Corporate Financial and Investment Policies when Future Financing is not Frictionless*

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Abstract

We study a model in which future financing constraints lead firms to have a preference for investments with shorter payback periods, investments with less risk, and investments that utilize more pledgeable assets. The model also shows how investment distortions towards more liquid, safer assets vary with the marginal cost of external financing and with firm internal cash flows. Our theory helps reconcile and interpret a number of patterns reported in the empirical literature, in areas such as risk-taking behavior, capital structure choices, hedging strategies, and cash management policies. For example, contrary to Jensen and Meckling (1976), we show that firms may reduce rather than increase risk when leverage increases exogenously. Furthermore, firms in economies with less developed financial markets will not only take different quantities of investment, but will also take different kinds of investment (safer, short-term projects that are potentially less profitable). We also point out to several predictions that have not been empirically examined. For example, our model predicts that investment safety and liquidity are complementary: constrained firms are specially likely to decrease the risk of their most liquid investments.

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Abstract

We study a model in which future financing constraints lead firms to have a preference for investments with shorter payback periods, investments with less risk, and investments that utilize more pledgeable assets. The model also shows how investment distortions towards more liquid, safer assets vary with the marginal cost of external financing and with firm internal cash flows. Our theory helps reconcile and interpret a number of patterns reported in the empirical literature, in areas such as risk-taking behavior, capital structure choices, hedging strategies, and cash management policies. For example, contrary to Jensen and Meckling (1976), we show that firms may reduce rather than increase risk when leverage increases exogenously. Furthermore, firms in economies with less developed financial markets will not only take different quantities of investment, but will also take different kinds of investment (safer, short-term projects that are potentially less profitable). We also point out to several predictions that have not been empirically examined. For example, our model predicts that investment safety and liquidity are complementary: constrained firms are specially likely to decrease the risk of their most liquid investments.

1 Introduction

Keynes (1936) originally pointed out that the ability of capital markets to provide financing for projects can affect firms' financial policies (p. 196). Keynes argued that if a firm can always costlessly access external capital markets, then it has no reason to save cash internally. Alternatively, if a firm faces incremental costs each time it raises capital, then it can increase its value by maintaining a more liquid balance sheet. Keynes focused his discussion on corporate cash policies, but the argument is much more general: *any* decision that affects a firm's ability to finance its projects will be affected by the distribution of financing demand and costs across time.

In this paper, we extend the above insight into the question of how real investments are affected by intertemporal financing frictions. In particular, we show that when future projects are valuable and capital markets are imperfect, factors related to a firm's ability to smooth the financing of investment over time become relevant to capital budgeting decisions today. This argument is quite general and has relevance to any situation in which a firm potentially faces costly financing decisions in the future; regardless of whether the firm currently faces costly financing. Indeed, we argue that a number of existing empirical findings can be explained through this idea, in which firms take actions today to minimize the impact of future financial constraints.[1]

We formalize these arguments in a simple framework. Suppose that a firm can choose among a menu of projects that differ across a number of dimensions, including not only the value of the cash flows produced, but also their timing, risk profile, and the liquidity of the assets the firm must acquire. The net present value (NPV) rule implies that the appropriate calculation for determining the value of an investment is to compare the investment's initial cost to the discounted expected cash flows from the project using the discount rate that reflects the project's risk. However, investment decision-making becomes more complex when firms face capital markets imperfections. In the absence of competitively-priced external funding, observed spending can depart from what would result from standard capital budgeting approaches, introducing significant distortions in the firm investment process.

Our model characterizes the nature of these distortions. In particular, when credit constraints are likely to bind in the future, capital budgeting rules are distorted towards projects that generate earlier cash flows, and against those that generate back-loaded flows. This distortion occurs because cash flows from current investments can provide financing for future valuable projects that otherwise would go unfunded. A practical implication of this distortion is that rather than being valued

[1] We use the term "financial constraints" more broadly than is common in the literature. If a firm's current and/or future investments differ from the "unconstrained" (first-best) solution due to costly financing arising from capital markets imperfections, we consider that firm to be financially constrained. For example, we see deadweight costs arising from financial distress as a particular manifestation of financial constraints. We also consider firms that face credit constraints arising from poor development of financial markets and institutions as financially constrained firms.

solely on the basis of its own independent merit, a project's valuation will also be influenced by the firm's position in the capital markets and by the project's position in the firm's investment schedule. We also model firms' choices between projects that differ with respect to their risk profile. When financing constraints are likely to bind in the future, firms prefer projects with safe cash flows over projects with the same (or even higher) NPV but risky cash flows, because safer cash flows can help mitigate future financing constraints; particularly in poor states of the world. The model also shows how firms will distort their investment policy towards projects that generate more tangible, verifiable cash flows (i.e., collateralizable projects) when they face financing constraints. Finally, the model shows that constrained firms will tend to distort the risk profile of the most liquid projects, rather than that of illiquid ones. In short, because illiquid projects have a lower impact on future financing capacity, their riskiness matters less for a constrained firm. As a result, project liquidity and safety become complementary attributes in the firm's investment policy.

In addition to advancing a number of new, untested predictions regarding firm investment policies (see Section 2), our analysis provides new insights into the following much-debated research questions: 1) Why firms do not appear to "risk-shift" when standard theory says they should? 2) Why are firms typically "underleveraged"? 3) How do firms decide on the liquidity of their asset portfolio, in particular, how much cash to hold? 4) Why do managers appear to hedge operationally in addition to financially, even if operational hedges come at a real cost to the firm? 5) Why do firms in countries with underdeveloped capital markets make different types of investments than firms in countries with developed capital markets? and 6) Why does financial development add so much to corporate growth by changing not only the quantity of investments, but also their type and mix?

Let us briefly discuss some of these questions here. One of the most widely-discussed arguments in corporate finance is the Jensen and Meckling (1976) "risk-shifting" story, by which firms have incentives to increase project risk when they become highly leveraged and near financial distress. While this argument has been taken to be an important consideration in capital structure decisions, there has been very little direct evidence of risk-shifting in practice.[2] One of the extensions of our basic model (Section 3.1) describes how financing constraints can lead to an effect that offsets a firm's incentives to risk-shift. In particular, when leverage leads firms to expect higher costs of external finance in the future, they distort investments toward *safer* projects. This effect is one possible reason why there is virtually no evidence that firms actually increase risk in the manner suggested by Jensen and Meckling. In addition, our analysis suggests an additional reason why firms limit their leverage. Higher leverage creates incentives for firms to distort real investments towards safer and liquid but potentially less profitable projects.

[2] One likely exception is the behavior of S&Ls in the 1980s. Note, however, that because of implicit government guarantees (i.e., bailouts) it is likely that S&Ls were less concerned with future financing constraints than other firms.

Our analysis also adds to the literature on corporate cash holdings. Previous work has suggested that a firm's cash balances and incremental savings out of new cash flows should be a function of the firm's position in the financial market (e.g., Almeida, Campello, and Weisbach (2004)). We extend and refine this analysis in Section 3.2 by considering additional ways in which a constrained firm can transfer resources through time. In particular, we show that the sign of "cash–cash flow sensitivities" *need not* be positive when the firm has access to liquid investments other than cash. An increase in current cash flows, for example, can reduce future costs of external financing through its effect on liquid capital investments, thereby reducing the demand for cash. Consequently, whether cash–cash flow sensitivities are positive or negative becomes an empirical question. We review the available evidence in Section 4.3.

Our arguments also have implications for the burgeoning literature on international comparisons of corporate financial policy. Much of this literature documents that there is substantial variation across countries in the ability of firms to raise external finance (see, e.g., La Porta, Lopez de Silanes, Shleifer, and Vishny (1997, 1998)). Our model suggests that a high cost of external finance should affect not only the quantity of investments made in different countries, but also the types of investments that we observe. In particular, where costs of raising additional external finance are expected to be high, we should observe a preference for investments that use more tangible assets and generate more collateral. The empirical literature largely supports these predictions (see, e.g., Demirgüç-Kunt and Maksimovic (1999)). A consequence of our theory is that financial development should make firms in emerging markets more prone to make longer term, potentially riskier investments over time. Noteworthy, the effect of financial development on investment distortions inside firms can also help explain the strong link between financial development and investment efficiency (see Beck, Levine, and Loyaza (2000) and Wurgler (2000)).

Our paper contributes to the existing literature on financing constraints (see Hubbard (1998) and Stein (2003) for reviews) by considering intertemporal links between financing constraints and investment. These links generate implications that are absent from a purely static framework. For example, financial constraints do not always generate underinvestment in all kinds of assets. While this result is generally true for illiquid, long-term projects (those that do not generate cash flows that can be used to finance future investments), it need not hold for investments that help mitigate future financing problems. Whether the constrained firm underinvests or overinvests in liquid assets — relative to the first-best solution occurring with frictionless capital markets — depends on the relative strength of current versus future constraints, and on the profitability of current versus future investment opportunities. We show that in order to derive robust empirical implications about the effects of constraints on investment, it is helpful to look at the *ratios* between different kinds of investment. For example, irrespective of whether constraints cause under or overinvestment in liquid assets, our analysis implies that the ratio of liquid to illiquid investments (and of safe to risky investments) is increasing in the degree of financing constraints.

Previous papers have considered intertemporal implications of financing constraints. Smith and Stulz (1985) and Froot, Scharfstein, and Stein (1993), for example, argue that one reason for corporate hedging is to minimize future financing costs and future costs of financial distress. Essentially, their argument is that constrained firms have incentives to use financial instruments such as forwards, futures, and options to hedge negative cash flow shocks that have real effects on investment or distress costs. In contrast, our paper focuses on operational hedges that might involve distortions in real investments. Operational hedges are likely to be more costly than financial hedges. In practice, however, several sources of cash flow risk cannot be hedged using financial derivatives (see Section 4.4). As we discuss below, distortions arising from operational hedges are likely to be very important, especially in situations in which derivative markets are poorly developed.

Other papers have also looked at intertemporal links between financing constraints and investment. Boyle and Guthrie (2003) analyze firms' choice of investment in a real-options framework, showing that constrained investment can be accelerated with respect to the first-best schedule due to future financing frictions. The nature of the interactions between real investment and financial constraints considered by Boyle and Guthrie is markedly different from ours, nonetheless. For example, their model does not allow for cash flows from current investments to affect future financing constraints. Froot and Stein (1998) consider a model in which financial institutions cannot frictionlessly hedge the risks associated with their portfolios in the capital markets, and thus also use capital structure and capital budgeting as hedging devices. Hennessy, Levy, and Whited (2005) show that firms anticipating collateral constraints experience a side benefit from current investment because installed capital relaxes future constraints. Thakor (1990) shows that firms may prefer projects that pay back faster when they need to finance future investments with internal funds.[3] In similar fashion, Kim, Mauer, and Sherman (1998) show that firms might invest in liquid assets (e.g., cash) that earn low returns if they anticipate a future need for costly external financing.[4] An important innovation of our paper relative to these papers is that we model the constrained firm's choice over a menu of investments that differ simultaneously along several dimensions, including risk and liquidity. In contrast, Froot and Stein focus on risk distortions, Hennessy et al. consider only one type of capital asset, and Kim et al. and Thakor focus on investment liquidity. Our focus on a menu of investments generates new empirical implications, including the effects of financial constraints and cash flows on the ratios between different kinds of investment, the complementarity between safety and liquidity of

[3] Thakor also argues that future financing constraints increase the value of capital budgeting centralization in a multi-division firm, because information about firm-wide investment opportunities is required for optimal capital allocation.

[4] See also Huberman (1984) and Martin and Morgan (1988) for earlier theoretical analyses of the optimality of financial slack.

projects, and implications about cash flow sensitivities of cash holdings in the presence of alternative liquid investments.

The remainder of the paper proceeds as follows. Section 2 introduces our basic theory, and describes its main implications. Section 3 builds on the general framework of Section 2 to characterize some applications of our main results to specific areas of corporate finance, including cash policies and capital structure choices. Section 4 presents a discussion of empirical findings in light of the implications of the model. We show how findings in disparate areas such as capital structure, hedging and cash policies, product market competition, and international corporate finance can be understood as implications of the same types of investment distortions. Section 5 concludes.

2 A Model of Intertemporal Investment Decisions with Deadweight Costs of External Financing

2.1 Structure

Our model is a simple representation of a dynamic problem in which the firm has both present and future investment opportunities, and in which external finance may entail deadweight costs. There are three dates: 0, 1, and 2. While we shall discuss the present (date-0) investment opportunities shortly, the future investment, I_1, made at date 1, produces cash flows in period 2 equal to $g(I_1)$. We parametrize the costs of external finance as in Froot, Scharfstein, and Stein (1993) by assuming that the firm pays a deadweight cost $C(E, k)$ if it raises an amount E in external funds. For example, if the firm has zero internal funds at date 1, it will pay deadweight costs $C(I_1, k)$ for any amount of investment $I_1 > 0$. We assume that $C_E(E, k) > 0$ if $E > 0$, $C_E(E, k) = 0$ if $E = 0$, $C_k(E, k) > 0$, $C_{Ek}(E, k) > 0$, and $C_{EE}(E, k) > 0$. The parameter k summarizes the variables that affect the marginal cost of external funds for the firm. Firms that have high costs of external funds have high k.

Froot et al. discuss a number of economic rationales based on agency and information problems to motivate a link between capital market imperfections ("financing constraints") and corporate policies. Formally, those authors show how the above external financing cost function, $C(E, k)$, naturally arises from the Gale and Hellwig (1985) variant of Townsend's (1979) costly-state verification model. Stein (1998) arrives at a similar functional form for financing costs within a banking framework in which non-deposit liabilities are subject to adverse selection problems. The external financing cost function $C(E, k)$ can also arise from capital market imperfections engendered by poor investor protection (see Section 3.3 for a model of this idea).[5] Since deadweight costs of external finance can arise from many different sources, in this section we abstract from modeling any particular source of constraints when developing our baseline framework. Indeed, the underlying reason for the financing

[5]In addition, we show in Section 3.1 that financial distress costs can be thought of as an alternative motive for the $C(E, k)$ formulation.

cost does not affect our analysis, as long as it results in a cost function similar to $C(E,k)$. What is important is that the ideas that come from our basic model are very general, and they can be applied whenever there is a potential deadweight cost of external finance in the future.

A distinct contribution of our analysis is to consider that firms have a variety of investments to choose from. Differently from previous papers, we focus on the optimality of those investment choices. Consider that at date 0, the firm has access to a menu of investment opportunities that differ along the following dimensions:

• *Liquidity/Pledgeability*: Some date-0 investments produce cash flows that have high pledgeability (i.e., are highly liquid) to creditors, while others produce cash flows that cannot be pledged at date 1. For example, some investments might have front-loaded cash flows (short-term projects), which can be used for (re-)investment at date 1. Other investments might only produce long-term cash flows (at date 2). The firm can borrow against these date-2 cash flows at date 1. However, the extent to which date-2 cash flows can serve as collateral at date 1 varies across different investments.[6]

We capture these differences in asset liquidity/pledgeability via a menu of date-0 projects. One of the date-0 investments that the firm can make, I_0, produces cash flows at date 2, equal to $(1+\theta)g(I_0)$, with $\theta > 0$. We assume that these investments generate zero collateral at date 1. There is also another set of date-0 investments, I_0^λ, that generate total cash flows equal to $g(I_0^\lambda)$ at date 2. A fraction λ of these cash flows can be used as collateral at date 1. There are two possible interpretations for $\lambda g(I_0^\lambda)$. One is that the firm can borrow against the date-2 cash flow $\lambda g(I_0^\lambda)$ without paying deadweight costs of external finance. The other interpretation is simply that $\lambda g(I_0^\lambda)$ is a date-1 cash flow (investment with front-loaded cash flows). In either case, $(1-\lambda)g(I_0^\lambda)$ is a date-2 cash flow that is totally illiquid as of date 1, in the same way that the cash flow $(1+\theta)g(I_0)$ is illiquid. The assumption that $\theta > 0$ means that the perfectly illiquid investment has higher productivity.

• *Risk*: Some date-0 investments produce risky cash flows in the future, while others produce certain (safe) cash flows.

As we later show, the riskiness of the illiquid investment I_0 is irrelevant for the constrained firm. Accordingly, we can assume that the payoff $(1+\theta)g(I_0)$ is nonstochastic. In contrast, we consider two types of liquid investment: I_{0S}^λ produces a safe cash flow equal to $g(I_{0S}^\lambda)$, while I_{0R}^λ produces a risky cash flow. In particular, with probability p, the firm is in the high state (H) in which the cash flow is equal to $c_H g(I_{0R}^\lambda)$; and with probability $(1-p)$ the firm is in the low state (L), in which the cash flow is equal to $c_L g(I_{0R}^\lambda)$. We let $\bar{c} = pc_H + (1-p)c_L$, where $\bar{c} > 1 > c_L$. These assumptions imply that the risky investment is more productive than the safe one, but the safe investment produces higher

[6] One can also think of the resale value/redeployability of the assets that are acquired with investment funds at date 0. Some assets may provide high level of collateral (liquidating values) in the future, while other assets may not provide collateral (either because their liquidating cash flows are unverifiable or because liquidation costs are too high).

cash flows than the risky one in state L. The uncertainty about the state gets resolved at date 1.

The final element of our setup is the firm's current operations. We assume that the firm has assets in place that produce exogenous cash flows equal to w_0 at date 0, and w_1 at date 1. We take that the cash flow w_1 is risky, and is equal to w_{1H} in state H, and 0 in state L. Cash flows from assets in place will help determine the marginal cost of external funds.

2.2 Analysis

At date 0, the firm must allocate funds across three types of the investments: I_0, I_{0S}^{λ}, and I_{0R}^{λ}. At date 1, a new investment opportunity arises, and conditional on the observed state (H or L), the firm invests either I_{1H} or I_{1L}. To economize on notation, we drop the superscript λ and let $\{I_{0S}^{\lambda}, I_{0R}^{\lambda}\} \equiv \{I_{0S}, I_{0R}\}$. If, at date 0, the firm's total investment is larger than w_0, then the firm must pay the deadweight cost of external finance, $C(I_{0R}+I_{0S}+I_0-w_0,k)$. At date 1, we assume that the cash flow w_{1H} is large enough that the firm can invest at first-best levels in state H without paying any deadweight costs. In contrast, the firm pays the deadweight cost $C(I_{1L}-\lambda c_L g(I_{0R})-\lambda g(I_{0S}),k)$ in state L.

The firm's program is to maximize the sum of the value of its investments, net of the deadweight costs of external funds:

$$\begin{aligned} \max_{I_{0S},I_{0R},I_0,I_{1H},I_{1L}} \; & p\left[c_H g(I_{0R}) + g(I_{1H}) - I_{1H}\right] + (1-p)\left[c_L g(I_{0R}) + g(I_{1L}) - I_{1L}\right] \\ & -I_{0R} + g(I_{0S}) - I_{0S} + (1+\theta)g(I_0) - I_0 \\ & -C(I_{0R}+I_{0S}+I_0-w_0,k) - (1-p)C(I_1 - \lambda c_L g(I_{0R}) - \lambda g(I_{0S}),k), \end{aligned} \tag{1}$$

where we incorporate the assumption that $C(.,k)=0$ in state H at date 1.[7] In state H, the firm will invest at the first-best level defined by:

$$g^{'}(I_{1H}^{FB}) = 1. \tag{2}$$

In state L, investment is determined by:

$$g^{'}(I_{1L}^{*}) = 1 + C_E(E_L,k), \tag{3}$$

where $E_L = I_{1L} - \lambda c_L g(I_{0R}) - \lambda g(I_{0S})$. If $E_L > 0$, then $C_E(E_L,k) > 0$, and $I_{1L}^{*} < I_{1L}^{FB}$. This setup captures the idea that the firm is more likely to be constrained in the future if future cash flows turn out to be low.[8]

We can divide the solution in two cases:

[7] A sufficient condition to ensure that $C(.,k)=0$ in state H is that $w_{1H} > I_{1H}^{FB}$.

[8] For simplicity, we assume that investment opportunities are uncorrelated with future cash flows. If the firm has higher investment opportunities in state H, then it could become more financially constrained in that state. We are also abstracting away from financial hedging policies that might allow the firm to transfer cash flows across states. These issues are analyzed in a recent paper by Acharya, Almeida, and Campello (2007).

Case 1: The firm is unconstrained in state L, that is, $I^*_{1L} = I^{FB}_{1L}$.

If we define $(\widehat{I}_0, \widehat{I}_{0S}, \widehat{I}_{0R})$ as:

$$(1+\theta)g^{'}(\widehat{I}_0) = \bar{c}g^{'}(\widehat{I}_{0R}) = g^{'}(\widehat{I}_{0S}) = 1 + C_E(\widehat{I}_0 + \widehat{I}_{0S} + \widehat{I}_{0R} - w_0, k), \tag{4}$$

then this case obtains as long as $I^{FB}_{1L} < \lambda c_L g(\widehat{I}_{0R}) + \lambda g(\widehat{I}_{0S})$.

The investment levels $(\widehat{I}_0, \widehat{I}_{0S}, \widehat{I}_{0R})$ represent the optimal investment policy if the firm ignores the interplay between *current* investment polices and *future* financing constraints. In this case, the firm simply equates the marginal productivity of the three types of investment.

We emphasize that whether or not the firm is constrained at date 0 does not affect the marginal conditions established in Eq. (4). To see this, notice that if $C_E(I^{FB}_0 + I^{FB}_{0S} + I^{FB}_{0R} - w_0, k) = 0$, then investment policy is set at first-best levels: $(\widehat{I}_0, \widehat{I}_{0S}, \widehat{I}_{0R}) = (I^{FB}_0, I^{FB}_{0S}, I^{FB}_{0R})$. In contrast, if $C_E(I^{FB}_0 + I^{FB}_{0S} + I^{FB}_{0R} - w_0, k) > 0$, then investment is set at sub-optimal levels: $(\widehat{I}_0, \widehat{I}_{0S}, \widehat{I}_{0R}) < (I^{FB}_0, I^{FB}_{0S}, I^{FB}_{0R})$. Yet, the marginal productivities of the three types of investment are equal under either investment regime. In particular, Eq. (4) implies that:

$$\begin{aligned}
\frac{g^{'}(\widehat{I}_0)}{g^{'}(\widehat{I}_{0R})} &= \frac{\bar{c}}{(1+\theta)} = \frac{g^{'}(I^{FB}_0)}{g^{'}(I^{FB}_{0R})} \\
\frac{g^{'}(\widehat{I}_0)}{g^{'}(\widehat{I}_{0S})} &= \frac{1}{(1+\theta)} = \frac{g^{'}(I^{FB}_0)}{g^{'}(I^{FB}_{0S})} \\
\frac{g^{'}(\widehat{I}_{0R})}{g^{'}(\widehat{I}_{0S})} &= \frac{1}{\bar{c}} = \frac{g^{'}(I^{FB}_{0R})}{g^{'}(I^{FB}_{0S})}.
\end{aligned} \tag{5}$$

Case 2: The firm is constrained in state L. This case obtains if $I^{FB}_{1L} > \lambda c_L g(\widehat{I}_{0R}) + \lambda g(\widehat{I}_{0S})$.

If the firm invests myopically at date 0, then it will become constrained in future low cash flow states. The condition for optimality is modified in a straightforward way:

$$\begin{aligned}
(1+\theta)g^{'}(I^*_0) = [\bar{c} + (1-p)c_L\lambda C_E(E^*_{1L}, k)]\, g^{'}(I^*_{0R}) = \\
[1 + (1-p)\lambda C_E(E^*_{1L}, k)]\, g^{'}(I^*_{0S}) \quad &= \quad 1 + C_E(E^*_0, k),
\end{aligned} \tag{6}$$

where $E^*_0 = I^*_0 + I^*_{0S} + I^*_{0R} - w_0$, and $E^*_{1L} = I^*_{1L} - \lambda c_L g(I^*_{0R}) - \lambda g(I^*_{0S})$. The cash flows from the liquid investments I^*_{0R} and I^*_{0S} reduce the marginal cost of external finance in state L (the term $C_E(E^*_{1L}, k)$) by an amount that is proportional to the liquidity of investments (the parameter λ). This equation implies that:

$$\begin{aligned}
\frac{g^{'}(I^*_0)}{g^{'}(I^*_{0R})} &= \frac{\bar{c} + (1-p)c_L\lambda C_E(E^*_{1L}, k)}{(1+\theta)} > \frac{g^{'}(\widehat{I})}{g^{'}(\widehat{I}_{0R})} \\
\frac{g^{'}(I^*_0)}{g^{'}(I^*_{0S})} &= \frac{1 + (1-p)\lambda C_E(E^*_{1L}, k)}{(1+\theta)} > \frac{g^{'}(\widehat{I})}{g^{'}(\widehat{I}_{0S})}
\end{aligned} \tag{7}$$

In words, the firm's investment policy is *distorted* towards more liquid investments because of future financing constraints. In equilibrium, the ratios $\frac{g^{'}(I_0^*)}{g^{'}(I_{0R}^*)}$ and $\frac{g^{'}(I_0^*)}{g^{'}(I_{0S}^*)}$ are higher than in the myopic case (see Eq. (5)).

In addition, we have:

$$\frac{g^{'}(I_{0R}^*)}{g^{'}(I_{0S}^*)} = \frac{1+(1-p)\lambda C_E(E_{1L}^*, k)}{\overline{c}+(1-p)c_L\lambda C_E(E_{1L}^*, k)} > \frac{g^{'}(\widehat{I}_{0R})}{g^{'}(\widehat{I}_{0S})}. \tag{8}$$

Because the safe investment produces greater cash flows in state L ($c_L < 1$), the investment policy is also distorted towards safe investments. Thus, among the liquid investments, the constrained firm is particularly prone to increasing the allocation of funds towards those investments that are safer.

Eq. (8) implies that if $\lambda = 0$, then future constraints create no distortions in the riskiness of the firm's investment policy. In other words, if all investments are illiquid, then the firm does not care about the riskiness of its investments, and simply allocates funds according to marginal productivities. Consequently, there is a complementarity effect between risk and liquidity induced by financing constraints: the firm is particularly prone to fine-tuning the riskiness of its liquid investment, as opposed to that of the illiquid ones. This positive interaction is a novel implication of the financing constraints framework we develop here.

2.3 Results

To derive additional results in a more intuitive way, we assume that the function $g(.)$ has a standard Cobb-Douglas functional form, that is:

$$g(x) = Ax^{\alpha}, \text{ for } \alpha < 1 \tag{9}$$

We stress that our results also hold under other standard parametric choices for $g(.)$; for example, a simple log production function $g(x) = \ln x$.

The model delivers a number of testable predictions.

Result 1: If future financing constraints are binding, the ratio between liquid and illiquid investments increases relative to a benchmark case in which future constraints are not binding:

$$\frac{I_{0R}^*}{I_0^*} > \frac{\widehat{I}_{0R}}{\widehat{I}_0} \text{ and } \frac{I_{0S}^*}{I_0^*} > \frac{\widehat{I}_{0S}}{\widehat{I}_0}. \tag{10}$$

Result 2: If future financing constraints are binding, the ratio between safe and risky investments increases relative to a benchmark case in which future constraints are not binding:

$$\frac{I_{0S}^*}{I_{0R}^*} > \frac{\widehat{I}_{0S}}{\widehat{I}_{0R}}. \tag{11}$$

Proof: Both results follow directly from Eqs. (7)–(9). For example, Eq. (8) implies that:

$$\frac{g'(I^*_{0R})}{g'(I^*_{0S})} = \left(\frac{I^*_{0S}}{I^*_{0R}}\right)^{(1-\alpha)} = \frac{1+(1-p)\lambda C_E(E^*_{1L},k)}{\overline{c}+(1-p)c_L\lambda C_E(E^*_{1L},k)} > \frac{g'(\widehat{I}_{0R})}{g'(\widehat{I}_{0S})} = \left(\frac{\widehat{I}_{0S}}{\widehat{I}_{0R}}\right)^{(1-\alpha)}, \tag{12}$$

thus $\frac{I^*_{0S}}{I^*_{0R}} > \frac{\widehat{I}_{0S}}{\widehat{I}_{0R}}$.

Results 1 and 2 are implications about investment *ratios*. Indeed, one can derive more precise results about investment ratios than about investment levels in this framework. To see why, notice that it is possible that the constrained firm chooses to overinvest in both risky and safe investments ($I^*_{0R} > \widehat{I}_{0R}$ and $I^*_{0S} > \widehat{I}_{0S}$), because both increase the firm's date-1 liquidity. Alternatively, for other parameter values, the constrained firm may underinvest in safe and risky assets. Although these possibilities make it more difficult to derive implications regarding investment levels, Result 2 unambiguously shows that the ratio between safe and risky assets will be biased upwards relative to the first-best solution.[9,10]

As we suggested above, there is a complementarity effect between investment liquidity and risk for constrained firms. Given Eq. (9), we can show a more complete characterization of this result:

Result 3: There is a threshold level of λ, $\overline{\lambda}$, such that for all $\lambda < \overline{\lambda}$ the optimal ratio between safe and risky investments increases with investment liquidity; that is, $\frac{I^*_{0S}}{I^*_{0R}}$ increases with λ.

Proof: Eqs. (8) and (9) imply that $\frac{I^*_{0S}}{I^*_{0R}}$ is monotonically increasing in the following expression:

$$h(\lambda) = \frac{1+(1-p)\lambda C_E(E^*_{1L},k)}{\overline{c}+(1-p)c_L\lambda C_E(E^*_{1L},k)}. \tag{13}$$

Differentiating $h(\lambda)$ with respect to λ we obtain:

$$sgn\left[h'(\lambda)\right] = sgn\left[(\overline{c}-c_L)(C_E(E^*_{1L},k) + \lambda\frac{dC_E(E^*_{1L},k)}{d\lambda})\right]. \tag{14}$$

While the first term inside the brackets is positive, the second term can be negative since $\frac{dC_E(E^*_{1L},k)}{d\lambda}$ can be lower than zero (an increase in liquidity decreases marginal costs of external funds). However,

[9] Capital budgeting in financial institutions typically involves setting aside a liquid reserve to offset the effects of risky projects. In the model, one can think of Eq. (12) as establishing the optimal amount of safe investments per unit of risky ones. Result 2 shows that this "liquid reserve" should be higher if the firm is financially constrained. This reserve is also increasing in future external financing costs, as we show below.

[10] One might worry whether these results would survive in a general equilibrium setting in which the prices of different types of capital were allowed to respond to the relative demand by constrained firms. For example, the higher demand of liquid assets by constrained firms could increase their prices to a point at which constrained firms no longer benefit from biasing capital allocation towards liquid assets. However, it is important to notice that not all firms are constrained. If constrained firms are indifferent between liquid and illiquid assets, then it must be the case that unconstrained firms strictly prefer the illiquid assets (because they do not benefit from liquidity). This effect would push down the relative price of liquid assets. Thus, with firm heterogeneity, equilibrium price effects would not necessarily eliminate the biases that we identify in our partial equilibrium model.

because the effect of the second term is proportional to the level of λ, it follows that for sufficiently low values of λ, one can guarantee that $h^{'}(\lambda) > 0$, implying that $\frac{\partial \frac{I^*_{0S}}{I^*_{0R}}}{\partial \lambda} > 0$.

Notice that the parameter λ captures the liquidity of the liquid investments with respect to the illiquid ones. In particular, we assume in this derivation that the change in λ is uncorrelated with the parameter k, which captures variables that change the firm's costs of external funds. Of course, one potential issue with Result 3 is that λ and k might be correlated. In an international finance context, for instance, one could argue that better laws might help the firm collateralize future cash flows more easily (higher λ) as well as reduce the costs of external finance (lower k). In order to test Result 3, it is important to look for sources of variation in λ that are uncorrelated with k. For example, some firms might naturally invest in more pledgeable assets because of the properties of their technology (e.g., they may invest more in buildings and machines as opposed to R&D and human capital). Result 3 would imply that such firms would be particularly likely to distort their investment choices towards safe investments, if they happen to face high external financing costs.

Maintaining our previous assumptions, we can also derive predictions regarding variation in k.

Result 4: The ratio between liquid and illiquid investments is increasing in k; that is, $\frac{I^*_{0R}}{I^*_0}$ and $\frac{I^*_{0S}}{I^*_0}$ increase with k.

Proof: Eqs. (7) and (9) imply that $\frac{I^*_{0R}}{I^*_0}$ is monotonically increasing in the following expression:

$$\nu(k) = \frac{\bar{c} + (1-p)c_L \lambda C_E(E^*_{1L}, k)}{(1+\theta)}. \tag{15}$$

This expression increases with k if marginal costs of external finance increase with k; that is, $\frac{dC_E(E^*_{1L},k)}{dk} > 0$. Notice that the first-order condition for I^*_{1L} implies that:

$$g^{''}(I^*_{1L})\frac{\partial I^*_{1L}}{dk} = \frac{dC_E(E^*_{1L}, k)}{dk}. \tag{16}$$

Since $g^{''} < 0$, as long as optimal future investment decreases with external financing costs ($\frac{\partial I^*_{1L}}{dk} < 0$), we must have $\frac{dC_E(E^*_{1L},k)}{dk} > 0$. The proof is similar for $\frac{I^*_{0S}}{I^*_0}$.

Result 4 is also straightforward. However, it is again important to focus on investment ratios rather than levels to derive this implication. In particular, it is not necessarily the case that both I^*_{0R} and I^*_{0S} are increasing in k. An increase in k raises both current and future external financing costs. Thus, while higher future costs push towards higher liquid investments, higher current costs reduce all types of investments. Result 4 obtains because it pertains to the *ratio* between liquid and illiquid investments. Even when I^*_{0R} and I^*_{0S} decrease with k, Result 4 shows that they will decrease less than the illiquid investment, I^*_0.

We can show a similar result for the firm's risk choices.

Result 5: The ratio between safe and risky investments is increasing in k; that is, $\frac{I_{0S}^*}{I_{0R}^*}$ increases with k.

Proof: Eqs. (8) and (9) imply that $\frac{I_{0S}^*}{I_{0R}^*}$ is monotonically increasing in the following expression:

$$h(k) = \frac{1 + (1-p)\lambda C_E(E_{1L}^*, k)}{\overline{c} + (1-p)c_L \lambda C_E(E_{1L}^*, k)}. \tag{17}$$

Differentiating $h(k)$ with respect to k we obtain:

$$sgn\left[h^{'}(k)\right] = sgn\left[(\overline{c} - c_L)\frac{dC_E(E_{1L}^*, k)}{dk})\right] > 0. \tag{18}$$

Once again, one potential caveat regarding Results 4 and 5 is that it may be hard to isolate sources of variation in k that do not affect λ. If the cost of external funds is higher, it should also be harder for firms to collateralize future cash flows, and thus λ should decrease. This effect could push towards the opposite direction to that emphasized in Results 4 and 5. For example, in the region in which $\lambda < \overline{\lambda}$, Result 3 suggests that a decrease in λ will push towards a decrease in $\frac{I_{0S}^*}{I_{0R}^*}$.

One way to separate variations in external finance costs, k, from investment liquidity, λ, is to focus on variations in the availability of internal funds, the parameter w_0. In the model, this parameter represents current cash flows from assets in place. As we show next, this cash flow affects the marginal costs of external finance through its effect on E_0^* and E_{1L}^*.

Result 6: An increase in w_0 decreases the ratio of liquid to illiquid investments, and also decreases the ratio of safe to risky investments.

Proof: The first order condition for I_{1L}^* implies that:

$$g^{''}(I_{1L}^*)\frac{\partial I_{1L}^*}{dw_0} = \frac{dC_E(E_{1L}^*, k)}{dw_0} = C_{EE}\frac{dE_{1L}^*}{dw_0}. \tag{19}$$

So long as $\frac{\partial I_{1L}^*}{dw_0} > 0$, we have that $\frac{dC_E(E_{1L}^*,k)}{dw_0} < 0$. Suppose, instead, that we had $\frac{\partial I_{1L}^*}{dw_0} < 0$, such that $\frac{dC_E(E_{1L}^*,k)}{dw_0} > 0$. This would require $\frac{dE_{1L}^*}{dw_0} > 0$. The definition of E_{1L}^* would then imply that:

$$\frac{dE_{1L}^*}{dw_0} = \frac{\partial I_{1L}^*}{dw_0} - \lambda c_L g^{'}(I_{0R}^*)\frac{\partial I_{0R}^*}{dw_0} - \lambda g^{'}(I_{0S}^*)\frac{\partial I_{0S}^*}{dw_0} > 0 \tag{20}$$

However, since $\frac{\partial I_{1L}^*}{dw_0} < 0$, this would require current investment–cash flow sensitivities to be negative as well; that is, $\frac{\partial I_{0R}^*}{dw_0} < 0$ and/or $\frac{\partial I_{0S}^*}{dw_0} < 0$. This argument suggests that any reasonable solution of the problem should have $\frac{dC_E(E_{1L}^*,k)}{dw_0} < 0$. It is then trivial to use this result to replicate the proofs of Results 4 and 5 for variations in w_0.

The intuition for this result is as follows: An increase in w_0 relaxes current and future financing constraints, thereby mitigating the distortions towards safer and more liquid investments. In particular, higher w_0 increases current liquid investments, which in turn reduces future costs of external funding.

Testing this implication empirically is subject to the standard problem that observed cash flow might capture variations in investment opportunities. In particular, investment can increase with cash flows even if financial constraints are never binding (see, e.g., Gomes (2001) and Alti (2003)). However, note that our focus on investment ratios proves to be helpful in these circumstances. Presumably, higher investment opportunities should increase *all* types of investment. Unless cash flow contains significantly more information about the marginal productivity of some particular types of investments (through some involved story), the sensitivity of the *ratio* of investments to cash flow should capture the effect of future financing constraints on current firm policies.

2.4 Direct Model Implications

It is worth summarizing the set of implications that are derived directly from our framework — to our knowledge, none of these implications have been directly tested before. Empirical examination of these hypotheses may provide new insights into the problem of how capital markets imperfections affect corporate behavior; in particular, how those imperfections lead to distortions in firms' real investment behavior across time. The nature of these distortions might be interesting not only for financial researchers, but also for economic policy makers.

For brevity, we present the direct implications of our model in a table. Table 1 abstracts from the use of heavy notation and states in simple language what one should expect to see in terms of investment distortions (e.g., towards safer, more liquid assets) as firms experience increasing (binding) costs of external financing over time. The table also presents the sorts of distortionary effects one should observe following shocks to the availability of internal funds and how investment risk and liquidity might interact in the presence of financing constraints.

Testing these implications empirically is beyond the scope of our current study. However, it is easy to sketch strategies one could use to take a first cut at the implications listed in Table 1. For instance, during the onset of macroeconomic movements that likely constrain small, unrated firms' access to credit (e.g., an aggregate recession or a contractionary monetary policy), one might see those firms choosing to increase their ratios of cash stocks (liquid investments) relative to that of plants and machines (illiquid investments), even when the latter set of investments have a higher marginal product. In addition, one should see that distortion declining in response to positive innovations to cash flow from operations. These findings could be validated in a differences-in-differences framework by using the behavior of financially unconstrained firms as an empirical benchmark.

Table 1: Untested Direct Model Implications

Topic	*Testable Implications*
Investment Liquidity	The ratio of liquid-to-illiquid investments increases with the likelihood that financial constraints are binding in the future
Investment Risk	The ratio of safe-to-risky investments increases with the likelihood that financial constraints are binding in the future
Investment Liquidity and Risk (Complementarity Effect)	The ratio of safe-to-risky investments increases with asset liquidity when financial constraints are likely to bind in the future
Investment Liquidity and External Financing Costs	The ratio of liquid-to-illiquid investments increases with the marginal cost of external finance when financial constraints are likely to bind in the future
Investment Risk and External Financing Costs	The ratio of safe-to-risky investments increases with the marginal cost of external finance when financial constraints are likely to bind in the future
Investment Liquidity and Availability of Internal Funds	The ratio of liquid-to-illiquid investments decreases with the availability of internal funds when financial constraints are likely to bind in the future
Investment Risk and Availability of Internal Funds	The ratio of safe-to-risky investments decreases with the availability of internal funds when financial constraints are likely to bind in the future

3 Model Extensions

In Section 2 we kept the complexity of our benchmark model to a minimum level. This allowed us to derive implications about the impact of future financing constraints on current investment decisions in a general way. In this section, we explore various extensions of our analysis as a way to facilitate our discussion of the empirical literature (see next section). In particular, we consider extensions that discuss: capital structure choices and their effect on future financing constraints and investment, how financing constraints affect a firm's optimal cash policy, and how poor investor protection can lead to external financing costs that have similar properties as the $C(E, k)$ function we use in Section 2.

3.1 Firm Leverage, Financial Distress, and Financial Constraints

One potential source of financing constraints occurs when a leveraged firm enters financial distress. A firm that faces a cost of financial distress — a loss in firm value due to the inability to honor financial obligations — is also financially constrained. These distress costs can map into the reduced-form specification of financing costs discussed above.

To introduce financial distress into our framework, suppose that the firm enters the model at date 0 with an existing amount of debt equal to D_0. For simplicity, assume that this debt is due entirely at date 1. Additionally, assume that the firm cannot change its debt level at date 0, and that date-0 investments are financed with equity. At date 1, the firm repays its debt and invests in new projects. Thus, the firm will enter financial distress at date 1 if its total date-1 cash flow (including the payoffs from date-0 investments) is lower than D_0. For simplicity, we do not consider explicit date-1 investments in this extension. Instead, we capture date-1 value losses due to financial distress with a simple functional form $\phi(D_0 - W_1)$, which we assume to be increasing in the cash shortfall ($\phi'(.) > 0$). These parametric costs of financial distress include both direct and indirect costs, such as higher financing costs for (hypothetical) date-1 investments.[11]

We also assume that the cash flow from assets in state H is higher than D_0, implying that the firm is never in distress in state H. We define $W_{1L}^{FB} = \lambda c_L g(I_{0R}^{FB}) + \lambda g(I_{0S}^{FB})$ as the state-L cash flow that the firm realizes if it follows its first-best investment policy. As long as $W_{1L}^{FB} > D_0$, the firm does not distort its investment policy to reduce financial distress costs at date 1. However, if $W_{1L}^{FB} < D_0$, first-best cash flows are not enough to avoid distress, and the firm must take that into account when deciding on date-0 investments.

In such a setting, debtholders will capture most of the value in the bad state of the world, and thus an equity value-maximizing manager might have incentives to overinvest in the risky asset (Jensen and Meckling's risk-shifting effect). Because the point of this analysis is to better understand reasons why the firm might *not* risk-shift, we assume for simplicity that date-0 investment is chosen to maximize firm value.[12] In that case, the optimal date-0 investments will be determined by:

$$(1+\theta)g'(I_0^*) = \left[\overline{c} + (1-p)c_L\lambda\phi'(D_0 - W_{1L})\right] g'(I_{0R}^*) = \left[1 + (1-p)\lambda\phi'(D_0 - W_{1L})\right] g'(I_{0S}^*), \quad (21)$$

where $W_{1L} = \lambda c_L g(I_{0R}) + \lambda g(I_{0S})$. One can verify that Eq. (21) is very similar to Eq. (6) in the benchmark model, with external financing costs $C(.)$ replaced by $\phi(D_0 - W_1)$. Thus, Eq. (21) implies that for a distressed firm, the optimal ratios of safe to risky, and of liquid to illiquid investments are higher than in a situation with zero distress costs. In addition, an increase in D_0 increases the ratios of safe to risky, and liquid to illiquid investments.[13]

These results point to financial distress costs as a possible source of the external financing costs modeled in Section 2. In addition, the costs arising from suboptimal investment at date-0 can be seen as indirect costs of distress as well (though not included in the function $\phi(.)$ in above).

[11] The existing debt will reduce the amount of date-1 cash flows that can be used for investment in new projects, increasing the date-1 cost of external finance.

[12] See Leland (1998) for an analysis of the case in which the manager chooses investment risk taking into account both transfers from debtholders (i.e., risk-shifting) and default costs.

[13] Strictly speaking, these comparative static results require the function $\phi(.)$ to be convex, so that marginal distress costs are increasing in the cash shortfall.

Naturally, one option that the firm has is to adjust its leverage policy to reduce distress costs. In the context of our model, the firm can use date-0 cash flow (w_0) to reduce debt, instead of using it entirely for investment (as implicitly assumed in the analysis above). However, notice that reducing debt is not costless, since debt reductions require cash that can alternatively be used for productive investments.[14] While we do not model this trade-off explicitly in this extension, we conjecture that in equilibrium the firm will balance the costs of debt (including direct distress costs and future financing costs) with debt benefits that might include tax shields and the ability to undertake additional investment projects today. The analysis above would then imply that firms that optimally choose to become highly leveraged will have incentives to distort their investment policy towards safe and liquid assets, as a way to counteract some of the costs of high leverage. These arguments imply that optimal capital structure decisions should take into account the impact of debt on future external financing costs, and on the investment distortions that are engendered by higher leverage. While research on capital structure has largely ignored the issue of capital market imperfections,[15] our model may help explain why firms' leverage ratios seem too low to be reconciled by standard tradeoff theories that emphasize more traditional costs of financial distress.

Despite the potential importance of leverage for the investment distortions that we discuss in this paper, it is important to reinforce the point that these distortions do not require the presence of high leverage. In other words, a firm can be financially constrained without necessarily having high leverage. To see this most clearly, consider a (rather extreme) version of the model in which external financing costs are so high that the firm chooses not to raise any external finance at all. In this case, leverage is obviously zero. However, the firm faces the constraint that it cannot invest more than its internal funds, and must take that into account when optimizing its investment program. In the context of the model of Section 2, the firm's problem reduces to:

$$\max_{I_{0S}, I_{0R}, I_0, I_{1L}} \bar{c}g(I_{0R}) - I_{0R} + g(I_{0S}) - I_{0S} + (1+\theta)g(I_0) - I_0 + (1-p)[g(I_{1L}) - I_{1L}] \text{ s.t.} \tag{22}$$

$$W_0 = I_{0R} + I_{0S} + I_0$$

$$I_{1L} = \lambda c_L g(I_{0R}) + \lambda g(I_{0S})$$

The solution to this problem will have the same properties as the basic solution in Section 2:

$$(1+\theta)g^{'}(I_0^*) = \left[\bar{c} + (1-p)c_L\lambda\left(g^{'}(I_{1L}^*) - 1\right)\right]g^{'}(I_{0R}^*) = \left[1 + (1-p)\lambda\left(g^{'}(I_{1L}^*) - 1\right)\right]g^{'}(I_{0S}^*). \tag{23}$$

Liquid and safe investments help the firm increase I_{1L}^*, and this is valuable if $g^{'}(I_{1L}^*) - 1 > 0$; that is, if the firm is constrained in state L in the future.

[14] This additional cost is specially important for firms that face high deadweight costs when issuing outside equity.
[15] Lemmon and Zender (2004) and Faulkender and Petersen (2005) are notable exceptions.

In the real world, both financial distress costs induced by high leverage and "pure" financing constraints can be important. For example, a large, highly-leveraged US firm might very well find plenty of external funding for any profitable opportunity it faces in "normal times" (i.e., times at which it is not distressed). This firm, however, may care about future financial distress costs if those costs are potentially large. Alternatively, a small firm in a developing economy does not have access to sophisticated capital markets and faces very high external financing costs at all times, even if it is not financially distressed (e.g., even if unleveraged). Our analysis suggests that both firms are likely to distort their current investment policy to facilitate financing of future investments.

3.2 Cash as a Safe Investment and the Cash Flow Sensitivity of Cash

Recent papers have studied the role played by cash in the optimal financial policy of financially constrained firms (see, for example, Almeida et al. (2004) and Acharya et al. (2007)). These papers, however, do not consider the possibility that the firm can also use its real investments to manage liquidity intertemporally. In this section, we extend our model to show how cash savings behavior interacts with other liquid investments across time.

The firm's demand for cash can be seen as a particular case of the safe investment I_{0S} that we consider in our general model. Standard formulations assume that cash's future payoff is linear in the amount held, where the return on cash reflects the market interest rate on safe investments and other costs of holding cash, such as taxes and a liquidity premium.[16] We denote the firm's cash balance as S, and assume that its future payoff is equal to $(1-\tau)S$, where the parameter $\tau > 0$ captures the cost of carrying cash. If we replace I_{0S} with S and $g(I_{0S}) = (1-\tau)S$ in the model of Section 2, we obtain the first order condition for an interior solution for the optimal level of cash balances S^*:

$$(1-p)(1-\tau)C_E(E_{1L}^*, k) = C_E(E_0^*, k) + \tau. \tag{24}$$

The left-hand side of Eq. (24) is the marginal benefit of carrying cash (lower future marginal costs of external finance). The right-hand side of (24) represents the marginal cost of carrying cash, which reflects both current marginal costs of external financing and the carrying cost τ. Because of the cost of carry, the optimal cash balance is zero ($S^* = 0$) for firms that do not expect to be constrained in future periods. In contrast, the constrained solution will generally imply a positive level of cash balances (see Almeida et al. (2004)). Accordingly, Results 1 and 2 of the general model hold for investment in cash (i.e., savings): financially constrained firms should invest more in cash relative to other investments than unconstrained firms. The result also holds for the absolute levels of cash; that is, constrained firms should hold more cash in their balance sheets than unconstrained firms.

[16] The results in Faulkender and Wang (2006) suggest that a dollar of cash is worth less than a dollar for firms that are financially unconstrained, consistent with a cost of carrying cash.

Importantly, the constrained firm has an alternative way of transferring resources across time in our model, which is to make liquid real investments (I_{0R}). A constrained firm chooses I_{0R} by setting:

$$g^{'}(I_{0R}^{*}) = \frac{(1-\tau)[1+(1-p)C_E(E_{1L}^{*},k)]}{\bar{c}+(1-p)c_L\lambda C_E(E_{1L}^{*},k)} \tag{25}$$

Similarly, I_0^* is given by:

$$g^{'}(I_0^{*}) = \frac{(1-\tau)[1+(1-p)C_E(E_{1L}^{*},k)]}{(1+\theta)} = \frac{1+C_E(E_0^{*},k)}{(1+\theta)} \tag{26}$$

We can use these equations to analyze the relation between current internal funds and the various types of investment. One can verify from Eqs. (25) and (26) that, under the same conditions underlying Result 6, we obtain:

$$\frac{\partial I_{0R}^{*}}{\partial w_0} > 0 \text{ and } \frac{\partial I_0^{*}}{\partial w_0} > 0. \tag{27}$$

An increase in w_0 relaxes current and future financing constraints, allowing the firm to invest more aggressively in illiquid and risky assets.

Interestingly, the positive effect of cash flows on liquid real investments ($\frac{\partial I_{0R}^{*}}{\partial w_0} > 0$) has important implications for the "cash flow sensitivity of cash" (cf. Almeida et al., 2004). Almeida et al. assume that all investments are illiquid (i.e., $I_{0R} = 0$). In this case, Eq. (24) implies that the cash flow sensitivity of cash is always positive (i.e., $\frac{dS^*}{dw_0} > 0$). In order to see this, note that the increase in w_0 reduces $C_E(E_0^*, k)$, and thus decreases the right-hand side of Eq. (24) (the cost of carrying cash). In the new equilibrium, the marginal benefit of carrying cash must also decrease (i.e., $C_E(E_{1L}^*, k)$ must decrease). Since $E_{1L} = I_{1L} - (1-\tau)S$ in this case ($I_{0R} = 0$), the firm must also increase its cash balances to reduce E_{1L} and allow for higher future investment, I_{1L}. As explained by Almeida et al., in this case the firm uses its cash balances to convert the impact of the cash flow shock into higher investment in the future.

Nevertheless, when I_{0R} is allowed to respond to w_0, the constrained firm has an alternative way to reduce future external financing costs, and allow for higher future investment. Specifically, notice that $E_{1L} = I_{1L} - (1-\tau)S - \lambda c_L g(I_{0R})$, so the increase in I_{0R} automatically decreases the future demand for external financing. In this case, it is possible that the constrained firm responds to a positive cash flow shock by holding less cash. In other words, in the presence of an alternative liquid investment, the cash flow sensitivity of cash is smaller and might become *negative*.

Importantly, we note that there might still be other effects that push towards more positive or negative cash flow sensitivities of cash. For example, the variation in w_0 may contain information about future cash flows and investment opportunities. In fact, as discussed in Riddick and Whited (2006), a positive serial correlation between cash flows can reduce the constrained firm's propensity to save, since a positive current cash flow shock also increases future cash flows, relaxing future financing constraints. In addition, Acharya et al. (2007) show that the cash flow sensitivity of cash may depend on the constrained firm's future hedging needs. If hedging needs are low, saving cash might be dominated by saving debt capacity, which reduces the cash flow sensitivity of cash. Ultimately, whether cash–cash flow sensitivities are positive or negative is an empirical matter. Section 4 provides a discussion of the available evidence.

3.3 Poor Investor Protection as a Source of Financial Constraints

The prior analysis has adopted a "reduced form" specification of financing costs, simply assuming that financing costs increase with the amount of capital raised and an exogenous parameter that indexes the overall level of financing costs. This specification is sufficiently general so that it can apply in a number of different circumstances. Yet, one concern is that the underlying reasons for the financial constraints could somehow affect the distortions in investment we focus on.

To address this concern, we extend our basic model by explicitly modeling an underlying structure that creates a cost of external finance with the properties of the $C(E,k)$ function we use in Section 2. We do so in the context of one of the most commonly discussed reasons for costly external financing: weak legal protection. In particular, we show how poor investor protection can generate the external financing cost function $C(E,k)$ by solving a modified version of the Shleifer and Wolfenzon (2002) model that is similar to Almeida and Wolfenzon (2006).

Suppose that the date-1 investment in our model (I_1) is chosen by a controlling shareholder who owns the entire firm at that date. The controlling shareholder also has wealth equal to W, and has to raise cash from outside investors to help finance the date-1 investment. As in Shleifer and Wolfenzon, we assume that external finance takes the form of equity. Accordingly, the controlling shareholder ends up owning a fraction $(1-\alpha)$ of the cash flows $g(I_1)$ that will be produced at date 2, while the remaining cash flows $\alpha g(I_1)$ are owned by minority shareholders.[17] After the investment level is chosen, the controlling shareholder can divert a fraction d of the cash flows. Hence, the firm produces $dg(I_1)$ in private benefits for the controlling shareholder, and $(1-d)g(I_1)$ in security benefits. We do not need to think of $dg(I_1)$ as stealing. More generally, the private benefits represent the fraction of the value that accrues only to the controlling shareholder.[18]

Also, as in Shleifer and Wolfenzon, we assume that the consumption of private benefits creates deadweight costs that are represented by $h(d,P)g(I_1)$. The function $h(d,P)$ is assumed to be increasing and convex in d, and the variable P represents the level of investor protection.[19] Shleifer and

[17] We note, however, that the model can also accommodate debt finance that is constrained by protection of outside creditors. In that case, $\alpha g(I_1)$ should be interpreted as the total cash flows belonging to outside investors.

[18] For example, the controlling shareholder may derive private benefits from employing his family members in the firm.

[19] For instance, employing the controlling shareholder's family might reduce total productivity. Notice that this formulation also assumes that the costs of private benefits are increasing in the size of the firm. It is assumed that the

Wolfenzon model investor protection by assuming that higher investor protection increases the cost of diversion by the controlling shareholder ($h_P > 0$). To simplify the analysis, we adopt a parametric form for $h(d,P)$:

$$h(d,P) = P\frac{d^2}{2}. \tag{28}$$

Given the investment level and the ownership stake α, the controlling shareholder decides on the optimal amount of private benefits that he will consume by solving the following problem:

$$\max_{d\in[0,1]} \left((1-\alpha)(1-d) + d - P\frac{d^2}{2}\right) g(I_1). \tag{29}$$

This program produces the optimal diversion $d^*(\alpha,P) = \frac{\alpha}{P}$.[20]

Given the optimal diversion function $d^*(\alpha,P)$ that is expected to occur ex-post, the controlling shareholder chooses 1) how much to invest in the project, and 2) how much external funds to raise to maximize his ex-ante payoff. His maximization problem is constrained by the condition that minority shareholders must break even:

$$\max_{\alpha,I_1} \left[(1-\alpha)(1-\frac{\alpha}{P}) + \frac{\alpha}{P} - \frac{\alpha^2}{2P}\right] g(I_1) \text{ s.t.} \tag{30}$$
$$I_1 - W \leq \alpha(1-\frac{\alpha}{P})g(I_1).$$

If the constraint is binding, we can also write this program as:

$$\max_{\alpha,I_1} g(I_1) - I_1 - \frac{\alpha^2}{2P}g(I_1) \text{ s.t.} \tag{31}$$
$$I_1 - W = \alpha(1-\frac{\alpha}{P})g(I_1).$$

The controlling shareholder maximizes the NPV of the investment net of diversion costs. Because diversion is priced at the time the controlling shareholder issues shares, the controlling shareholder would like to commit to zero diversion, if possible. To increase investment the manager might need to issue shares and raise external funds. As α increases, ex-post diversion will increase ($d_\alpha > 0$), generating external financing costs per unit of output of $\frac{\alpha^2}{2P}$.

The budget constraint creates a relation between the investment level I_1 and the minority ownership stake α, which we denote as $\alpha(I_1,P)$. The optimal investment level satisfies:

$$\max_{I_1} g(I_1) - I_1 - \frac{\alpha(I_1,P)^2}{2P}g(I_1). \tag{32}$$

This expression maps directly into the framework discussed in Section 2, with an external financing cost function equal to $C(I_1,P) = \frac{\alpha(I_1,P)^2}{2P}g(I_1)$. The properties of $C(I_1,P)$ depend on the function

costs $h(d)g(I_1)$ are borne by the controlling shareholder, but this assumption is not crucial for the results.

[20] This assumes that $d^* < 1$. If $P < \alpha$, then $d^* = 1$.

$\alpha(I_1, P)$. When the firm raises zero external finance ($I_1 - W < 0$), the controlling shareholder keeps $\alpha(I_1, P) = 0$. This implies that external financing costs are zero, and so $C(I_1, P) = 0$ for $I_1 < W$.

For $I_1 > W$, external financing costs are a function of I_1 and P. We can calculate $\alpha_{I_1}(I_1, P)$ as:

$$\alpha_{I_1}(I_1, P) = \frac{1 - \alpha(1 - \frac{\alpha}{P})g^{'}(I_1)}{g(I_1)(1 - \frac{2\alpha}{P})}. \tag{33}$$

At the optimal solution I_0^* the numerator of (33) must be positive, or else the financial constraint could not be binding (it would be possible to relax the constraint by increasing investment). Similarly, Shleifer and Wolfenzon argue that at the optimum investment level, $\alpha_{I_1}(I_1, P) > 0$. Otherwise, the controlling shareholder could increase his payoff by increasing investment, which would raise his ownership stake and decrease diversion. This logic implies that the denominator of $\alpha_{I_1}(I_1, P)$ must also be positive. We can additionally calculate $\alpha_P(I_1, P)$ as:

$$\alpha_P(I_1, P) = -\frac{\alpha^2}{P^2 g(I_1)(1 - \frac{2\alpha}{P})}. \tag{34}$$

Since $g(I_1)(1 - \frac{2\alpha}{P}) > 0$, it follows that $\alpha_P(I_1, P)$ is negative.

We can now use the properties of $\alpha(I_1, P)$ to show that the cost function $C(I_1, P)$ satisfies the assumptions of Section 2 for $I_1 > W$:

$$C_{I_1} = \frac{\alpha^2 g^{'}(I_1) + 2\alpha\alpha_{I_1} g(I_1)}{2P} > 0, \tag{35}$$

$$C_P = \frac{[2\alpha\alpha_P - \alpha^2]g(I_1)}{2P^2} < 0. \tag{36}$$

These expressions indicate that the costs of external financing increase with the level of investment that is subject to expropriation, and decline with the level of investment protection.

4 Additional Implications, Existing Evidence, and Directions for Future Research

In the last section we extended our original analysis, gearing it towards topics that have received much attention in the literature (e.g., financial distress, risk-shifting, and cash policies). In this section, we discuss various applications of our framework and the relevant empirical evidence. We go beyond the topics discussed thus far and point out to additional implications that can be tested in future empirical work (for example, in the area of financial development). For ease of reference, the discussion is summarized in Table 2.

Table 2: Mapping between Model and Existing Evidence

Topic	*Implications*	*Existing Evidence*
Leverage and Investment Risk	Highly leveraged firms will take safer, not riskier investments	Andrade/Kaplan (1998), Rauh (2007)
	Asset substitution more likely in less pledgeable assets	Eisdorfer (2007)
Leverage and Investment Liquidity	Highly leveraged firms should invest in more liquid assets, and in assets that produce shorter-term cash flows	Peyer/Shivdasani (2001), Ahn/Denis/Denis (2006), Campello (2003), Campello/Fluck (2005)
Capital Structure Choices	Lower debt-asset than traditional tradeoff model predicts	Graham (2000)
Cash Management	Constrained firms hold more cash	Almeida/Campello/Weisbach (2004), Han/Qiu (2006), Riddick/Whited (2006)
	Difference between constrained and unconstrained firms in cash flow sensitivity of cash	Almeida/Campello/Weisbach (2004), Sufi (2006), Acharya/Almeida/Campello (2007), various int'l studies
	Cash management more valuable for constrained firms	Faulkender/Wang (2006), Sibilkov (2005)
Hedging	Constrained firms hedge using both financial and operating strategies, particularly when derivatives are not available	Petersen/Thiagarajan (2000), Acharya/Almeida/Campello (2007)
Cross-Country Comparisons	More liquid investments in countries w/ high financing costs	Dittmar/Mahrt-Smith/Servaes (2003), Khurana/Pereira/Martin (2006)
	More tangible investments in countries w/ high financing costs	Demirgüç-Kunt/Maksimovic (1999), Braun (2003), Claessens/Laeven (2003), Carlin/Mayer (2003)
	Safer investments in countries w/ high financing costs	John/Litov/Yeung (2005)
Real Effects of Fin. Development	Link between fin. development and investment efficiency	Beck/Levine/Loyaza (2000), Wurgler (2000)

4.1 Leverage, Risk-Shifting, and Investment Liquidity

The extension in Section 3.1 suggests that high leverage can force firms to distort their investments in the directions suggested by our model. In particular, we expect highly leveraged firms to have a preference for safer investments, investments that produce cash flows sooner, and for investments that utilize assets that can be collateralized to help finance other investments.[21] We emphasize that the first prediction, the preference for safer investments by highly leveraged firms, is exactly the *opposite* of what comes from the classic Jensen and Meckling (1976) risk-shifting analysis. Hence, our model provides a plausible explanation for the lack of evidence for Jensen and Meckling's proposition.[22]

The preference for safer investments is consistent with the findings of a number of studies. Andrade and Kaplan (1998) examine a sample of firms undergoing financial distress following leveraged recapitalizations. Despite the fact that these firms are likely candidates for risk-shifting, Andrade and Kaplan find no evidence that any of their sample firms take any actions that increase risk. Instead, consistent with our model, the distressed firms' investments tend to be safer ones, designed to increase the probability of firm survival.[23] Rauh (2007) considers how firms manage the assets in their pension fund and how pension fund management relates to firm-wide risk. He finds that as firms get into financial difficulties, their pension fund management becomes more conservative, the opposite of what the Jensen and Meckling arguments would imply, but consistent with the arguments in our model. His result is also consistent with the implication of our model that the preference for safer assets by constrained firms would be primarily in liquid assets.

Peyer and Shivdasani (2001) consider a sample of firms that have undergone leveraged recapitalizations. Consistent with our second prediction, these authors find that their sample firms tend to undertake investments that yield cash flows sooner, even though these investments do not appear to be as profitable as the ones they took prior to the recapitalization. Ahn, Denis, and Denis (2006) show that higher leverage causes conglomerates to curtail investment in non-core/high-Q segments, to the benefit of core/low-Q segments, indicating that higher financing frictions lead conglomerates to refocus on corporate survival at the expense of inefficient investment decisions.

[21] There is substantial evidence that leverage has a negative impact on investment *levels* (see, e.g., Lang, Ofek, and Stulz (1996) and Zingales (1998)). We emphasize, however, that these predictions pertain to distortions in the *types* of investments rather that their levels.

[22] One can also look at the existence (and enforcement) of covenants as a reason why there is little asset substitution in practice (see Nini, Smith, and Sufi (2006)). Covenants are often tied to cash flows (Sufi (2006)) and violating a covenant today may lead to having higher costs of external financing in the future. These intertemporal considerations about future financing costs and current investment decisions lead to the same dynamics we describe in our model: higher expected costs of external financing leads firms to choose safer, more liquid investment today.

[23] See also Maksimovic and Phillips (1998) for evidence on the efficiency of plant sales (disinvestment) by distressed firms. Khanna and Poulsen (1995) compare the decisions of bankrupt firms with those of a matched sample of non-bankrupt firms. Based on stock market reactions to managerial actions (e.g., asset sales, personnel reductions, acquisitions), the authors conclude that managers of bankrupt firms make investment decisions that are very similar to those of non-bankrupt firms with respect to risk and efficiency. In contrast, a recent paper by Eisdorfer (2007) finds that the relationship between investment spending and project volatility is less negative for distressed firms.

Evidence from "involuntary changes" in leverage also provides results that are consistent with our theory. In the product markets literature, Chevalier and Scharfstein (1996), Campello (2003), and Campello and Fluck (2005) look at the pricing policies of leveraged firms during aggregate recessions — taken as periods when the claim of debt over corporate income increases exogenously. These studies find that the more leveraged firms increase markups (i.e., underinvest in market share building) by more than their unleveraged industry rivals in the onset of recessions. Crucially, they do so in a way that is consistent with a suboptimal attempt to boost cash flows in the short term at the expense of long-term profits. Findings in this literature agree with our model's prediction that considerations about binding financial constraints in the future cause firms to distort current investment policies toward shorter-term, safer investments.

We do not know of any studies that examine the liquidity of the assets used in investments by firms undergoing large changes in leverage; studying such changes would be a useful topic for future research. Whenever firms can substitute into investments with varying degrees of liquidity, our model suggests that we should observe "liquidity-shifting" into more tangible assets when firms begin to face financial constraints. In addition, one prediction of our model is that financing constraints should have a higher effect on the risk profile of the firm's liquid investments than on its illiquid ones. Thus, to the extent that risk-shifting does occur, we expect to observe it more with a firm's real (illiquid) assets than with its financial (liquid) ones. Evidence in Eisdorfer (2007) suggests that risk-shifting is more likely to take place when creditors have a harder time recovering assets in liquidation (when assets are less pledgeable).

4.2 Capital Structure Choices

One of the most commonly discussed and taught theories of capital structure is that a firm adjusts its capital structure over time to maintain (or to be near) a prespecified "target," determined by the tradeoff between taxes and bankruptcy costs. But a puzzle for this theory is that firms in the real world appear to be setting their targets too low. Graham (2000), for example, argues that most firms could add substantial leverage and reap the corresponding tax benefits of debt without noticeably increasing distress costs.

Our model extension in Section 3.1 identifies an additional cost of financial leverage: the potential impact of high leverage on future financing costs might cause today's real investments to be distorted away from their first-best levels. As we explain in Section 3.1, this investment policy distortion can be viewed as an indirect cost of distress, albeit one that has been less emphasized by the academic literature. While it is hard to quantify the magnitude of this effect, the expected value losses from distorted investment could be one factor leading firms to set their target debt ratio lower than one might otherwise expect.[24]

Our arguments also suggest that in addition to tax shields and pure bankruptcy costs, managers will be concerned with the ability to secure additional financing when deciding on capital structures. Anecdotal evidence is certainly consistent with this argument. For example, in the Graham and Harvey (2001) survey, "financial flexibility," presumably referring the ability to fund future investment at a fair cost, was cited by 59% of CFOs as an important determinant of leverage levels — the single most commonly cited determinant of leverage in the survey (see also Bancel and Mittoo (2002)). Richard Passov, the treasurer of Pfizer, argues in Passov (2003) that, because of the high value they place on future R&D expenditures, technology and life science companies carry very little (or even "negative") debt in their balance sheets. Supporting this argument, Bates, Kahle, and Stulz (2006) document that the increase in R&D expenditures in recent years is associated with a massive decline in 'net leverage' (debt minus cash) ratios among industrial firms: from 1980 to 2004, the average net leverage ratio of industrial firms plummeted from 16% to –1%.[25]

4.3 Cash Management

Another important financial decision for managers is how liquid a balance sheet their firms should have. This was the context in which Keynes (1936) proposed his original argument. However, the decision to hold cash is, at its core, an investment decision. A firm could otherwise invest the money in physical or alternative financial investments, or pay it out to shareholders.

The analysis in Section 3.2 shows how a constrained firm should distort its cash and investment policies to mitigate future financing constraints. In particular, when firms are anticipating tighter financing constraints in the future, they should hold more cash today. This prediction is consistent with available evidence (see, among others, Kim et al. (1998), Almeida et al. (2004), Han and Qiu (2006), Faulkender and Wang (2006), and Riddick and Whited (2006)).

Following Almeida et al. (2004), recent literature has also focused on the "cash flow sensitivity of cash," namely the propensity to save cash out of a marginal dollar of cash flow. In contrast to Almeida et al., the analysis in Section 3.2 shows that the cash flow sensitivity of cash can be positive or negative. The difference in results is explained by Almeida et al.'s assumption that holding cash is the only way to transfer resources across time; put differently, that all fixed investments are illiquid. Under the more general setup that we consider in this study, it follows that whether constrained firms disproportionately save or spend their marginal cash flows becomes an empirical question.

[24] We note that there are other explanations for debt conservatism (see, e.g., Hennessy and Whited (2005)).

[25] In a recent study DeAngelo and DeAngelo (2006) take financial flexibility as the primary driver of capital structure choices. In their analysis, firms determine their optimal financial policies as a function of the benefits of financial slack (namely, the ability to invest in positive NPV projects) and its associated costs (agency concerns). The authors argue that, although it reduces agency, high debt today also hinders firms' ability to invest in the future. They recommend high dividend payouts, moderate cash holdings, and low debt as an optimal strategy for firms' financial policy.

Almeida et al. consider a number of measures of credit constraints and estimate the sensitivity of cash holdings to incremental cash flow. They find that the cash flow sensitivity of cash is noticeably higher for the firms classified as financially constrained than for those classified as unconstrained.[26] Sufi (2006) uses data that allow him to further refine the financial constraint proxies used in Almeida et al. Looking at information on whether a firm has access to an unused line of credit, Sufi finds that constrained firms that do not have access to a line of credit are particularly more likely to save cash out of cash flows. Acharya et al. (2007) find that the cash flow sensitivity of cash depends on constrained firms' hedging needs. If hedging needs are high (that is, if future cash flows and investment opportunities are not highly correlated), then constrained firms tend to save cash out of cash flows. However, if hedging needs are low, cash–cash flow sensitivities become insignificant. In contrast, Riddick and Whited (2006) use a different empirical methodology to estimate cash flow sensitivities of cash and find that such sensitivities are often negative.

Besides the direct evidence on the level of cash holdings and on cash flow sensitivities of cash, there is also other evidence suggesting that the concern about future financing ability is an important determinant of firms' cash policies. Using Almeida et al.'s measures, Faulkender and Wang (2006) show that the value of the cash increases with the degree of financing constraints a firm faces (see also Sibilkov (2005)). Han and Qiu (2006) use those same measures of financing constraints to show that constrained firms' cash savings increase with the volatility of their cash flows. Thus, constrained firms appear to use cash holdings to counteract the riskiness of their cash flows.[27]

4.4 Hedging Policy

When a firm hedges its cash flows, it is essentially taking a series of investments that alter its cash flow distribution. Froot et al. (1993) argue that one reason why firms hedge is to better align their cash flows with their investment opportunities, and to minimize the deadweight costs associated with future financing needs.[28] To a degree, our model is a generalization of Froot et al. In particular, one can think of the constrained firm's preference for safer investments as a hedging-like strategy.

One important difference between our paper and Froot et al. is that they focus their discussion on the use of financial derivatives and options. There is a reasonable theoretical justification for this choice. Barring transaction costs, a financial derivative such as futures contracts can be thought of as a zero NPV investment that transfers funds across future states of the world. In contrast, the

[26] A number of recent papers have reported similar results using international data. See Ferreira and Vilela (2004) for Continental Europe; Nguyen (2005) for Japan; Chang, Tan, and Wong (2005) for Australia; Costa and Paz (2005) for Brazil; Marchica (2006) for the UK; and Saddour (2006) for France.

[27] Opler, Pinkowitz, Stulz, and Williamson (1999) also report a positive relationship between volatility and cash holdings. However, they do not examine the mediating role of financing constraints.

[28] Mello and Parsons (2000) propose an alternative model of the relation between financial constraints and optimal hedging strategies, while Smith and Stulz (1985) argue that financial distress creates incentives for hedging.

investment distortions that we discuss in this paper have real costs for a firm that pursues them. Following the Froot et al. argument, the empirical hedging literature has attempted to characterize the use of similar kinds of financial instruments (futures, forwards, etc.).[29] However, the bulk of the evidence suggests that, contrary to the intuition of Froot et al., the use of financial derivatives is concentrated in large (likely unconstrained) companies. As a result, the link between future financial constraints and hedging remains somewhat controversial.

An advantage of our argument is precisely that we *do not* focus on financial derivatives. In practice, the effectiveness of derivatives might be hampered by the difficulty of securitizing cash flows that are not contingent on easily verifiable variables, such as commodity prices and currency exchange rates.[30] These limits to securitization should be particularly stringent on firms that face deadweight costs of issuing more standard securities such as debt (i.e., potentially constrained firms). This argument might explain why, in practice, firms use alternative means of hedging that involve both financial and operating strategies (see Petersen and Thiagarajan (2000)).[31] It might also explain why the literature has struggled to find evidence for a link between hedging and financial constraints. In particular, while the investment distortions that we discuss in this paper entail true NPV costs, they might be more easily implementable, hence they may be a more relevant hedging tool than futures and forwards for constrained firms.

This discussion also suggests that the investment distortions that we describe would be less likely to obtain for firms that can more easily use financial derivatives to hedge future cash flows. An implication of our argument is that increases in the use of derivatives contracts written on the firm's operating cash flows should be associated with a decline in investments that are safer and liquid relative to riskier and potentially more profitable ones. While the use of financial derivatives is a choice variable for the firm, financial innovation processes could be used as a source of exogenous variation in the supply of derivatives that are associated with corporate cash flows. We are not aware of any empirical evidence that speaks directly to interplay between real and financial hedging in the presence of financing constraints.[32]

[29] Papers with evidence that speak to the link between financial constraints and hedging include Nance, Smith, and Smithson (1993), Mian (1996), Géczy, Minton, and Schrand (1997), Gay and Nam (1998), and Guay (1999).

[30] Froot and Stein (1998) make a similar point, in the context of a model in which financial institutions cannot frictionlessly hedge all risks of its positions in the capital markets. They analyze capital structure and capital budgeting choices of financial institutions that face costly external finance and limited hedging. Besides the specific focus on financial institutions, one important difference between our paper and Froot and Stein is that they analyze only one dimension of capital budgeting distortions, namely, distortions in the risk of real investments. Additional examples of hedging papers that did not focus only on financial derivatives are Vickery (2004), who analyzes the maturity structure of corporate debt, and Acharya et al. (2007), who analyze the choice between cash and debt capacity. Both papers report evidence that is consistent with a link between hedging and financial constraints. See also Faulkender (2005).

[31] Moral hazard is an alternative reason why firms cannot always use derivatives to hedge cash flows (Stulz, 2002). For example, a derivative written directly on firm sales would not work well because it reduces managerial incentives to spend costly effort that increases sales.

[32] Opler et al. (1999) report results suggesting that cash holdings decrease with observed derivatives usage. However,

4.5 Cross-Country Comparisons

There is substantial evidence that in many countries the financial system does an imperfect job of allocating capital across the economy's investment opportunities (see Levine (2005) and Demirgüç-Kunt and Levine (2001) for recent surveys). These capital allocation frictions arise partly from costly external financing. For example, in environments with poor investor protection (La Porta, Lopez de Silanes, Shleifer, and Vishny (1998)), firms may not be able to fully undertake their investment opportunities due to the high costs associated with external funding by minority investors (see Shleifer and Wolfenzon (2002)).

In Section 3.3, we built on Shleifer and Wolfenzon (2002) to show how the level of investor protection can be a source of external financing costs. Given the well-documented cross-country differences in institutional environments related to investor protection and international differences in the costs of external finance, our model predicts that we should observe different types of investments across different countries. In countries where costs of raising external finance are high, we should observe a stronger preference for shorter-term, safer investments that use more liquid assets (such as cash), relative to countries with low costs of external finance. The findings of Dittmar, Mahrt-Smith, and Servaes (2003) are consistent with these predictions. These authors show that firms in countries with poor shareholder protection — thus high cost of external finance — hold substantially more cash than otherwise similar firms in high shareholder protection countries. In addition, Khurana, Pereira, and Martin (2006) show that the cash flow sensitivity of cash decreases with the degree of financial development, indicating that firms are more concerned with cash management if the level of financial development is low.[33]

There is also substantial evidence that firms try to increase the pledgeability of their assets as a response to financial market underdevelopment. Demirgüç-Kunt and Maksimovic (1999) find that firms in developing countries have higher proportions of fixed assets to total assets and use less intangible assets than firms in developed countries. Carlin and Mayer (2003) show that the structure of countries' financial systems has a stronger effect on R&D expenditures than in fixed capital. As emphasized by Rajan and Zingales (2001), this finding is consistent with the idea that fixed assets create pledgeable collateral, which is more valuable when financial markets are underdeveloped. Claessens and Laeven (2003) find that sectors that use intangible assets grow faster in countries with more secure property rights, again consistent with the idea that tangible (pledgeable) assets are relatively

they do not attempt to measure exogenous shifts in the supply of derivatives nor look at implications for real investment.

[33] At the same time, Kalcheva and Lins (2005) and Pinkowitz, Stulz, and Williamson (2006) argue that because poor investor protection is associated with more severe agency costs of managerial entrenchment, higher cash balances may also intensify overinvestment by entrenched managers. Specifically, they report evidence suggesting that a dollar of liquid assets is valued at less than a dollar in countries with poor investor protection, and that this discount is even greater in firms that show large separation between cash flow and control rights. Thus, further research is required to establish the optimality of cash balances for firms in poor investor protection countries.

more valuable than intangible assets when external financing costs are higher in expectation. Finally, Braun (2003) shows that in countries with poorly developed financial systems, industrial composition is skewed towards industries with tangible assets. In addition, the impact of underdevelopment on industry growth is greater if the industry is more dependent on external finance. The evidence in all of these papers supports the notion that high financing costs distort the types of investments firms make toward more pledgeable assets, that can be used to secure financing for future investments.

The literature has paid less attention to the effect of poor investor protection on corporate risk-taking. Yet, the available evidence is also consistent with the implications of the model we present. Specifically, John, Litov, and Yeung (2005) report cross-country evidence suggesting that risk-taking is positively associated with the degree of investor protection. More research is required to confirm the link between financial market underdevelopment and corporate risk-taking.

4.6 Real Effects of Financial Development

Our theory posits that when financing costs are high, firms might be willing to sacrifice profits at the margin in exchange for more pledgeable assets and less risky, shorter-term cash flow distributions that can be used to finance subsequent investments. Taken to the context of financial development, our theory implies that as a country develops financially, its companies will be less likely to sacrifice profits to facilitate future financing, and we should observe changes in the nature of their investments, as well as an increase in their ultimate profitability.

This prediction is consistent with much of the recent literature in international finance indicating that financial development lowers the cost of external funding and leads to higher investment and growth (see, e.g., King and Levine (1993), Levine and Servos (1998), Rajan and Zingales (1998), and Demirgüç-Kunt and Maksimovic (1998)). Our argument suggests that financial development will affect not only the level of investment, but also its quality. Consistent with this argument, Beck, Levine, and Loyaza (2000) find that financial intermediary development affects growth mostly through its effect on productivity growth and technological change. In addition, Wurgler (2000) suggests a strong link between financial development and investment efficiency across countries.

Clearly, there are other explanations for why financial development has especially large effects on the productivity of investment. For example, developed financial systems might do a better job at generating information about projects, improving the flow of capital across firms. Future research could attempt to understand the relative importance of these alternative channels, and thereby quantify the magnitude of investment distortions inside firms for economic growth and welfare.

5 Final Remarks

The majority of managers in the U.S. and Europe list "financial flexibility" as the most important goal of their firms' financial policies. Managers' stated policies are consistent with the idea of ensuring funding for present and future investment undertakings in a world where contracting and information frictions often force firms to pass up profitable opportunities. A consequence of these frictions is that they affect the marginal costs and benefits of various projects depending on *both* the firm's financial position and on the project's ability to help the firm finance future investments. We develop this idea in a simple model and discuss numerous implications. The key insight of the model is that future financing constraints lead firms to prefer investments with shorter payback periods, investments with less risk, and investments that utilize more liquid/pledgeable assets. These characteristics of investment are valuable because they help relax future financing constraints. We argue that this simple insight may help explain and reconcile empirical findings in different areas of corporate finance. Critically, it directs us to various promising topics for future research.

As Modigliani and Miller (1958) show in their celebrated paper, corporate finance is interesting only to the extent that financing frictions of one form or another are present. Managers not only react to financing frictions when they occur, but they also anticipate future frictions and adjust their firms' policies so that the impact of these frictions is minimized. We have discussed a number of margins on which managers can make these adjustments. Undoubtedly, our stylized model understates the extent to which this type of behavior occurs. Additional work on the nature of these adjustments will likely lead to a more thorough understanding of corporate financial decisions.

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