



Capital stock management during a recession that freezes credit markets[☆]



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ABSTRACT

This paper considers the problem of how to price a conspicuous product while maintaining liquidity during a recession which both reduces demand and freezes credit markets. Reducing price would help maintain cash flow, but low prices can erode brand image and, hence, long-term sales. The paper extends earlier work of the same authors by explicitly deriving a firm's optimal cash management behavior, taking into account that a too low cash level results in bankruptcy.

There are different sets of initial conditions for which qualitatively different solution trajectories are optimal. We distinguish mild and severe recessions. With mild recessions bankruptcy can be avoided for sure when the brand image is large enough. In case the recession is of intermediate strength, it can be optimal to throttle forward then back how aggressively one spends down cash reserves, with the associated state constraint alternately being non-binding, binding, non-binding, then binding in such a way that the firm ceases operation.

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1. Introduction

This paper explores an interesting application motivated by the recent global recession, that attracted attention in the popular press, see (The Economist, 2008a, 2009; The New York Times, 2009a). From a firm's perspective, a recession is typically characterized by a reduction in demand. But the recent global recession was atypical in the sense that it also involved a major disruption ("freezing") of capital markets. Even firms with sound fundamentals found it essentially impossible to raise financing in the form of either bank loans or new equity. So for the duration of the recession, firms' feasible regions were

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restricted by an additional constraint that current obligations had to be covered by current operating revenue plus cash on hand (here and throughout we will use the term “cash” to mean assets that are liquid even during a severe recession). During the recession liquidity mattered, not just the firm’s discounted expected future stream of net operating profits, because there was no way to convert a future profit stream into cash while the capital markets were not functioning. Complicating firms’ planning, it was unclear in the midst of the recession how long it would be before the financial institutions returned to their customary practices of providing short-term financing to firms with sound fundamentals but a short-term need for liquidity.

We conclude that managing cash reserves is an important aspect of firm behavior in the recent global recession. The model presented in this paper determines the firm’s optimal cash management policy during this recession and as such is an extension to [Caulkins et al. \(2011\)](#). In the latter paper, the firm also operates during a recession with a non-functioning capital market, but the crucial cash management issues are not taken into account there. Where our paper offers a theoretical approach, empirical works regarding the effects of financial factors on real firm (investment) behavior include [Fazzari et al. \(1988\)](#) and [Bayer \(2008\)](#). Like us, [Mittnik and Semmler \(2013\)](#) focus on the influence of a recession, but they take a more macroeconomic approach.

During the recession firms do not just passively look on as cash burn takes them dangerously close to illiquidity. Rather, they begin to draw down other assets. This can be done actively, by selling or liquidating some of those assets. Or it can be done by investing at below replacement rates, e.g., deferring maintenance on physical capital or not hiring replacements when human capital leaves the firm. Similar ideas apply not only to physical and human capital, but also to technological capital or brand reputation/awareness.

The last is perhaps the least familiar, but brand reputation is indeed a form of capital; it is built up over time, has inertia, and enhances profitability. We make it the focus below because it produces particularly interesting dynamics. Since reputation is influenced directly by price, the decision variable (price) affects not only cash flow (by determining demand and revenues) but also changes in the capital stock.

We use the term “capital stock” to refer to the stock that can be drawn down, regardless of whether it is a physical, human resources, intellectual, or reputational stock. But since we use the adjective “capital” to describe those stocks, we will use the term “credit markets” rather than “capital markets” to refer to sources of financing, even though we mean to encompass not only credit markets in the narrow sense but also equity financing.

Uncertainty about how long it will be before the firm can negotiate normal financing greatly complicates decision making. If the firm is too passive, and forgoes relatively low cost ways of spending down capital early on, it might be forced into slash and burn tactics later or even simply be forced out of business. But almost by definition, any draw down of a capital stock, even a reduction in the rate by which that stock would otherwise have increased, that is motivated by the (temporary) lack of access to financing is suboptimal relative to a hypothetical situation in which the firm could borrow against future revenues. So if the firm makes plans that would see it through an extended capital drought, and then it turns out that the recession is over sooner than expected, the firm will have made sacrifices that become unnecessary in retrospect. In short, management has to balance the risks of two types of errors: acting with insufficient decisiveness and acting too aggressively when it comes to protecting liquidity.

These decisions are not one-shot, so a two-period discrete time model would be overly simplistic. Rather, on a day-by-day if not continuous basis, the firm can adjust the aggressiveness with which it spends down its capital stock in order to delay deterioration in its cash position. So this is a sequential decision problem. Furthermore, there are no natural milestones; strategy can be adjusted at any moment, not just at the beginning of each week or month. So this problem is perhaps best thought of within the framework of continuous dynamic optimization.

Naturally the particular functional forms and parameter values will be capital-type-, industry- and firm-specific. We focus on one particular type of capital (brand reputation for selling goods expensive enough to be exclusive) but make no attempt to model any particular firm based on its unique data and operating parameters. Rather, we create a stylized model that captures the essence of the problem and expresses it in the precise and parsimonious language of mathematics. Doing so clarifies the nature of the problem and proves by example that the optimal strategies can be complex and counter-intuitive.

We describe this problem by setting up a two-stage dynamic model. During Stage 1 (the recession), the firm has to price so that its operations are self-financing. The firm takes into account that the recession’s duration is unknown. In Stage 2 the recession is over, demand returns to its normal level, and there are normal (perfect) credit markets, implying that the firm can borrow as much as it wants at a fixed interest rate.

As already stated, the model considered here is an extension of [Caulkins et al. \(2011\)](#) who look at the impact of a recession freezing capital markets on a firm with a conspicuous product, however, without the possibility of building up and spending down cash reserves. The defining characteristic of a conspicuous product is that its demand increases in brand reputation, which itself increases in price. Examples include luxury cars, jewelry, fancy hotel rooms, fashion goods, etc. This so-called Veblen effect has found much attention in literature, see [Bagwell and Bernheim \(1996\)](#). The question why it is advantageous for consumers to be attracted by this higher price has been studied within a large number of papers; see, e.g., [Bikhchandani et al. \(1992\)](#), [Coelho and McClure \(1993\)](#), [Frijters \(1998\)](#), [Corneo and Jeanne \(1999\)](#), [Bianchi \(2002\)](#). There also exist contributions, like [Corneo and Jeanne \(1997\)](#), [Peng \(2006\)](#), [Yamada \(2008\)](#), that consider pricing of conspicuous goods in a general equilibrium framework. Papers studying the resulting implications for firms particularly concerning strategic decisions such as the question of how to price a conspicuous product include [Amaldoss and Jain \(2005b,a, 2008, 2010\)](#), [Kort et al. \(2006\)](#), [Caulkins et al. \(2007\)](#), [Huschto and Sager \(2012\)](#).

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