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journal homepage: www.elsevier.com/locate/jfecMaturity rationing and collective short-termism[☆]Konstantin Milbradt^{a,b,*}, Martin Oehmke^c^a Kellogg School of Management, Northwestern University, 2001 Sheridan Rd #435, Evanston, IL 60208, United States^b NBER, United States^c Columbia Business School, Columbia University, 420 Uris Hall, 3022 Broadway, New York, NY 10027, United States

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ABSTRACT

Financing terms and investment decisions are jointly determined. This interdependence, which links firms' asset and liability sides, can lead to short-termism in investment. In our model, financing frictions increase with the investment horizon, such that financing for long-term projects is relatively expensive and potentially rationed. In response, firms whose first-best investments are long-term may adopt second-best projects of shorter maturities. This worsens financing terms for firms with shorter-maturity projects, inducing them to change their investments as well. In equilibrium, investment is inefficiently short-term. Equilibrium asset-side adjustments by firms can amplify shocks and, while privately optimal, can be socially undesirable.

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1. Introduction

Financing terms affect investment decisions, and investment decisions affect financing terms. This interdependence creates an intimate link between firms' asset and liability sides. In particular, when financing for long-term projects is relatively expensive or impossible to obtain, firms may adjust their investment behavior towards shorter-term projects, even when those are less efficient.

In this paper we develop an integrated equilibrium framework to study how financing frictions that arise on the liability side affect investments on firms' asset sides, and vice versa. In our model, contracting frictions due to limited commitment are more pronounced at longer horizons, which leads to less attractive funding terms and, ultimately, credit rationing for long-term investment projects. Firms with long-term investment opportunities

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respond by adjusting their asset-side investments towards alternative, shorter-maturity projects, even if those projects are second best. The central result of our paper is that these asset-side adjustments are self-reinforcing: An individual firm's asset-side decision endogenously determines the financing terms faced by other firms, thereby influencing their investment decision—creating an externality. In the presence of this externality, the competitive equilibrium exhibits inefficient “collective” short-termism in real investment relative to the constrained optimum.

Consider a firm that seeks funding for the development of a new product that requires substantial investment in long-term research and development (R&D). While the development of this innovative product may be efficient from a net present value (NPV) perspective, the uncertainty associated with the required long-term R&D can make financing such a project difficult. The firm may therefore choose to develop a product that builds on an existing technology and can be brought to market more quickly, even if that product is inferior. Or consider a mining company seeking to fund a long-term exploration project, such as the development of an oil sand.¹ The riskiness of long-term exploration makes financing such a project difficult. The mining company may therefore forego the long-term project and settle for a shorter-term investment, for example, the development of a shale gas well, even if this is an inferior investment for this particular company.² In both cases, the firm affects funding terms for those firms that have efficient short-term projects, which may now be abandoned in favor of even shorter-term investments. Or consider a financial institution in the aftermath of the Lehman default. Increased uncertainty about the quality of banks' balance sheets made financing for long-term investments hard to come by,³ thereby pushing financial institutions with good long-term investments into less profitable shorter-term investments.⁴ However, through this adjustment also shorter-term financing to banks becomes riskier, thereby encouraging other banks to shorten their assets and liabilities as well. The common thread in these examples is that privately optimal asset-side adjustments lead to a cross-firm externality.

In our model, firms are born with first-best investment projects of different maturities but constant average quality. Some firms have safe projects, while others have risky projects whose risk, a mean-preserving spread relative to

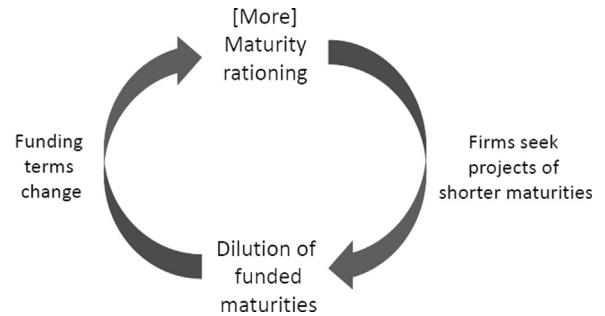


Fig. 1. Short-termism spiral. Illustration of the short-termism spiral that emerges from endogenous adjustments on the asset side in response to financing frictions on the liability side.

safe projects, increases with the maturity of the project. The main friction is a limited-commitment assumption in the spirit of Bolton and Scharfstein (1990) and Hart and Moore (1994): While there is no ex ante information asymmetry on whether a project is safe or risky, ex post successful firms with risky projects can always pretend to have had a safe project and abscond with the difference in cash flow. Firms seek financing from a competitive financial sector that can observe the maturity of an investment project. Financing optimally occurs via a debt contract and, in order for the financier to break even, the interest rate on this debt contract has to increase with project maturity in order to reflect the higher risk at longer project horizons, leading to less attractive financing terms for long-term projects. Beyond a certain project maturity, the limited commitment friction is so severe that financiers cannot break even, such that lending breaks down and *maturity rationing* arises.

Rationing of long-term projects generates the endogenous asset-side adjustments central to this paper. Firms that cannot fund their (first-best) long-term projects react by adopting second-best projects of shorter maturity, for which financing is available. This maturity adjustment is unobservable to financiers and therefore creates endogenous asymmetric information, because the inflow of second-best projects worsens the pool of funded, shorter-maturity projects. This affects the terms of the debt contract offered by financiers who now face a worse pool of borrowers, leading to a negative externality: Funding terms for firms that up to now could receive financing worsen and, because the maximum funded maturity shortens, a number of formerly fundable firms are now rationed. These firms now also respond by adopting second-best shorter-term projects, thereby inducing an additional inflow of second-best projects into the funded region. The process repeats, and a *short-termism spiral* arises (see Fig. 1). Taking into account the interdependence between the asset and liability sides, the equilibrium is thus given by a fixed point: Firms' investment decisions respond optimally to financing frictions on the liability side, while financiers take into account firms' investment decisions when setting funding terms.

When capital markets are competitive, the resulting equilibrium is *constrained inefficient*: Investment is inefficiently short-term, and surplus is strictly lower compared to the case in which financing is offered by a central planner

¹ Oil sand projects require large up-front investments in well pads or mines and are therefore long-term projects.

² Shale gas properties, on the other hand, tend to produce out in a few years and are thus shorter-term projects.

³ Krishnamurthy (2010) shows that maturities in the commercial paper market, a significant source of funding for financial institutions, shortened significantly after the Lehman default. Kuo, Skeie, Vickery, and Youle (2013) use FedWire data to show that a similar shortening of maturities occurred in the interbank lending market, with a particularly sharp decline in the fraction of loans with a maturity of at least three months.

⁴ For example, a financial institution with a comparative advantage in making long-term loans may shift its loan portfolio to shorter maturities, where it has less of an advantage. In addition, the shortening of the financial institution's loans may distort the real decisions of the firms funded through these loans.

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