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The impact of assets-in-place on corporate financing and investment decisions ☆

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ABSTRACT

In a dynamic setting with asymmetric information we consider firms' debt-equity choice and investment timing. We extend recent research by adding an abandonment option and assets-in-place and we show that these extensions make debt more attractive. This implies, e.g., that mature firms (with larger assets-in-place) mainly use debt financing, whereas young high-growth firms (without assets-in-place) frequently use equity financing and signal their type by early investment. Simulation analyses confirm this and our model is thus able to explain empirical patterns which contradict the static pecking order theory.

1. Introduction

How do assets-in-place impact a firm's investment and financing decisions when the financial market cannot perfectly observe the firm's potential? The debt-equity choice under private information has been a concern for decades. For example, Ross (1977) argues that good-type firms (firms with high expected future cash flows) use debt to signal their type, as the cost of financial distress is higher for bad-type firms than for good-type firms. Myers (1984) and Myers and Majluf (1984) establish an information-based explanation for the pecking order theory in which debt is preferred to equity. A key determinant in their analysis is the value of assets-in-place relative to the value of a new investment. Building on McDonald and Siegel (1984) and Morellec and Schürhoff (2011), we analyze the firm's debt-equity choice in a dynamic setting with asymmetric information. Firms can credibly convey information to outside investors through their timing of investment and choice of financing. Morellec and Schürhoff (2011) find that debt is rarely used in a separating equilibrium, but assets-in-place are not included in their analysis. This paper extends Morellec and Schürhoff (2011) in two directions. First, we allow firm owners to have an option to abandon the project at all times. This option substantially impacts the signaling strategies. A good-type firm now uses debt more often. Second, we analyze how assets-in-place impact corporate financing and investment decisions. Assets-in-place enhance the above pattern, but pooling equilibria also become more prevalent. Our consideration of assets-in-place is important for understanding empirical evidence on the debt-equity choice. For example, we can analyze the behavior of mature firms as opposed to young high-growth firms.[2]

The implications of the pecking order theory have been tested extensively in the literature. The initial positive evidence by Donaldson (1961) has been challenged by later empirical work, and to date there is little agreement as to whether or not firms

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[2] In our setup, good-type firms are characterized by higher future cash flows and larger values of assets-in-place compared to bad-type firms. The term *young high-growth firm* refers to firms in our model setup that face a valuable investment opportunity while not possessing any assets-in-place. In this case good-type firms only differ from the bad-type firms due to higher future cash flows.

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act according to this theory. For example, Shyam-Sunder and Myers (1999) find that the pecking order of securities describes observed financing choices well and performs better than the static trade-off model. Building on this analysis, Lemmon and Zender (2010) also consider debt capacity and find that unconstrained firms choose debt over equity when they need external financing. In contrast, firms with limited capacity rely more heavily on equity financing. Other papers find support for the pecking order theory to a lesser extent. For example, Frank and Goyal (2003) find that the pecking order does not describe the behavior of small firms well. In the sample presented by Fama and French (2005), half of the firms violate the behavior predicted by the pecking order. These are only a few of the examples of the opposing points of view in the empirical capital structure literature. Our model helps to shed light on the conflicting evidence. For example, the model provides a theoretical basis for the arguments used in Lemmon and Zender (2010).

While the implications of the pecking order theory are discussed, its main underlying assumption that imperfect information matters for corporate decisions is less controversial. For example, Chang et al. (2006) and Bharath et al. (2009) find that information asymmetry affects firms' capital structure decisions and financing choices. This is supported by Autore and Kovacs (2010), who find that time variation in information asymmetry is significantly related to firms' external financing decisions.[3] These findings show the relevance of private information for investment and financing decisions.

Dynamic issues of information asymmetries between the firm and outside investors have mostly been ignored, except for the analysis in Morellec and Schürhoff (2011). They find that investment timing can act as a signal and, consequently, the costs of adverse selection are reduced. This implies that equity becomes more favorable, and hence a deviation from the static pecking order is likely to be observed. However, Morellec and Schürhoff (2011) assume that firm owners are forced to continue with a project even though the profit flow is negative. Indeed, this also holds for debt holders, and thus they can be forced to take over a negative value in case of default. Our inclusion of an abandonment option prevents this. To analyze the implications of this in terms of empirical predictions we perform a simulation analysis.[4] We find that our abandonment option heavily tilts good-type firms towards debt financing. An equally important issue is our inclusion of assets-in-place. Our simulation analyses reveal that the major effect of assets-in-place is that debt becomes even more preferred. Thus, we verify that the abandonment option and assets-in-place are important determinants in an empirical analysis of firms' debt-equity choice.

The paper is organized as follows. Section 2 sets up a benchmark model under perfect information. Section 3 considers investment timing and the debt-equity choice with asymmetric information with an abandonment option and assets-in-place. Section 4 contains discussions and develops empirical predictions. Section 5 concludes, and proofs are postponed to the appendices.

2. Benchmark case with perfect information

Consider a firm composed of assets-in-place (AIP) and one risky investment opportunity. To set up the model we adapt as much as possible from Myers and Majluf (1984) and Morellec and Schürhoff (2011). The firm's initial capital structure consists of one share of common equity, the manager acts in the best interest of the passive, existing equity holders, markets are competitive, and all agents are risk neutral (value maximizing). The firm's type, k, relates to both the value of the AIP and the value of the investment opportunity. For tractability, we consider two different firm types, the good type ($k = g$) and the bad type ($k = b$). The good-type firm holds larger AIP and a more valuable investment opportunity due to higher expected future cash flows. With perfect information the firm's type is publicly known.

We separate the value of the AIP in two parts—tangibles and intangibles. Tangible assets are easily assessed by the financial market, whereas intangible assets are not. To focus on the impact of asymmetric information, we restrict our attention to intangible assets and normalize the value of tangible assets to zero.[5] Henceforth, we assume the value of the AIP is $\tilde{A}_k$ before the investment and A_k after the investment. We assume that $A_g > A_b$ holds.

The investment opportunity is a perpetual option to invest in a project, the firm has monopoly rights to this project, and there is a constant irreversible investment cost, $I > 0$. Once initiated, the firm receives a profit flow consisting of a state variable, X, scaled by a factor s_k (s depends on the firm's type) from which a fixed operating cost, $f > 0$, is subtracted. Thus, the profit flow is $s_k X_t - f$. We assume that $s_g > s_b$ holds. The fixed cost is similar across different firms in the industry under consideration and hence independent of firm quality. The firm owners have an option to abandon the project. The abandonment option is important because the operating costs can lead to a negative profit flow. Including the option to abandon effectively models a situation in which investors are protected by limited liability.

The state variable, $X = (X_t)$, captures shocks in the cash flow, e.g., shocks in demand resulting in price fluctuations in the output product. One could think of this as an industry index. At time t, X_t is publicly observable and X follows a geometric Brownian motion

$$dX_t = \mu^P X_t dt + \sigma X_t dZ_t^P, \quad X_0 > 0, \tag{1}$$

where the drift rate μ^P and the volatility $\sigma > 0$ are constant over time. $Z^P = (Z_t^P)$ denotes a standard Brownian motion under the objective (physical) probability measure $\mathbb{P}$.

We assume that the financial market is dynamically complete and free of arbitrage and that there is a constant risk-free interest rate, r, implying that all gains processes must earn the risk-free rate of return under the risk-neutral measure $\mathbb{Q}$. This implies that there is a market price of risk, λ, so that the risk-neutral drift rate of X is $\mu = \mu^P - \lambda\sigma$ under $\mathbb{Q}$.[6] That is, if $Z = (Z_t)$ denotes a standard Brownian motion under the risk-neutral measure, X follows a geometric Brownian motion

$$dX_t = \mu X_t dt + \sigma X_t dZ_t, \quad X_0 > 0, \tag{2}$$

under $\mathbb{Q}$. In this setting, the condition $\mu < r$ is required to obtain well-behaved values.

We consider two funding possibilities: either the investment is funded by equity or it is funded by debt. If debt is chosen, the firm may default, in which case debt holders take over the company. To distinguish between the different cases we let V be the value of the investment opportunity, and we use the superscript a to indicate that abandonment is the only decision left for the firm owners. If the investment is funded by equity, the all-equity firm value is

[3] Other examples are Bessler et al. (2011) and Agarwal and O'Hara (2007), who show that firms with higher information risk have higher market leverage. They focus, however, on information asymmetry across equity investor groups and not between the firm and the external financial market.

[4] We are grateful for a referee suggesting this to us.

[5] Our modeling of AIP implies that they cannot serve directly as collateral and thereby increase the firm's debt capacity. If a fraction of AIP could serve as collateral, this would provide the firm with a substitute for risk-free borrowing. This could effectively be used to decrease the need for external financing, i.e., the investment cost funded from the financial market would be the net financing need.

[6] We introduce the market price of risk explicitly, so that a change in volatility directly spills over into the risk-neutral drift rate.