Journal of Banking & Finance 37 (2013) 474–489

Contents lists available at SciVerse ScienceDirect

Journal of Banking & Finance

journal homepage: www.elsevier.com/locate/jbf

Asset liquidity, corporate investment, and endogenous financing costs

Christian Riis Flor [a], Stefan Hirth [b,*]

[a] Department of Business and Economics, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark
[b] Business and Social Sciences, Aarhus University, Fuglesangs Allé 4, DK-8210 Aarhus V, Denmark

ARTICLE INFO

Article history:
Received 22 December 2011
Accepted 20 September 2012
Available online 8 October 2012

JEL classification:
G31
G32
G33

Keywords:
Financing constraints
Corporate investment
Asset liquidity
Redeployability
Liquid funds

ABSTRACT

We analyze how the liquidity of real and financial assets affects corporate investment. The trade-off between liquidation costs and underinvestment costs implies that low-liquidity firms exhibit negative investment sensitivities to liquid funds, whereas high-liquidity firms have positive sensitivities. If real assets are not divisible in liquidation, firms with high financial liquidity optimally avoid external financing and instead cut new investment. If real assets are divisible, firms use external financing, which implies a lower sensitivity. In addition, asset redeployability decreases the investment sensitivity. Our findings demonstrate that asset liquidity is an important determinant of corporate investment.

1. Introduction

What is the effect of real asset liquidity on corporate investment? Moreover, how is the effect influenced by the liquid financial assets of the firm? Empirical evidence shows that the question is highly relevant, e.g., Gan (2007) shows how an exogenous decline in firms' collateral value leads to less new investment. Surprisingly, theoretical research has not focused much on how the liquidity of a firm's existing assets affects new investment. Our paper fills this gap. A key feature of our model is that financing costs are endogenous. More precisely, we show how financing costs result of the trade-off between underinvestment costs and asset liquidation costs. These asset liquidation costs affect a financially constrained firm's investment policy in two respects: First, firms with a higher degree of redeployability invest with less sensitivity to their liquid funds. Second, both the usage of debt financing and the sign of the sensitivity of investment to the firm's liquid funds depend on real and financial asset liquidity in a non-monotonic way.

We build on Cleary et al. (2007), who introduce the notion of a U-shaped investment curve in liquid funds, i.e., the lowest investment volume is reached for an intermediate level of liquid funds. They use a particular liquidation rule without aiming at a realistic specification of asset liquidity. In contrast, we analyze the effect of asset liquidity on corporate investment. We distinguish between two dimensions of asset liquidity. First, the degree of redeployability of existing assets, i.e., how easily assets can be sold to another company. Second, we address the degree of divisibility of existing assets. A fire sale of assets can be used to avoid full liquidation, but the nature of the assets can restrict a fractional fire sale or it can be prohibited due to covenants, see e.g. Morellec (2001).

Our findings can be summarized as follows. First, investment is less sensitive to liquid funds for firms with a higher degree of redeployability. Higher redeployability eases the creditors' break-even constraint allowing the firm to get closer to the first-best investment level. Since the latter is constant, sensitivity decreases. Second, asset divisibility and the level of internal funds determine both the amount of debt financing and the sign of the sensitivity of investment with respect to the firm's liquid funds. Firms facing full liquidation in financial distress avoid debt financing and have a one-to-one, positive sensitivity of investment to liquid funds, if they have high internal funds. If they have low internal funds, they use debt financing and have a negative sensitivity of investment to liquid funds. Firms with the option of a fire sale in financial distress use risk-free debt financing and have a positive sensitivity of investment to liquid funds significantly below unity, if they have high internal funds. Firms with low internal funds use risky debt financing and have a negative sensitivity of investment to liquid funds.

* Corresponding author. Tel.: +45 8716 5329.
E-mail addresses: crf@sam.sdu.dk (C.R. Flor), shirth@econ.au.dk (S. Hirth).

0378-4266/$ - see front matter © 2012 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.jbankfin.2012.09.014

The analysis in Cleary et al. (2007) is most similar to the case in which a fire sale is possible, i.e., our second liquidation rule. By extending the analysis to include the case of full liquidation, we can explain why firms with high internal funds may cut investment to avoid debt financing. This prediction cannot be derived in the framework of Cleary et al. (2007), as liquidation in their model has too little effect for high-liquidity firms. Our argument is related to that of Myers and Majluf (1984), namely that shareholders pass on positive NPV projects if the outsiders' undervaluation of the existing assets is too severe. In our model, the underinvestment problem is more pronounced for a high value of the existing assets relative to the new investment. Thus, in both models the firm trades off possible losses on the existing assets against the underinvestment costs.

A related strand of literature on asset liquidity and investment focuses on the liquidation of assets and the usage of the proceeds for subsequent investment, see Hovakimian and Titman (2006) and Gopalan et al. (2012). In contrast, we examine how the conditions for a possible future asset liquidation affect today's investment. Other papers on asset liquidity focus on the implications for capital structure, see e.g. Shleifer and Vishny (1992); Myers and Rajan (1998), Morellec (2001), Ang and Mauck (2011). In many of these papers, asset sales are seen as a means to divert value away from debtholders. However, in our setting we assume symmetric information and perfectly enforceable contracts. Thus, we abstract from the "dark side of liquidity", as Myers and Rajan (1998) term the problem. The costly liquidation of existing assets is only used if necessary to service the payments to debtholders. Interestingly, empirical evidence by Brown et al. (1994) illustrates that the proceeds from asset sales can indeed benefit the debtholders.

Another stream of corporate investment literature uses investment-timing models to show that investment can be increasing in constraints, see e.g. Boyle and Guthrie (2003) and Shibata and Nishihara (2012). The timing behavior derived in these papers can be interpreted as an inversely U-shaped investment curve in liquid funds. This contrasts our findings. A key reason for the difference is the fact that the timing models only use a fixed investment model. Instead, we derive explicit predictions on investment volume.

Recent empirical evidence shows that investment volume can be non-monotonic and, in particular, increasing in financing constraints. Thus, investment-cash flow sensitivities can be negative.[1] Bhagat et al. (2005) find negative sensitivities as a result of firms being distressed, particularly having negative operating income. They explain this finding as being due to the infusion of new equity to gamble for resurrection. Cleary et al. (2007) explain their evidence as an external investor's trade-off between the cost of providing funds to a firm and the possible revenue received from the firm's investment project. Guariglia (2008) elaborates on Cleary et al.'s critique that it is difficult to find proxies for capital market imperfections with enough variation when only analyzing publicly traded firms. Focusing on data from unquoted firms she provides additional empirical support. Hovakimian (2009) explains negative sensitivities with the life-cycle hypothesis: Firms with low cash holdings are often young and have promising projects. Therefore it can be easier for them to get external funding than it is for more mature firms. Overall, our predictions are in line with the evidence by Bhagat et al. (2005), Cleary et al. (2007), Guariglia (2008) and Hovakimian (2009) – low-cash firms have negative sensitivities. As we show, the magnitude of the sensitivity is determined by the firm's asset liquidity. Moreover, we derive testable predictions on the use of debt financing that depend on both the availability of liquid financial assets and the degree of divisibility of existing real assets in liquidation. Therefore, our findings suggest that asset liquidity is indeed an important factor that can help to resolve the empirical puzzle of negative sensitivities of investment to liquid funds.

The paper proceeds as follows. We set up our model in Section 2. Section 3 derives predictions on the optimal investment behavior as the result of a trade-off between the underinvestment costs and liquidation costs faced by the firm. In Section 4, we present the results of our numerical analysis. Finally, Section 5 concludes. In the appendix, we present our formal propositions and corresponding proofs in Section A. In Section B, we analyze numerically the robustness of our results.

2. The model

We consider a firm with assets in place in a three-date model ($t = 0, 1, 2$). The existing assets have a long-run value of G, which corresponds to the value of future cash flows. This value is only fully realized if the firm is alive until $t = 2$. Otherwise, there are liquidation costs as discussed below. In addition to the existing assets, the firm has liquid funds, W, at time $t = 0$. The liquid funds stem from previous operation of the firm. A positive W is due to a previously favorable outcome, whereas a negative W indicates a liability.

The firm has a short-term investment opportunity. The opportunity must be exploited at time $t = 0$ and returns a cash flow at time $t = 1$. The present value of the investment opportunity depends on the size of the investment as well as on the state of the economy, which is revealed at $t = 1$. Specifically, an investment of an amount I generates revenue $F(I, \theta)$ in state θ. We assume θ is a random variable at $t = 0$ distributed on $[\underline{\theta}, \bar{\theta}] \in \mathbb{R}_{0+}$ with density $\omega(\theta)$ and cumulative density function $\Omega(\theta)$. Moreover, we use a production function with the following characteristics: a positive investment is needed for a positive probability of a positive value, i.e., $F(0, \theta) = 0$. The production technology has decreasing returns to scale, is increasing and concave in investment, and is sufficiently smooth. Finally, we simplify the analysis by assuming that all agents are risk-neutral and the risk-free interest rate is 0.

2.1. Benchmark case: the unconstrained firm

As a benchmark case we take a financially unconstrained firm. This means that the owner of the firm can provide unlimited additional funds out of his own pocket. Thus, the assets in place are known to yield future cash flow worth G at time $t = 2$.

Since the firm is financially unconstrained, the owner's best strategy is to undertake the investment that maximizes the net present value of the investment opportunity, i.e.,

$$\max_I \mathbb{E}[F(I)] - I, \qquad (1)$$

where $\mathbb{E}[\cdot]$ is the expectation operator with respect to θ. We denote the solution to problem (1) as I^{**}, which we call the first-best investment. The unconstrained firm's problem is illustrated in Fig. 1. We will later return to the costs of not undertaking the first-best investment, but first we set up the investment problem faced by the financially constrained firm.

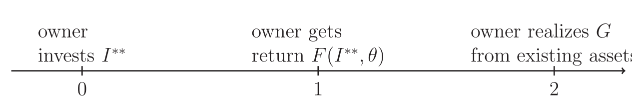

Fig. 1. Timeline and cash flows for the unconstrained firm.

[1] Earlier research on the impact of financing constraints on corporate investment is dominated by the empirical question: "Do investment-cash flow sensitivities provide useful measures of financing constraints?", asked most prominently in the title of the article by Kaplan and Zingales (1997). They criticize the study by Fazzari et al. (1988) and show that investment-cash flow sensitivities do not necessarily increase in constraints. However, they still take for granted that investment volume itself is decreasing in constraints, i.e., sensitivities are always positive. Recent studies such as Allayannis and Mozumdar (2004); Cleary (2006); and Carpenter and Guariglia (2008) provide additional support and refinements for the analysis by Kaplan and Zingales.