

Dynamics of Asymmetric Information and Capital Structure

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Abstract

I propose a model of financing decisions in an environment where asymmetric information changes through time. My goal is to determine the optimal sequence of securities as a function of the amount and dynamics of the asymmetric information advantage that insiders of the firm have with respect to outside investors. I identify a novel cost of debt that arises in this dynamic setting. Whereas in a one period model, debt is always preferred to equity because it is less sensitive to the private information managers have, with multiple overlapping investment projects, debt issues today make future security issues more sensitive to the degree of asymmetric information in the issuance period. I use the dispersion of analyst forecasts for different horizons to proxy for current and future asymmetric information and examine the financing of a large panel of US firms. I find that future adverse selection costs affect negatively the debt component of new external financing and positively the cash reserves of the firm. This evidence is consistent with the prediction of my model that companies try to minimize adverse selection costs intertemporally.

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1. Introduction

In this study, I propose a model of financing decisions in an environment with dynamic asymmetric information. In this setting, the choice of security depends not only on the current adverse selection cost of the security but also on the future information environment and future financing needs of the firm. When managers anticipate an increase in the asymmetric information, even though they have private information at present, managers may choose to issue equity. The goal is to determine the optimal sequence of securities as a function of the size and dynamics of the asymmetric information advantage that insiders of the firm have with respect to outside investors. I use dispersion of analyst forecast for different horizons, the probability of informed trading measure and analyst following to find support for my hypothesis. I find that the dispersion of analyst forecasts for the current year and following year have markedly different effects on the capital structure decisions of the firm which are consistent with firms trying to minimize adverse selection cost intertemporally.

Since the seminal research by Myers (1984) and Myers and Majluf (1984) it has been recognized that when it is impossible or costly for firms to convey the true value of their assets to outside investors, firms may be forced to forgo projects with positive net present value. In reaction companies optimally choose to use sources of funds that are insensitive to the information advantage of insiders. When managers know more about the mean expected returns, this leads to the classical pecking order of using all internal funds first and if additional capital is needed to be raised, debt should be issued. Equity

should be issued only as a last resort when the leverage is at a very high level at which the firm has exhausted its debt capacity.

In fact however, companies make a sequence of financing decisions over time. It is clear that myopically following the pecking order rule is not going to be optimal for a big proportion of firms. It is natural that insiders, namely the managers running the company, would do better if they minimize the adverse selection costs of all rounds of financing by picking an optimal sequence of securities. Although Myers and Majluf (1984) do not consider the dynamic issues explicitly, one solution that they propose for the single period problem suggests a remedy for the dynamic problem. If managers do not have an information advantage at some point before the investment has to be made, companies should build financial slack to be used later when the valuations of insiders and outsiders diverge.

For the majority of firms however, it is likely that they will suffer highest adverse selection costs while they are young and lack established relations with the capital markets. On the one hand for a typical firm, the information asymmetry may gradually be reduced through time as more and more investors start producing information about the firm and as it accumulates price histories of its securities. On the other hand, we often observe old established firms that still face significant information asymmetries when raising capital. Possible reasons for why the firm may become less transparent are sharp increases in prices of inputs, a change of the management team, a change in the corporate governance, or a change of the focus of the company through investments in projects that

are outside of main line of business or by developing new products². Essentially any change in the company that breaks patterns and invalidates the past historical experience of investors dealing with the firm diminishes the capability of outsiders to correctly price the securities of the firm. In this case, the informational advantage of managers receiving first-hand signals about the quality of the firm becomes bigger.

I consider a dynamic model of financing choices in a multiperiod setting. In this environment the choice of securities depends as much on the current level of adverse selection costs as on the change in adverse selection costs in the future. The main result is that firms may issue equity if corporate insiders anticipate that their asymmetric information advantage will increase in the future. This is a reversal of the single period intuition that firms issue debt in the presence of asymmetric information. The novel effect is that debt financing is associated with higher future adverse selection costs for the firm since the riskier securities of the levered firm will be more sensitive to the private information advantage of insiders. In addition, my model predicts that for big expected increases in adverse selection costs, firms may optimally raise financial slack and avoid external financing in the future.

Following the empirical literature, I consider the dispersion of analyst earnings-per-share forecasts as a proxy for asymmetric information. As Ryan (2001) shows, under fairly general restrictions on the analysts' information sets, forecast dispersion will decline when managers disclose information about future earnings that the analysts do not have and hence forecast dispersion can be used as a proxy for asymmetric information. An added advantage of forecast dispersion is that it provides an estimate

² Krishnaswami and Subramaniam (1999) show evidence that companies take into account expected adverse selection problems and try to mitigate them by spinning off firm divisions before raising more capital.

about the amount of information available to outside investors for different periods. Specifically I use the dispersion of forecasts about earnings for the current fiscal year and the following fiscal year to measure asymmetric information at present and in the future. I examine the slope coefficient on a regression of change in long term debt against financing deficit³. It measures the proportion of long term debt in total new external financing. I find, as predicted by my model, that the proportion of debt is negatively related to future adverse selection costs and positively related to adverse selection costs at present. The result is significant both statistically and economically and it does not appear to be driven by static trade off considerations or market timing. In particular, I control carefully for the risk level of the firm using the recent asset volatility of the firm, the unlevered Z-score and fixed effects for different long term issuer credit ratings and the effect of future adverse selection costs is robust. I also consider alternative proxies for the change in asymmetric information based on the number of analyst following the firm and the probability of informed trading measure (PIN), which can be estimated from the signed order flow, under the assumption that information events occur only at the beginning of a sequence of independent trading days. Therefore, the greater the estimated PIN⁴, the greater is the intensity of information asymmetry around firm *i*'s activity in a fiscal year. Finally, I find that firms with higher expected future asymmetric information keep higher levels of cash and marketable securities, consistent with the implications of the model.

³ For discussion of the test and evidence about the performance of the pecking order theory see Shyam – Sunder and Myers (1999) and Frank and Goyal (2003).

⁴ Annual estimates of PIN are kindly made available on the web by S. Hvidkjaer. For more details about the MLE estimation of PIN, see Easley, Hvidkjaer, and O'Hara, (2004).

The paper contributes to the body of literature that studies the effect of information asymmetry on the capital structure of the firm. It gives an alternative explanation why firms may issue equity even though in a one period setting equity is associated with higher adverse selection costs. I predict a different effect on the debt equity choice of adverse selection costs at present versus adverse selection costs in the future. The current literature predominantly considers the effect of current asymmetric information on capital structure but the evidence is mixed at best. Shyam-Sunder and Myers (1999) find that firms predominantly use debt when raising external financing but Fama and French (2002) challenge this result and Frank and Goyal (2003) find that the effect is restricted to large mature firms which arguably suffer from less asymmetric information problems. Lemmon and Zender (2004) consider explicitly the value of maintaining financial slack. Bharath, Pasquariello and Wu (2005) consider the effect of several proxies for asymmetric information based on the market microstructure literature. Dittmar and Thakor (2005) emphasize the effect of disagreement between investors and the managers of the firm. Korajczyk, Lucas and McDonald, (1992) consider the information asymmetry between earnings announcements and the effect on the secondary equity offering announcement effect while Viswanath (1993) studies the choice between cash and equity under asymmetric information. Chang, Dasgupta and Hillary (2004) study the effect of analyst following on capital structure, while Autore and Kovacs (2005) use the dispersion of analyst forecasts and the use of shelf and PIPE offers to study the hierarchy of financing choices. Finally, D'Mello and Ferris (2000) confirm that announcement effects of equity issues are negatively related to information asymmetry as measured by the dispersion of analyst forecasts.

The organization of the remainder of the paper is the following. Section 2 describes the model, section 3 discusses the empirical proxy for asymmetric information at different periods and shows the empirical test and section 4 concludes.

2. Model

There are 3 dates $t = 0, 1, 2$ (2 periods) in the model.

The model examines the capital structure decisions of firms that face adverse selection problems. In particular, managers are better informed about the prospects and the future payoffs of the firm than the potential outside investors. There are no moral hazard costs i.e. the managers maximize the value of existing (old) equity. Both managers (inside equity holders) and outside investors are risk neutral and the capital markets are under perfect competition where the intertemporal discount rate is 0, that is the expected returns for outsiders are 0.

The next section sets up the general structure where firms can only choose debt or equity to finance their project or they can pass up the investment opportunity and the amount needed for the investment is fixed. In addition, firms are not allowed to build financial slack by raising more capital than they can invest during the period. Later I will discuss a setting where this restriction is relaxed.

Project description

There are 2 types of firms, good (G) and bad (B) and it is common knowledge that the proportion of each type is 50%. There are 2 projects: Project A requires investment of I_0 at $t = 0$ and pays off at $t = 2$. The possible payoffs are a'' and a' ($a'' > a'$) depending on the quality of the firm. Project B requires an investment of I_1 at $t = 1$ and pays off $I_1 + b''$

if the firm is of the type G , and $I_1 + b'$ otherwise. Both projects have positive net present value i.e. $0.5[a'' + a'] - I_0 > 0$ and $0.5[b'' + b'] > 0$

Information structure

At $t = 0$ the managers receive a private signal $x \in \{g, b\}$ about the quality of their firm. Half of the firms receive a good signal g and half of them a bad signal b such that

$$Prob(G/g) = Prob(B/b) = q$$

If $q=0.5$ the managers do not know more than the market i.e. they know that their firm is of type G or B with equal probability. If $q > 0.5$ the insiders are better informed than outsiders about the prospects of the firm. If for example $q = 0.7$ and $x = g$, the managers know that their firm has a 70% percent chance to turn out to be of type G .

That is, at $t = 0$ there is asymmetric information and managers that received a good signal, managers that received a bad signal and outside investors will all have different expectations about the value of the firm and the payoffs of the projects and hence different valuation for the securities of the firm. Note that the quality of the signal q can be interpreted as the level of information asymmetry. The higher the q , the higher is the difference in the valuations of insiders and uninformed investors.

With probability $1 - p$ at $t = 1$ outsiders learn the $t = 0$ signal received by the manager. In other words, with probability $1 - p$ insiders and investors will have the same information set. I refer to this node as NoAI state.

With probability p at $t = 1$ the managers learn the type of the firm for sure, while the investors again believe each firm to be of type G with probability 0.5. In the sequel this state is referred to as HighAI state, since managers have a bigger advantage with respect to information compared to $t = 0$.

Figure 1 depicts the payoffs and the basic structure of the model.

I rule out any type of separating equilibrium due to signaling. While costless signaling holds under only some special conditions, signaling in general is costly and may not be available or optimal for all firms. Therefore the G firm faces financing costs due to the asymmetric information in a pooling equilibrium.

Securities' payoff description

At $t = 0$ the firm can issue debt in the form of a zero-coupon bond with face value of F_0 due at $t = 2$ or issue equity giving a proportion of α_0 of the future payoffs net of debt servicing. Analogously at $t = 1$ the firm can finance its project by raising debt with face value F_1 due at $t = 2$ or selling stock which gives rights to proportion α_1 of the firm net of debt repayment. Debt raised at $t = 0$ is senior to all securities and it includes a covenant that investment is always made at $t = 1$ if a positive NPV opportunity is available⁵. This debt is risky

$$I_0 > a' + b' + I_1 \quad (1)$$

For firms for which this condition does not hold issuing safe debt minimizes the adverse selection costs of outside financing trivially.

In order to price securities and measure asymmetric information costs let us start with the payoffs due to each class of investors under the possible capital structures.

At $t = 0$ the individual rationality (IR) conditions for outside investors are:

$$\text{Debt: } I_0 = 0.5[a' + b' + I_1] + 0.5F_0$$

$$\Rightarrow F_0 = 2I_0 - a' - b' - I_1$$

⁵ This assumption is simply meant to eliminate the possibility of debt overhang (Myers 1977) for the moment. Alternatively assume the NPV of the $t=1$ project is sufficiently high so that it always pays to stock holders to invest.

$$\text{Equity: } I_0 = \alpha_0 [0.5(a'' + b'' + I_1) + 0.5(a' + b' + I_1)]$$

$$\Rightarrow \alpha_0 = \frac{2I_0}{a''+b''+a'+b'+2I_1}$$

I measure the lemons costs (LC) of raising outside financing as the loss of firm of type G incurred by selling securities at the lower (market) prices that do not take into account the positive private information of the managers.

The fair debt value according to a manager that received a good signal about her firm is $qF_0 + (1 - q)(a' + b' + I_1)$. Therefore the lemons cost of issuing debt $LC(d)$ at $t = 0$ are

$$LC(d) = [2q - 1][I_0 - a' - b' - I_1] > 0$$

The fair equity value according to a manager that received a good signal about her firm is $\alpha_0 [q(a'' + b'' + I_1) + (1 - q)(a' + b' + I_1)]$. Hence the lemons cost of issuing equity at $t = 0$ $LC(e)$ are

$$LC(e) = \alpha_0 [q - 0.5][a'' + b'' - a' - b'] = (2q - 1)I_0 \frac{a'' + b'' - a' - b'}{a'' + b'' + a' + b' + 2I_1} > 0$$

In this setting the familiar Myers and Majluf (1984) result holds i.e.

$$LC(e) > LC(d) \text{ (see proof in the Appendix)}$$

At $t = 1$, first note that in the NoAI state that occurs with probability $1 - p$, managers and outside investors will have the same valuations for both the debt and the equity of the firm and therefore the companies can raise capital without incurring adverse selection costs.

When insiders and outside investors have different information about the value of the firm at $t = 1$ (HighAI state) the lemons costs will depend on the security chosen to finance the project at $t = 0$. Let us consider the two cases separately.

Case 1 the firm issued equity at $t = 0$

If the first investment is financed by equity we have the Myers and Majluf (1984) setting. i.e. at $t = 1$ managers will always finance the second project with debt. Analogous to issuing equity initially the individual rationality condition for $t = 1$ equity investors is

$$\alpha_I[0.5(a'' + b'' + I_1) + 0.5(a' + b' + I_1)] = I_1$$

The adverse selection costs of issuing equity given that equity was used at $t = 0$ $LC(ee)$ are

$$LC(ee) = I_1(a'' + b'' - a' - b') / (a'' + b'' + a' + b' + 2I_1)$$

If the necessary investment at $t = 1$, I_1 is such that it can be raised through issuing safe debt, there are no adverse selection costs. I assume debt is risky.

$$I_1 > I_1 + a' + b' \tag{2}$$

If (2) holds then the individual rationality condition for debt holders is

$$\text{Debt: } I_1 = 0.5[a' + b' + I_1] + 0.5F_1$$

$$\Rightarrow F_1 = I_1 - a' - b'$$

Given that managers in firms of type G know that debt with such face value is safe the adverse selection costs of issuing debt at $t = 1$ $LC(ed)$ are

$$LC(ed) = -a' - b' < LC(ee)$$

Case 2 the firm issued debt at $t = 0$

If the firm's investment at $t = 0$ is financed by debt, and (1) holds the residual payoffs that the firm can offer to new investors are positive if firms turn out to be of type G and 0 for type B firms. Therefore new equity and new (junior) debt will have the same

payoffs and the same high adverse selection costs. The IR condition for junior debt holders is

$$I_1 = 0.5F_1 \Leftrightarrow F_1 = 2I_1$$

And the lemons costs for issuing debt at $t = 1$ after debt was issued at $t = 0$ $LC(dd)$ are equal to the lemons costs associated with new equity $LC(de)$

$$LC(dd) = LC(de) = F_1 - I_1 = I_1$$

I have also considered a case where projects have more than 2 discrete possible outcomes and hence the payoffs structure of debt and equity would not be the same. While equity becomes more informationally sensitive than debt, the adverse selection costs associated with both securities are higher compared to the same securities in an all equity firm which is the necessary condition.

Optimal sequence of securities

Solving backward from $t = 1$, when the first project was funded with equity it is optimal to finance project B with debt. When project A was financed with debt both types of financing incur the same high adverse selection costs. So the possible sequences are

1) $t = 0$ debt; $t = 1$ debt/equity or

2) $t = 0$ equity; $t = 1$ debt.

Note that introducing information asymmetry provides another rationale for debt capacity. Debt is a dominating security in this setting since the only friction is that insiders are better informed about the future value of the firm. Debt is safer than equity and its value depends less on the private information. However, pushing up the leverage of the firm may not be optimal even without any dissipative costs associated with

bankruptcy and reorganization. Once there is senior debt in the capital structure all securities become riskier and more sensitive to the private information advantage of insiders.

A manager maximizing the value of existing equity would minimize the total expected lemons cost associated with $t = 0$ debt and $t = 0$ equity. The sum of adverse selection costs associated with debt is smaller than the ones associated with equity if and only if,

$$LC(d) + LC(dd) = LC(d) + LC(de) < LC(e) + LC(ed) \quad (3)$$

⇔

$$[2q - I][I_0 - a' - b' - I_1] + pI_1 < (2q - I)I_0 \frac{a'' + b'' - a' - b'}{a'' + b'' + a' + b' + 2I_1} + p(-a' - b') \quad (4)$$

Rearranging

$$p[I_1 - (-a' - b')] < [2q - I][I_0 \frac{a'' + b'' - a' - b'}{a'' + b'' + a' + b' + 2I_1} - (I_0 - a' - b' - I_1)] \quad (5)$$

This is the main result of the model. The left hand side is positive and represents the difference in future adverse selection costs associated with debt and equity. The right hand side is also positive and represents the difference between the adverse selection costs incurred this period ($t = 0$) by issuing equity and by issuing debt. Issuing debt at $t = 0$ is associated with lower immediate adverse selection cost and higher expected adverse selection costs next period. This leads to the following results:

Corollary 1: Debt issues are positively related to the amount of asymmetric information in the current period, as measured by the parameter q .

Corollary 2: Debt issues are negatively related to the amount of expected future asymmetric information, as measured by the parameter p .

Naturally, the firms should try to use debt at the period when the perceived savings in adverse selection costs are higher. In addition it is less likely for companies to choose debt when there are big investments coming up in the future, again describing a result very similar to debt capacity concerns without the typical tradeoff between tax shields of debt and the bankruptcy costs related to it.

The main difference of this model and static models under asymmetric information is that it does not restrict managers to myopic decisions i.e. choices of financing that take into account only current costs due to asymmetric information. In the setting of this study managers at $t = 0$ compare incurring lemons costs today for sure and the possible lemons cost that may be born by the company in a financing round next period. On the one hand, confirming the intuition of Myers (1984) and Myers and Majluf (1984), the value of the debt is less sensitive to asymmetric information advantage of insiders so it minimizes current lemons costs. On the other hand issuing debt today would make all securities next period riskier and more sensitive to private information. In the simplest case with 2 possible payoff states in fact debt has the same payoff structure and extreme lemons costs as equity.

Allow firms to build slack at $t = 0$

Another possible solution for firms that would expect high future adverse selection costs is to build up sufficient slack at $t = 0$ so additional raising of external capital is not needed. The following section allows companies to raise $I_0 + I_1$ at $t = 0$ and shows that building financial slack does not trivially solve the financing policy choice problem.

First note that, since equity values are more sensitive to private information, and in the absence of bankruptcy costs, building slack through issuing debt strictly dominates building slack through an equity issue. Consider a zero coupon bond that has present value of $I_0 + I_1$ and a face value of Fs . If (1) holds this debt will be risky and the individual rationality condition is

$$0.5Fs + 0.5(a' + b' + I_1) = I_0 + I_1$$

The lemons costs incurred by a firm that received a good signal associated with building slack $LC(s)$ are

$$LC(s) = (2q - 1)(I_0 - a' - b')$$

Note that as expected these costs are higher than the ones associated with raising I_0 only ($LC(d)$). Also, by definition the strategy of raising slack will not incur any adverse selection costs at $t = 1$.

Now consider the choice between raising slack and raising only I_0 at $t = 0$ through debt. Managers will choose the 'slack' strategy if and only if

$$LC(s) < LC(d) + LC(dd) \Leftrightarrow \quad (6)$$

$$(2q - 1)(I_0 - a' - b') < [2q - 1][I_0 - a' - b' - I_1] + pI_1 \Leftrightarrow$$

$$2q - 1 < p \quad (7)$$

This result is intuitive. Since slack is a policy through which the firm minimizes future adverse selection costs, this strategy is preferable to raising capital twice through debt at $t = 0$ and at $t = 1$ when the asymmetric information next period is relatively high compared to the current asymmetric information.

Next, consider the choice between building slack and issuing equity at $t = 0$. Managers would prefer to keep financial slack if

$$LC(s) < LC(e) + LC(ed) \Leftrightarrow \quad (8)$$

$$(2q - 1)(I_0 - a' - b') < (2q - 1) I_0 \frac{a'' + b'' - a' - b'}{a'' + b'' + a' + b' + 2I_1} + p (- a' - b') \quad (9)$$

There is no clear cut implication of the effect of current adverse selection problems. Depending on the parameters of the projects of the company it may pay to build financial slack or issue equity followed by debt. However it is true that there exist sets of parameter values for which (9) will not hold i.e. building slack is not always a dominating strategy. With respect to future asymmetric information, captured by p , the higher the adverse selection costs in the future, the more likely it is that the company will raise all necessary financing at $t = 0$ when the costs are relatively smaller. This leads to a testable hypothesis with respect to the cash balances of the firm.

Corollary 3: Higher expected future asymmetric information costs, as measured by p , will be associated with higher cash levels for the firm.

3. Empirical evidence

A significant problem of testing asymmetric information theory comes from the fact that by definition the proxies for private information are bound to be indirect. The literature has used three main groups of variables to identify companies with higher asymmetric information problems. The first is based on measures of divergence among the earnings forecasts by the analysts following the firm. The second group is derived from accounting variables aimed to capture firms with assets that are arguably harder to value by outside investors like higher growth opportunities, R&D expenses and

advertising expenses. Finally, following the intuition of microstructure models like Kyle (1985) and Easley and O'Hara (1987), measures have been developed to estimate the component of bid ask spread quoted by a market maker that is due to offset the losses of the specialists from trading with agents with superior information.⁶ These measures are proven to be useful in various cases, but there are other effects that affect the financing choice of the company. The most well known examples being the trade-off between tax shields and bankruptcy costs associated with debt and the market timing⁷.

To proxy for adverse selection costs at the current and future periods, I propose a measure based on analyst forecasts. Analysts provide on a monthly basis forecasts for the earnings per share for each of the following 4 quarters as well as up to five fiscal years ahead. I select forecasts made only during the month immediately preceding the beginning of a fiscal year that predict earnings for the coming fiscal year or for the fiscal year that would start a year in the future. I measure the amount of asymmetric information as the dispersion of analyst forecasts scaled by the mean forecast value.

My main data source is the I/B/E/S database, a product of Thomson Financial. Accounting variables come from Compustat. It is important that for each firm/year there are more than 3 forecasts available in IBES both for the coming 12 month period as well as for the period from month 13 to 24 ahead. I use the dispersion for the near term as proxy for asymmetric information this period and the dispersion for the following fiscal year as a proxy for expected future adverse selection costs. Because of data availability, my sample period is from 1986 to 2005. It includes 40112 firm/year observations of

⁶ Look at Clark and Shastri (2000) for a comprehensive empirical comparison of different asymmetric information proxies

⁷ Look at Baker and Wurgler (2002) and Fama and French (2002) among others for more detailed discussion and empirical evidence for these hypotheses.

which 5234 also have forecasts for fiscal year 2. As an illustration of the relative amount of asymmetric information, I assign a 2-digit rank to each firm. The first digit regards dispersion for fiscal year 1, the second digit the dispersion for fiscal year 2. I calculate the median dispersion for both horizons for my sample every year and assign a value of 1 if the dispersion of a firm is below the median, 2 if the dispersion is above the median and 3 if there are no forecasts for that horizon. For example a firm/year with a rank of 13 has dispersion for the next period that is below the median for that year and does not have forecasts for fiscal year 2. Table 1 and provides descriptive statistics for the sample.

First observe that about 13% percent of the sample has forecasts for both horizons. Second, there is significant time variation in the relative level of adverse selection cost proxy. If the relative amount of asymmetric information does not change through time one would expect that firms that had low asymmetric information this period will also have lower than most of the firms' dispersion over the next fiscal year.

Two caveats arise regarding this proxy of asymmetric information. First it can be argued that when analysts are particularly unable to provide an informative forecast they would tend to publish fictitious estimates that are clustered. It is straight forward however to look at the relation between the forecast dispersion and the difference between the mean earning forecast and the realized earnings. Clarke and Shastri (2000) for example find large positive correlation between the forecast error and the forecast dispersion which is indicative that the above consideration is unlikely to be problematic for the analysis.

Second it may be plausible that higher dispersion simply means higher (symmetric) uncertainty about future cash flows. Table 2 presents the correlation matrix

for the measures of asymmetric information and risk that are used in the analysis. It is unclear however why uncertainty over 2 different horizons would have an opposite effect of debt issuance. If analyst forecast standard deviation is associated with higher uncertainty or risk, the prediction of the trade-off theory would be that this proxy would decrease the share of debt in new issues. The reason is that riskier firms would suffer higher expected bankruptcy costs as well which would have a negative effect on borrowing. The prediction of this paper regarding current disagreement among analysts is exactly the opposite. If current forecast dispersion is high, the outside investors will be subject to a lemons problem and therefore companies would prefer to issue debt which is less sensitive to private information security. The effect of future adverse selection costs however should be unequivocal.

My approach is to look at the marginal financing decisions of firms (net debt issued and net equity issued) following the line of analysis of Shyam-Sunder and Myers (1999) and Frank and Goyal (2003). The base regression is of net debt issued on financing deficit, which is also equal to the total amount of external financing. A higher coefficient on the financing deficit (closer to 1) means that the firm predominantly issues debt to fill its needs. The model predicts that the propensity to use debt depends on the amount of asymmetric information today and tomorrow. Therefore I include interaction terms of financing deficit with forecast dispersion over fiscal year 1 and also with the dispersion over fiscal year 2. The hypothesis is that the dispersion today will be positively related and dispersion next period negatively related to net debt issued. The model predicts that controlling for current adverse selection costs, future asymmetric

information should decrease the proportion of financing needs of the firm that is satisfied with debt.

Table 3 contains the main empirical result of the paper. The model predicts that the coefficient on financing deficit is a function of the current and future asymmetric information costs. Therefore I consider interaction terms of financing deficit and the proxies of adverse selection costs for the corresponding period. As predicted, future information disadvantage of investors leads to lower usage of debt in the current period. The coefficients for the proxy for current asymmetric information are consistently positive but the effect is weaker and is significant only when controls for the credit rating of the firm are used.

Next I control for alternative capital structure explanations namely the trade-off model and market timing.

Other determinants of leverage

A pure adverse selection model of firms' capital structure decisions is based on information frictions at the moment when firms contact the external capital market. It uses a different set of variables than conventional, mostly cross-sectional empirical research on the level of debt that is usually rooted in the trade-off theory (see also Frank and Goyal (2003)). The basic trade-off theory states that the level of leverage is determined by trading off the tax benefit of debt against the expected cost of financial distress (see for example Bradley et al. (1984)). Hence, firms with a high present value of tax benefits and/or a low present value of expected distress costs should have higher levels of debt. Rajan and Zingales (1995) narrow the list of conventional determinants

down to four main variables: profits, size, tangibility of assets and the market-to-book ratio.

More tangible assets support debt because it means that firms can collateralize the debt which reduces bankruptcy costs. The market-to-book ratio is usually seen as a proxy for growth opportunities that should be negatively related to leverage. The argument is that leverage exposes firms to the “debt overhang” problem (Myers 1977) and that the future value of the firm is lost in bankruptcy. A recent alternative explanation for a negative relationship is market timing. Firms with a high market-to-book ratio are overvalued and hence issue equity to take advantage of it (Baker and Wurgler (2002)). Sales are usually positively associated with leverage. There is no clear theoretical foundation but one normally argues that larger firms have a better reputation or are less likely to go bankrupt so they can borrow more.

Profits show up regularly as a negative determinant of leverage. Traditionally this has been seen as a challenge for conventional trade-off models of leverage. They predict that more profitable firms should issue more debt since more profitable firms have a smaller risk of bankruptcy and have more taxable income to shield (see Titman and Wessels (1988) and Fama and French (2002)).⁸

Next let us examine the financing decisions of firms and see how they depend on the 2 asymmetric information proxies. Again we would expect that current and future adverse selection costs would have markedly different effect on the financing decisions of the firm. Market timing and trade off explanations as well as careful controls for the effect of financial slack is needed.

⁸ Recent dynamic trade-off theories can predict a negative relationship between profitability and leverage (for example Strebulaev (2004) and Hennessy and Whited (2004)).

The last column in Table 3 reports the results from regressing change in long term debt on the conventional capital structure variables and the asymmetric information proxies controlling for the long term credit rating of the firm.

Finally, Corollary 3 derives a testable hypothesis with respect to the cash/financial slack levels of the firm. When raising external financing in the future is costlier due to adverse selection costs, firms should hold bigger cash reserves.

The literature on cash management of the firm identifies profitability, investment opportunity set, as measured by the market-to-book ratio and size, as measured by the natural log of sales, as some of the most important determinants of cash levels. Other potentially important factors are the hedging needs of the firm (see Acharya, Almeida and Campello (2005) for discussion and empirical evidence). Table 4 reports results from regression of cash levels on conventional determinants of financial slack and future analyst forecast dispersion. The effect of future adverse selection costs is positive and significant. Figure 2 provides some non parametric evidence that cash balances of firms that are likely to suffer significant adverse selection costs in the future maintain larger balances of cash and marketable securities. Table 5 reports regression results of cash and marketable securities on the conventional variable and proxies for asymmetric information. The effect of future asymmetric information on cash is positive which is consistent with the prediction of the model. Finally Table 6 reports results from the baseline regression of change of long term debt on alternative proxies for asymmetric information. In the first column I use the current number of analysts following the firm as a proxy for the information asymmetry after 1 year and the number of analysts following the firm 12 month before the beginning of the fiscal year as proxy for private information

today. As predicted by the model the higher the analyst coverage (the smaller the expected information asymmetry in the future) the higher the proportion of long term debt in total new external financing. This result does not change qualitatively if I use the number of analyst covering the firm at present and number of analysts covering one year into the future.

Finally, I use the probability of informed trading measure (PIN) in the current fiscal year and the next fiscal year but the results do not support the prediction of the model. One possible explanation is that PIN during the next fiscal year is an ex-post measure which may not capture the ex-ante estimate of asymmetric information expected in the future. Moreover, more research is needed to ascertain to what extent measures of information asymmetry in the secondary markets (such as PIN) are a reasonable measure of the private information advantage that managers have with respect to outside providers of capital in the primary markets.

4. Conclusion

In conclusion, I present a multiperiod model with overlapping investments in which the amount of adverse selection cost of external financing varies through time. The model suggests that the optimal sequence of securities is chosen to minimize the adverse selection cost incurred in all rounds of financing. Debt issuance is positively related to asymmetric information at the current period and negatively related to future asymmetric information and future investments needed. In a setting with no taxes or bankruptcy costs I get several results that are typically associated with the debt capacity of the firm. I use the dispersion of analyst forecasts over different horizons to proxy for different levels of adverse selection costs at present and in future periods.

Appendix

$$LC(d) < LC(e) \Leftrightarrow \tag{A1}$$

$$[2q - 1][I_0 - a' - b' - I_1] < (2q - 1) I_0 (a'' + b'' - a' - b') / (a'' + b'' + a' + b' + 2I_1)$$

Multiplying through by $(a'' + b'' + a' + b' + 2I_1) / (2q - 1)$ and simplifying the expression

$$(A1) \Leftrightarrow I_0 - a' - b' - I_1 < a'' + b'' - I_0 + I_1$$

$$\Leftrightarrow 0 < (a'' + a' - 2I_0) + (b'' + b') + 2I_1 \tag{A2}$$

The terms in the brackets are positive since both investment projects are assumed to be with positive net present value. Therefore (A1) holds.

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Figure 1
Timeline and information structure of the model

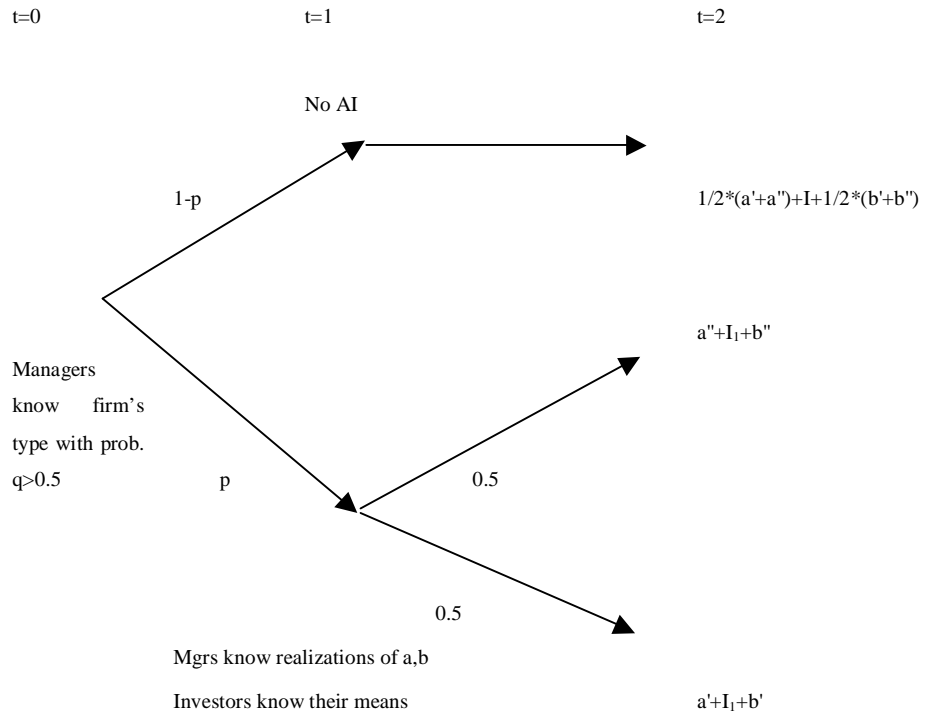


Table1**Balance sheets, cash flows and other descriptive statistics across asymmetric information groups**

The table reports average balance sheets, cash flow items and other descriptive statistics for each asymmetric information group. The first digit of the represents relative asymmetric information for the following year. The second digit represents relative asymmetric information 1 year into the future. Value of 1 denotes a below median number value of 2 above median, a value of 3 denotes that there were no analyst forecasts for that firm for that period. Asymmetric information is measured by the dispersion of analyst forecasts for the corresponding period. Each item is calculated as a percentage of the book value of total assets and then averaged across all firms in a decile. Definitions of variables follow Frank and Goyal (2003) and Fama and French (2002).

Asymmetric information index* Number of Observations	11 (Low/Low)		12 (Low/High)		13 (Low/n.a)		21 (High/Low)		22 (High/High)		23 (High/n.a)	
	2207		987		16862		307		3028		16665	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
This year forecast dispersion	0.026	0.023	0.039	0.038	0.032	0.030	0.123	0.084	0.481	0.163	0.427	0.142
Next year forecast dispersion	0.031	0.030	0.133	0.083		0.000	0.039	0.040	0.466	0.195		0.000
Number of analyst estimates	18.116	17.000	17.226	16.000	8.289	6.000	15.173	13.000	15.245	14.000	7.187	5.000
PIN	0.124	0.019	0.135	0.014	0.168	0.013	0.139	0.013	0.141	0.009	0.188	0.009

Table 2**Measures of Information asymmetry and risk: Correlation Matrix**

This table reports the correlation matrix of the alternative measure of risk and asymmetric information. PIN is the probability of informed trading measure as used in Easley, Hvidkjaer, O'Hara,(2004). NUMEST is the number of analyst following the firm. Z-score is unlevered Z-score. ***,** and * denote significance at the 1%, 5% and 10% level respectively.

	Analyst Forecast Dispersion Year 1	Analyst Forecast Dispersion Year 2	NUMEST	PIN	Asset Volatility	Zscore
Analyst Forecast Dispersion Year 1	1.000	0.409***	-0.050***	0.109***	0.115***	-0.243***
Analyst Forecast Dispersion Year 2	0.409***	1.000	-0.098***	0.123***	0.145***	-0.318***
NUMEST	-0.050***	-0.098***	1.000	-0.437***	-0.137***	0.015**
PIN	0.109***	0.123***	-0.437***	1.000	-0.014	0.083***
Asset Volatility	0.115***	0.145***	-0.137***	-0.014	1.000	-0.254***
Zscore	-0.243***	-0.318***	0.015**	0.083***	-0.254***	1.000

Table 3**Regression of net debt issues on conventional variables, asymmetric information proxies and financing deficit**

Asymmetric information is measured by the dispersion of analyst forecasts for the corresponding period. Tangibility is defined as property, plant & equipment over total assets. Market-to-book is defined as in Fama and French (2002). LogSales is the natural logarithm of net sales. Profitability is operating income before depreciation over total value of assets.. t-stats reported below the coefficients.

Dependent Variable	Change in LT debt	Change in LT debt	Change in LT debt	Change in LT Debt (LT rating fixed effects)
Intercept	-0.004	0.024	0.024	n.a
	-3.227	4.134	4.027	n.a
Deficit _t	0.224	0.278	0.253	0.326
	22.224	14.047	21.745	22.680
Deficit _t *Dispersion _{t t-1}	0.005	0.006	0.005	0.040
	0.782	1.011	0.747	2.778
Deficit*Dispersion _{t+1 t-1}	-0.012	-0.008	-0.009	-0.049
	-3.176	-2.252	-2.373	-3.060
Volatility of assets _{t-1}		-0.744		
		-1.286		
Zscore _{t-1}			0.003	
			1.638	
LogSales _{t-1}		0.000	0.001	0.000
		0.598	0.886	0.490
MTB _{t-1}		-0.003	-0.003	-0.002
		-6.646	-6.460	-2.935
Profitability _{t-1}		-0.006	-0.014	0.034
		-0.531	-1.196	1.940
Tangibility _{t-1}		0.011	0.007	0.011
		2.060	1.251	1.906
Leverage _{t-1}		-0.128	-0.124	-0.148
		-18.291	-17.132	-17.811
# of observations	5234	5109	4785	3394
Adj. R-squared	0.093	0.158	0.155	0.253

Figure 2

Mean total external financing and cash levels for firms with different expected change in asymmetric information

Descriptive stats (means) calculated for each quintile based the difference between 2 year forecast dispersion (long term) and 1 year forecast dispersion (short term).

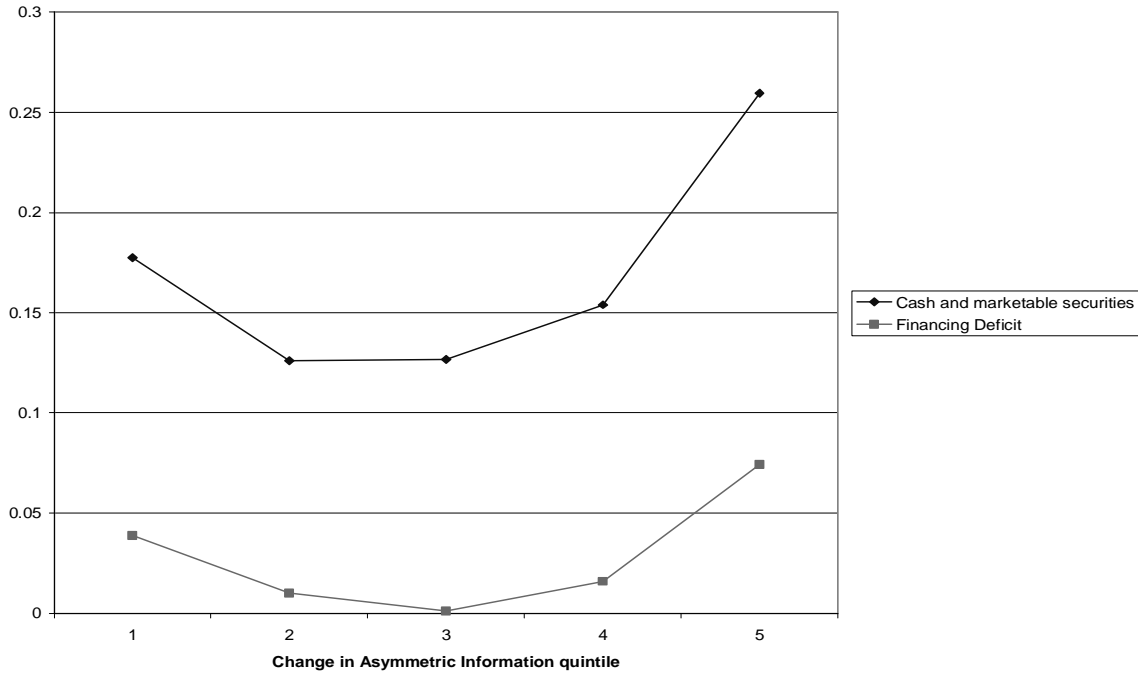


Table 4

Mean total external financing and cash levels for firms with different expected change in asymmetric information

	Change in information asymmetry				
	low	2	3	4	high
Cash and marketable securities	0.177	0.126	0.127	0.154	0.260
Financing deficit	0.039	0.010	0.001	0.016	0.074

Table 5
Effect of asymmetric information proxies on cash balances held by the firm

Asymmetric information is measured by the dispersion of analyst forecasts for the corresponding period. Tangibility is defined as property, plant & equipment over total assets. Market-to-book is defined as in Fama and French (2002). LogSales is the natural logarithm of net sales. Profitability is operating income before depreciation over total value of assets. t-stats reported below the coefficient.

Dependent Variable: Cash and marketable securities	OLS	Year Fixed effects
Forecast Dispersion t	0.002 1.440	0.000 0.16
Forecast Dispersion $t+1$	0.014 7.291	0.009 5.341
Volatility of Assets $t-1$	6.911 48.483	3.693 19.11
Log Sales $t-1$	0.009 14.090	-0.024 -19.22
MTB $t-1$	0.014 15.972	0.011 14.32
Profitability $t-1$	-0.263 -15.680	-0.205 -13.54
Tangibility $t-1$	-0.152 -16.870	-0.199 -23.35
Leverage $t-1$	0.011 0.871	-0.081 -7.20
# observations	5219	5219
Adj R-sq	0.670	0.677

Table 6**Regression of change in long term debt on conventional variables, alternative asymmetric information proxies and financing deficit**

Asymmetric information is measured by the dispersion of analyst forecasts for the corresponding period. Tangibility is defined as property, plant & equipment over total assets. Market-to-book is defined as in Fama and French (2002). LogSales is the natural logarithm of net sales. Profitability is operating income before depreciation over total value of assets.. t-stats reported below the coefficients.

Dependent Variable	Change in LT debt	Change in LT debt
Intercept	0.009 3.040	-1.252 -3.734
Deficit _t	0.232 30.262	0.371 11.172
Deficit _t *Numest _{t-1}	-0.002 -1.390	
Deficit*Numest _t	0.010 7.422	
Deficit _t *PIN _{t-1}		-0.683 -3.996
Deficit*PIN _t		0.438 2.579
Volatility of assets _{t-1}	-0.101 -2.217	3.198 3.872
LogSales _{t-1}	0.002 5.467	0.002 3.662
MTB _{t-1}	-0.003 -9.542	-0.007 -7.426
Profitability _{t-1}	0.025 5.550	0.082 7.824
Tangibility _{t-1}	0.014 5.486	0.013 3.840
Leverage _{t-1}	-0.130 -39.834	-0.150 -31.761
# of observations	26122	10602
Adj. R-squared	0.190	0.256