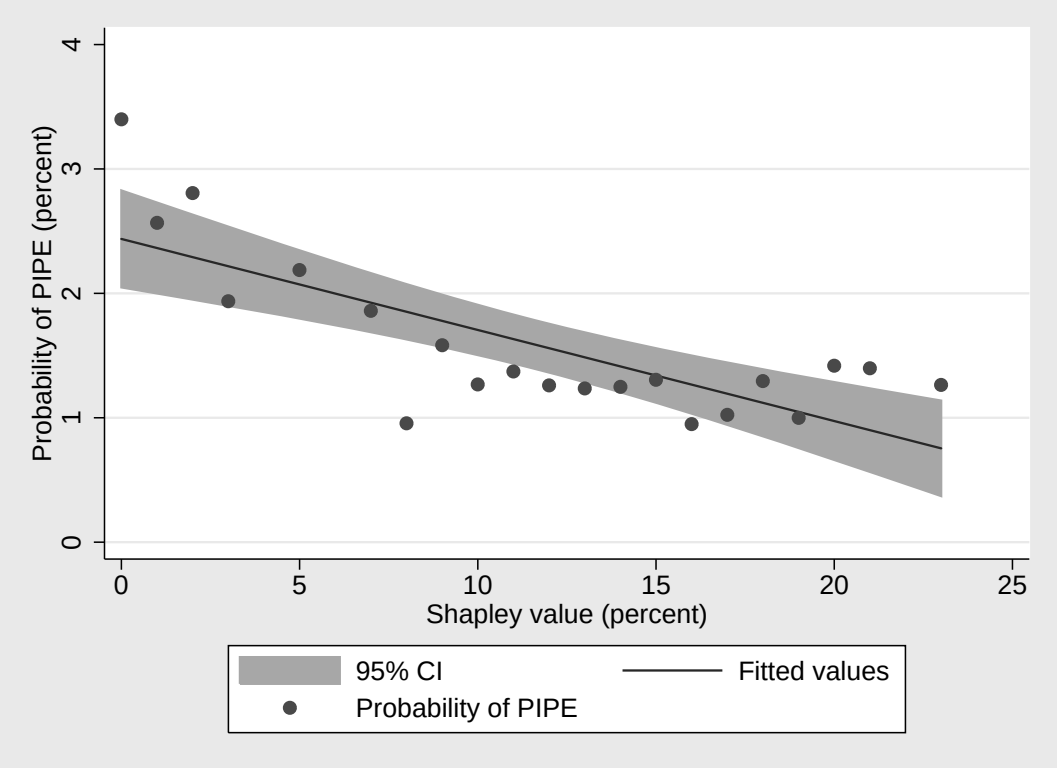

Fig. 3. Probability of PIPE issuance as a function of Shapley value. This figure plots the estimated probability of PIPE issuance as a function of a firm's lagged Shapley value. The Shapley value measures the coordination ability of a firm's incumbent equity holders in reaching a majority decision. 95% CI refers to the 5th and 95th confidence intervals. Excluded are firms with Shapley values exceeding 25% (top 10% of the PIPE sample).

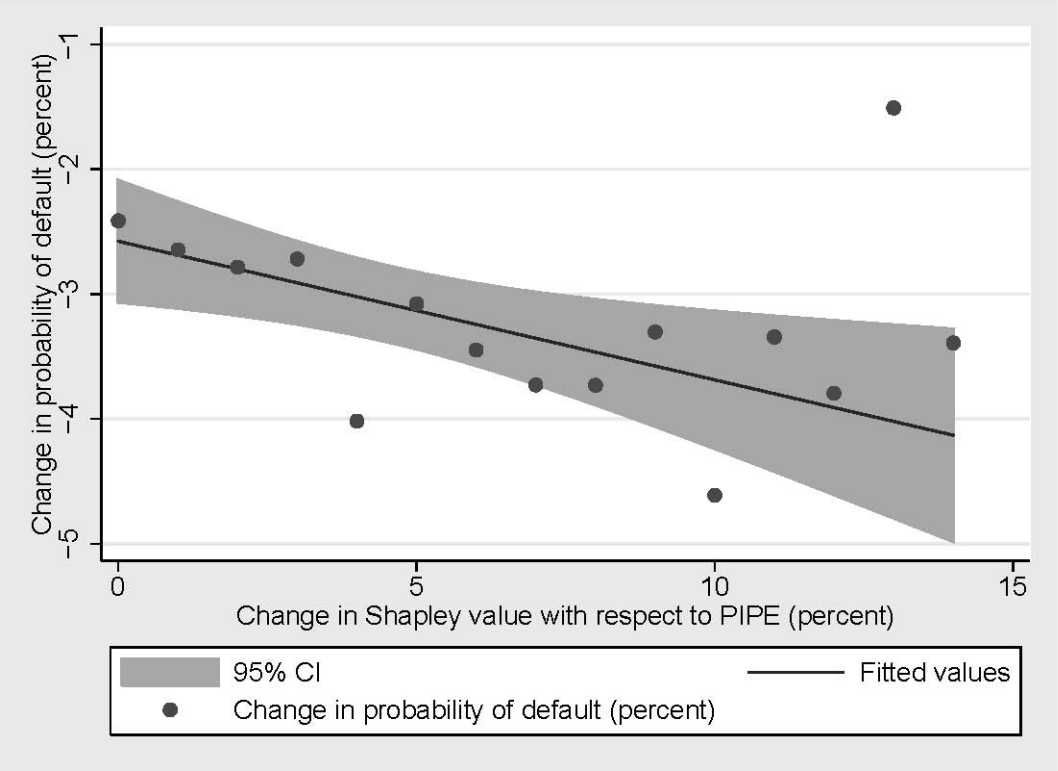

Fig. 4. Change in default probability versus change in Shapley value after PIPE issuance. This figure plots the change in predicted default probability after PIPE issuance versus the change in the issuer's Shapley value. The Shapley value measures the coordination ability of a firm's incumbent equity holders in reaching a majority decision. Default is estimated by a logistic regression, in which the dependent variable equals one if a firm suffers default or bankruptcy, and the independent variables are log of firm assets, EBITDA/assets, book leverage, Altman's Z-score, and debt capacity. 95% CI refers to the 5th and 95th confidence intervals.

Table 1
Private placement transactions, 1995–2007

The table reports statistics on the distribution of private placements in Sagient's PlacementTracker database. The sample covers 1995–2007 and excludes non-US, 144-A, and Regulation S issuers. Column 1 presents gross proceeds from secondary equity offerings (SEOs), and Column 2 reports gross proceeds from private investment in public equity (PIPE) issues. Data on public equity offerings are obtained from Thomson Reuters Securities Data Company (SDC) Platinum. Column 3 shows the percent of equity proceeds coming from PIPE issues. Columns 5 and 6 include only common stock private equity placements (i.e., non structured PIPEs). Column 7 reports the percent of PIPE issues with warrant coverage. Column 8 lists the percent of structured PIPEs in the sample, i.e., common stock or convertible issues with resets, structured equity or floating convertibles. $B denotes billions of dollars.

Year	Gross SEO proceeds, $B (1)	Gross PIPE proceeds, $B (2)	% Equity proceeds (3)	PIPE issues (4)	% Current discount (5)	% Equity dilution (6)	% with warrants (7)	% Structured PIPEs (8)
1995	31.65	1.33	4.03	114	25.19	20.36	4.19	30.70
1996	43.09	4.08	8.65	306	25.94	28.03	8.71	52.94
1997	47.00	4.75	9.18	456	16.18	28.42	7.01	57.24
1998	45.28	3.00	6.21	440	12.47	25.41	7.96	55.23
1999	63.72	10.30	13.92	691	14.39	22.58	13.59	28.08
2000	71.37	24.40	25.48	1,254	10.42	25.14	21.84	31.26
2001	51.29	14.60	22.16	1,036	7.33	25.95	16.08	21.91
2002	48.52	12.10	19.96	756	5.91	29.06	14.73	15.34
2003	49.34	11.60	19.04	880	14.16	25.86	20.60	6.70
2004	68.19	13.70	16.73	1,285	11.70	22.30	29.48	12.45
2005	59.26	16.90	22.19	1,325	7.99	25.14	31.77	15.16
2006	68.78	22.40	24.57	1,346	8.02	28.89	38.11	15.97
2007	67.05	24.70	26.92	876	7.61	34.20	30.72	11.19
Total	714.54	163.86		10,765				
Mean	54.96	12.60	18.65	828	12.87	30.07	23.06	21.95

Table 2
Correlation matrix of coordination and information asymmetry proxies

Pairwise correlation between coordination measures and common information asymmetry proxies. The sample period is 1995–2007. A firm's equity coordination is measured by the total Shapley value of its incumbent equity owners; a firm's debt concentration is proxied by the bond Herfindahl Index of outstanding public bond issues. Information asymmetry variables include research and development (R&D) expense ratio, analyst coverage, and trading volume. All measures are lagged by one quarter relative to the occurrence of a private placement.

	Private Placement	Equity Coordination	Debt Herfindahl	R&D Ratio	Analyst Coverage	Trading Volume
Private Placement	1.0000					
Equity Coordination	-0.0427	1.0000				
Debt Herfindahl	0.0180	-0.0073	1.0000			
R&D Ratio	0.0882	-0.0723	0.0930	1.0000		
Analyst Coverage	-0.0486	0.1123	-0.2180	-0.1014	1.0000	
Trading Volume	0.0547	0.0950	0.0036	0.0449	0.2508	1.0000

Table 3
Comparison of PIPE issuers with non-PIPE firms

The table reports results of two-sample t-tests with unequal variances. The sample period is 1995–2007. Panel A compares PIPE issuers with firms with secondary equity offerings (SEOs). Panel B compares PIPE firms with the average CRSP/Compustat firm. Equity coordination is measured by the total Shapley value of incumbent equity holders. Debt concentration is proxied by the Herfindahl Index of bond issues. All variables are defined in the Appendix. Columns 5 and 6 report the difference in means between PIPE and non-PIPE firms. Stars denote statistical significance (*** $p<0.01$, ** $p<0.05$, and * $p<0.1$).

Panel A: Comparison with SEO firms

	PIPE firms		SEO firms		Difference	Standard Error
	Mean	25%–75%	Mean	25%–75%	in means	of difference
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Equity Coordination	0.109	0.000–0.150	0.223	0.105–0.273	-0.114***	0.002
Debt Herfindahl Index	0.592	0.338–1.000	0.444	0.201–0.506	0.147***	0.015
R&D Ratio	0.073	0.013–0.093	0.023	0.000–0.029	0.050***	0.002
Analyst Coverage	1.309	0.693–1.946	2.023	1.386–2.708	-0.714***	0.019
Trading Volume	18.710	6.098–21.574	18.072	7.212–22.964	0.638*	0.382
Market-to-book	2.882	0.749–3.415	2.508	0.947–2.440	0.374***	0.078
Altman's Z-score	-2.711	-4.543– -0.340	0.271	0.055–1.099	-2.982***	0.039
Debt Capacity	0.066	0.001–0.023	0.370	0.040–0.704	-0.304***	0.004

Panel B: Comparison with all CRSP/Compustat firms

	PIPE firms		All firms		Difference	Standard Error
Variable	Mean	25%–75%	Mean	25%–75%	in means	of difference
Equity Coordination	0.109	0.000–0.150	0.157	0.040–0.200	-0.047***	0.002
Debt Herfindahl Index	0.592	0.338–1.000	0.494	0.209–1.000	0.098***	0.015
R&D Ratio	0.073	0.013–0.093	0.029	0.000–0.034	0.044***	0.002
Analyst Coverage	1.309	0.693–1.946	1.695	1.099–2.485	-0.386***	0.019
Trading Volume	18.710	6.098–21.574	11.812	3.358–14.334	6.898***	0.375
Market-to-book	2.882	0.749–3.415	2.733	0.656–2.097	0.149	0.100
Altman's Z-score	-2.711	-4.543– -0.340	0.088	-0.126–1.200	-2.798***	0.039
Debt Capacity	0.066	0.001–0.023	0.280	0.009–0.532	-0.215***	0.003

Table 4
Propensity score matching on information asymmetry and default likelihood

The table presents results of propensity score matching on pre-issuance differences in information asymmetry and predicted probability of default. The sample period is 1995–2007. Panel A compares private investment in public equity (PIPE) issuers only with firms with secondary equity offerings (SEOs). Panel B compares PIPE firms with the average CRSP/Compustat firm. Matched comparisons of PIPE issuers to non-PIPE firms use a single propensity score index to control for differences in information asymmetry (proxied by research and development expense ratio, analyst coverage, and trading volume) and predicted default (estimated by a standard bankruptcy regression using firm characteristics). Incumbent equity coordination is measured by the total Shapley value of institutional equity holders. Debt concentration is proxied by the Herfindahl Index of par values of outstanding bond issues. Variable definitions and estimation procedures are discussed in the Appendix. Stars denote standard statistical significance (*** $p<0.01$, ** $p<0.05$, and * $p<0.1$, respectively).

Panel A: Firms with secondary equity offerings					
	Sample	PIPE	No PIPE	Difference	Standard Error
Equity Coordination	Unmatched	0.160	0.226	-0.066***	0.007
	Matched	0.160	0.232	-0.072***	0.010
Debt Herfindahl Index	Unmatched	0.560	0.478	0.082***	0.032
	Matched	0.560	0.464	0.096***	0.035
Panel B: All CRSP/Compustat firms					
Equity Coordination	Unmatched	0.160	0.223	-0.063***	0.005
	Matched	0.160	0.211	-0.051***	0.005
Debt Herfindahl Index	Unmatched	0.560	0.459	0.101***	0.026
	Matched	0.560	0.502	0.058*	0.026

Table 5
Probability of PIPE issuance as a function of coordination proxies

The table presents estimation of the probability of PIPE issuance as a function of equity coordination and debt concentration, controlling for an issuer's information asymmetry and predicted default. The sample period is 1995–2007. Columns 2 and 4 restrict the comparison sample to firms with secondary equity offerings (SEOs), and Columns 3 and 5 use all CRSP/Compustat firms. Incumbent equity coordination is measured by the total Shapley value of institutional equity holders. Debt concentration is proxied by the Herfindahl Index of par values of outstanding bond issues. Column 1 includes only information asymmetry proxies [research and development (R&D) ratio, analyst coverage, and volume] and predicted default (estimated by a standard bankruptcy regression using firm characteristics). All variables are defined in the Appendix. Columns 2 and 3 report results of logistic regressions ($Y = 1$ if a firm issues private equity). Columns 4 and 5 present propensity score logistic estimation in which PIPE issuers are first matched to controls on information asymmetry, predicted default, and access to public markets. Standard errors are clustered by firm. Year fixed effects are included. Stars denote significance levels (*** p<0.01, ** p< 0.05, and * p<0.1).

	Logistic regressions			Propensity score matching	
Independent Variables	All firms	SEO firms	All firms	SEO firms	All firms
	(1)	(2)	(3)	(4)	(5)
Equity Coordination		-1.744***	-1.227**	-2.111***	-1.569**
		(0.636)	(0.614)	(0.704)	(0.661)
Debt Herfindahl Index		0.856**	0.953***	0.667*	0.634*
		(0.636)	(0.348)	(0.380)	(0.373)
R&D Ratio	5.744***	0.398	2.380	-1.357	1.039
	(0.850)	(2.777)	(2.926)	(1.967)	(1.753)
Analyst Coverage	-0.516***	-0.521***	-0.493***	0.015	0.101
	(0.040)	(0.133)	(0.124)	(0.155)	(0.142)
Trading Volume	0.006***	0.010**	0.014***	0.008	0.004
	(0.001)	(0.005)	(0.004)	(0.05)	(0.004)
Predicted Default	11.666***	6.078***	6.594***	1.053	1.426
	(0.578)	(0.846)	(0.769)	(0.978)	(0.823)
Amount Equity Raised		0.239		-0.087	
		(0.188)		(0.180)	
McFadden's R^2	14.56%	15.26%	17.37%	4.23%	3.83%
Number of observations	41,143	6,834	15,877	699	1,129

Table 6
Instrumental variables (IV) approach: PIPE issuance as a function of coordination proxies

The table presents an instrumental variables (IV) estimation of the probability of PIPE issuance as a function of equity coordination and debt concentration. The sample period is 1995–2007. Columns 2 and 4 restrict the comparison sample to firms with secondary equity offerings (SEOs), and Columns 3 and 5 use all CRSP/Compustat firms. The initial year (i.e., 1995) mean industry Shapley value is used as an instrument for the firm-specific Shapley value of an issuer. Incumbent equity coordination is measured by the total Shapley value of institutional equity holders. Debt concentration is proxied by the Herfindahl Index of outstanding bond issues. Column 1 includes only information asymmetry proxies [research and development (R&D) ratio, analyst coverage, and volume] and predicted default (estimated by a standard bankruptcy regression using firm characteristics). All variables are defined in the Appendix. Columns 2 and 3 report probit regressions ($Y = 1$ if a firm issues private equity). Columns 4 and 5 present propensity score estimation in which PIPE issuers are first matched to controls on information asymmetry, predicted default, and access to public markets. Standard errors are clustered by firm. Year fixed effects are included. Stars denote standard significance levels (*** p<0.01, ** p<0.05, and * p<0.1).

		Probit Regressions		Propensity score matching	
Independent Variables	All Firms	SEO firms	All firms	SEO firms	All firms
	(1)	(2)	(3)	(4)	(5)
Equity Coordination		-5.052***	-5.035**	-4.774***	-4.740**
		(0.459)	(1.357)	(0.771)	(1.908)
Debt Herfindahl Index		-0.131	0.003	-0.645	-0.562
		(0.238)	(0.169)	(1.037)	(0.773)
R&D Ratio	3.149***	-1.636	-0.348	-2.672**	-1.103
	(0.406)	(1.694)	(1.799)	(1.304)	(2.429)
Analyst Coverage	-0.240***	-0.001	-0.035	0.017	0.067
	(0.018)	(0.082)	(0.038)	(0.086)	(0.109)
Trading Volume	0.003***	0.002	0.006***	-0.001	0.0003
	(0.001)	(0.003)	(0.002)	(0.004)	(0.004)
Predicted Default	5.230***	1.874	3.053***	0.544	0.430
	(0.265)	(1.528)	(0.924)	(0.876)	(0.762)
Amount Equity Raised		0.041		-0.246**	
		(0.277)		(0.112)	
Pseudo R^2	20.25%				
Number of Observations	41,143	6,969	16,567	703	1,137

Table 7
Estimation of the PIPE discount to market price

The table presents analysis of the PIPE discount to pre-issue market price. The sample period is 1995–2007. Panel A compares the average PIPE discount between firms with above- and below-median levels of Shapley value (measuring equity coordination costs) and bond Herfindahl Index (measuring debt concentration). Panel B presents ordinary least squares (OLS) regressions in which the dependent variable is the (absolute) value of the PIPE discount. *High Debt Herfindahl Index* is an indicator for above-median bond Herfindahl Index. *Distressed Firm* denotes below-median Z-score. Standard errors are clustered by firm. Year fixed effects are included. Stars denote significance levels (*** $p<0.01$, ** $p< 0.05$, * $p<0.1$).

Panel A: Variation of PIPE discount with coordination proxies				
	Mean	Standard error	Difference	Standard error
Low Equity Coordination	18.356	0.399	-4.965***	0.507
High Equity Coordination	13.391	0.313		
Low Debt Herfindahl Index	10.792	1.155	5.586***	1.186
High Debt Herfindahl Index	16.379	0.270		

Panel B: OLS regressions of PIPE discount				
Equity Coordination	-11.309***	-10.950***	-11.151***	-9.283***
	(1.634)	(1.623)	(1.607)	(1.597)
High Debt Herfindahl Index		3.489***	3.006***	2.432**
		(1.290)	(1.204)	(1.198)
Distressed Firm			3.196***	2.618***
			(0.718)	(0.710)
Proceeds to Market Value			2.700*	2.091
			(1.506)	(1.554)
Warrant Coverage (percent)				5.908***
				(0.998)
McFadden's R^2	10.87%	10.86%	13.27%	15.96%
Number of observations	1,971	1,971	1,971	1,971

Table 8
Estimation of post-issuance default

The table reports predictive regressions estimating default probability as a function of private investment in public equity (PIPE) issuance ($Y = 1$ if a firm experiences bankruptcy or default). The sample period is 1995–2007. Column 1 presents a standard default regression on firm-level characteristics. PIPE is instrumented by Shapley value (measuring equity coordination costs) and bond Herfindahl Index (measuring debt concentration). Information asymmetry is estimated in a first stage ordinary least squares (OLS) regression based on research and development (R&D) ratio, analyst coverage, and volume. See the Appendix for variable definitions. Year fixed effects and clustered standard errors by firm are included in the first-stage regressions. Columns 2 and 4 restrict the comparison sample to firms with secondary equity offerings (SEOs), and Columns 3 and 5 use all CRSP/Compustat firms. Columns 4 and 5 present propensity score logistic estimation in which PIPE issuers are first matched to either SEO firms or all firms based on pre-issuance differences in information asymmetry, predicted default, and access to public markets. Stars denote standard significance levels (*** $p<0.01$, ** $p<0.05$, and * $p<0.1$).

	(Instrumental) logistic regressions			Propensity score matching	
Independent Variables	All firms	SEO firms	All firms	SEO firms	All firms
	(1)	(2)	(3)	(4)	(5)
Private Placement		-123.889***	-105.563***	-78.204***	-52.316***
		(46.234)	(32.267)	(31.443)	(21.605)
Log(Assets)	-0.361***	-0.565*	-0.358***	-0.215	-0.058
	(0.066)	(0.301)	(0.138)	(0.225)	(0.119)
EBITDA/Assets	-4.299***	-7.888**	-8.418***	-2.128	-3.808
	(1.420)	(3.773)	(2.741)	(3.649)	(2.875)
Book Leverage	0.603***	-0.553	0.111	-0.247	-0.067
	(0.245)	(1.021)	(0.537)	(0.898)	(0.555)
Z-Score Tercile	-0.499***	-0.395	-0.450**	-0.033	-0.033
	(0.105)	(0.369)	(0.205)	(0.356)	(0.206)
Debt Capacity Tercile	0.937***	0.804*	0.783***	0.008	0.048
	(0.149)	(0.482)	(0.303)	(0.406)	(0.292)
Amount Equity Raised		0.358		0.081	
		(0.525)		(0.572)	
Information Asymmetry		19.833	19.474*	-12.595	-10.149
		(14.114)	(10.485)	(12.511)	(8.127)
McFadden's R^2	8.62%	9.72%	8.97%	4.41%	1.81%
Number of Observations	39,039	6,835	16,144	794	1,822

Table 9
Probability of PIPE issuance (controlling for bank debt)

The table presents estimation of the probability of PIPE issuance as a function of equity coordination and debt concentration, controlling for an issuer's information asymmetry, predicted default, and proportion of bank debt. The sample period is 1995–2007. Columns 1–3 restrict the comparison sample to firms with secondary equity offering (SEOs), and Columns 4–6 use all CRSP/Compustat firms. Incumbent equity coordination is measured by the total Shapley value of institutional equity holders. Debt concentration is proxied by the Herfindahl Index of par values of outstanding bond issues. A firm's ratio of bank debt is calculated as the proportion of bank debt to the sum of bank and bond debt based on the intersection of Mergent Fixed Income Securities Database and Thomson Reuters LPC's Dealscan. *High Ratio of Bank Debt* indicates firms in the top tercile of all firms in terms of their bank debt ratios. All variables are defined in the Appendix. Standard errors are clustered by firm. Year fixed effects. Stars denote significance levels (*** $p<0.01$, ** $p< 0.05$, and * $p<0.1$).

Independent Variables	SEO firms			All firms		
	(1)	(2)	(3)	(4)	(5)	(6)
Equity Coordination	-1.716***	-1.660***	-1.642***	-1.212**	-1.131*	-1.120*
	(0.634)	(0.625)	(0.625)	(0.613)	(0.609)	(0.614)
Debt Herfindahl Index	0.843**	1.042***	1.046***	0.940***	1.195***	1.297***
	(0.353)	(0.364)	(0.364)	(0.349)	(0.367)	(0.350)
R&D Ratio	0.425	-0.653	-0.634	2.418	1.492	1.312
	(2.780)	(2.582)	(2.582)	(2.933)	(2.626)	(2.544)
Analyst Coverage	-0.522***	-0.456***	-0.456***	-0.496***	-0.443***	-0.350***
	(0.133)	(0.134)	(0.134)	(0.124)	(0.124)	(0.117)
Trading Volume	0.010**	0.007	0.007	0.014***	0.011***	0.004***
	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.001)
Predicted Default	6.074***	5.967***	5.960***	6.581***	6.423***	6.595***
	(0.845)	(0.832)	(0.832)	(0.769)	(0.753)	(0.743)
Amount Equity Raised	0.237	0.321*	0.325*			
	(0.188)	(0.184)	(0.184)			
High Ratio of Bank Debt		-2.380***	-2.470***		-2.432***	-2.849***
		(0.702)	(0.703)		(0.700)	(0.870)
High Ratio of Bank Debt			-3.634*			-6.920***
x Equity Coordination			(2.001)			(2.675)
McFadden's R^2	15.28%	17.22%	17.24%	17.40%	19.16%	19.01%
Number of observations	6,793	6,771	6,771	15,810	15,767	15,783

Table 10
Loan renegotiations of PIPE issuers and matched control firms

The table reports a comparison of loan renegotiations between PIPE issuers and control firms matched on size (assets), equity coordination (Shapley value), and distress level (Altman's Z-score). The sample period is 1995–2007. Data on loan amendments are obtained from Thomson Reuters LPC's Dealscan and include all facilities whose terms are modified within a year of the issuance date. Only the first private placement is considered for firms with multiple PIPE issues. Panel A presents univariate comparisons of PIPE firms (before and after issuance) and the average matched control firm. Column 3 reports the difference in loan characteristics of PIPE firms before and after the private placement. Column 5 presents a comparison of PIPE firms after issuance and matched non-PIPE firms. Favorable amendments are classified following the approach in Roberts and Sufi (2009). Panel B presents a difference-in-differences analysis, in which control firms are assigned a random (placebo) issuance date. Stars denote significance levels (*** $p<0.01$, ** $p<0.05$, and * $p<0.1$).

Panel A: Univariate comparisons of loan renegotiations

	PIPE firms		Difference	Matched	Difference
	After issuance	Before issuance	after-before	control firms	PIPE after-Controls
Variable	(1)	(2)	(3)	(4)	(5)
Number of Amendments	3.279	4.218	-0.939*** (0.232)	4.637	-1.358*** (0.208)
Favorable Amendments	0.457	0.358	0.099** (0.050)	0.335	0.122*** (0.044)
Decreased Spread	0.737	0.623	0.114*** (0.038)	0.666	0.071** (0.033)
Increased Amount	0.308	0.298	0.010 (0.037)	0.239	0.069** (0.032)
Increased Maturity	0.254	0.273	-0.019 (0.036)	0.289	-0.035 (0.032)

Panel B: Difference-in-differences PIPE versus matched controls

	Before issuance		After issuance		Difference-
	PIPE firms	Control firms	PIPE firms	Control firms	in-differences
Variable	(1)	(2)	(3)	(4)	(5)
Number of Amendments	4.218	4.678	3.279	4.597	-0.858*** (0.414)
Favorable Amendments	0.358	0.356	0.457	0.312	0.143** (0.072)
Decreased Spread	0.623	0.715	0.737	0.617	0.211*** (0.057)
Increased Amount	0.298	0.248	0.308	0.230	0.028 (0.054)
Increased Maturity	0.273	0.322	0.254	0.255	0.048 (0.055)

Table 11
Probability of PIPE issuance [Chief Executive Officer (CEO) incentives for shareholder maximization]

The table presents estimation of the probability of PIPE issuance as a function of equity coordination and debt concentration, controlling for an issuer's information asymmetry, predicted default, and management incentives. The sample period is 1995–2007. Columns 1–3 restrict the comparison sample to firms with secondary equity offering (SEOs), and Columns 4–6 use all CRSP/Compustat firms. Incumbent equity coordination is measured by the total Shapley value of institutional equity holders. Debt concentration is proxied by the Herfindahl Index of par values of outstanding bond issues. CEO delta and vega proxy for management's incentives for shareholder maximization. CEO delta is defined as the change in the value of a manager's stake in the firm (including equity and options) for a given change in stock price. CEO vega captures the sensitivity of managerial wealth to stock return volatility. High CEO delta and vega indicate that a CEO is in the top tercile of all firms in terms of managerial incentives. All variables are defined in the Appendix. Standard errors are clustered by firm. Year fixed effects are included. Stars denote significance levels (*** $p<0.01$, ** $p< 0.05$, and * $p<0.1$).

Independent Variables	SEO firms			All firms		
	(1)	(2)	(3)	(4)	(5)	(6)
Equity Coordination	-1.760***	-1.917***	-1.922**	-1.288***	-1.503**	-1.507***
	(0.622)	(0.635)	(0.634)	(0.604)	(0.624)	(0.623)
Debt Herfindahl Index	0.729**	0.687*	0.684*	0.781**	0.660*	0.654*
	(0.341)	(0.351)	(0.352)	(0.345)	(0.353)	(0.353)
R&D Ratio	0.277	1.113	1.107	2.517	3.498	3.493
	(2.604)	(2.591)	(2.587)	(2.766)	(2.637)	(2.632)
Analyst Coverage	-0.412***	-0.373***	-0.371***	-0.342***	-0.308***	-0.307***
	(0.127)	(0.129)	(0.130)	(0.123)	(0.126)	(0.126)
Trading Volume	0.008*	0.008*	0.008*	0.012***	0.010***	0.010***
	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)
Predicted Default	5.208***	4.203***	4.201***	5.339***	4.119***	4.114***
	(0.832)	(0.953)	(0.953)	(0.803)	(0.898)	(0.898)
Amount Equity Raised	0.151	0.062	0.059			
	(0.194)	(0.186)	(0.187)			
High CEO Delta	-1.016***	-1.382***	-1.688***	-1.271***	-1.680***	-2.066**
	(0.272)	(0.306)	(0.648)	(0.285)	(0.301)	(0.621)
Predicted Default		8.526***	8.536***		10.783***	10.836***
x High CEO Delta		(2.583)	(2.607)		(2.306)	(2.315)
High CEO Vega			0.315			0.396
			(0.660)			(0.615)
McFadden's R^2	17.0%	18.0%	18.0%	19.7%	21.2%	21.2%
Number of observations	6,834	6,834	6,834	15,877	15,877	15,877