

Inventories, financial structure and market structure

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Abstract

In this paper, we study the effect of different financial contracts on the firm's inventory policy. Doing so will allow to define the best financial instruments to diminish the stock variability of a profit-maximizing firm in a given economic environment (expansion or recession), and for a given market structure. We show that in periods of recession (expansion), reducing (increasing) the amount of short-term debt is an optimal strategy independently of the market structure. © 2001 Elsevier Science B.V. All rights reserved.

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1. Introduction

This paper studies the impact of product differentiation and financial structure on firms' inventory policy. This type of analysis is supposed to deliver a global perspective on the interaction between input and output markets, and the dynamics of firms' inventories. We believe that this is a relevant question insofar the variability of firms' stocks is recognized to be one of the driving forces of business cycle fluctuations.

In order to give a broad idea of this phenomenon, Blinder and Maccini [1] find that up to 87% of GDP variance during short-term (ST henceforth) recessions is linked with drastic inventory reductions.¹ Other sources² find that as much as 11% of Chinese GDP is stored in stocks. From these pieces

of evidence we can understand the rationale for a Central Authority to give incentives to profit-maximizing firms for smoothing their steep inventory disinvestment (investment) in recessions (expansions). Hendel [2] links this issue with firms liquidity needs in the ST. Firms tend to increase their cash reserves through an aggressive stock disinvestment in order to satisfy ST financial obligations. In this perspective, it is an issue of interest to study the firms' interaction between inventory policy and their financial structure. Other studies such as Carpenter et al. [3], Kashyap et al. [4] and Olney [5] find a stronger impact of cyclical fluctuations on small firms' inventory variability than on that of bigger firms. These authors link this result to the fact that smaller firms can only obtain external funds through credits with ST maturities. On the other hand, larger firms can also obtain long-term (LT henceforth) financing (LT debt or equity).

Here we propose a model in which firms are hit by both economy-wide supply-side and economy-wide demand-side shocks. Focusing on

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¹See also The Economist, 1999, April 24th, "The Economics of Inventories".

²"China's Inventory Problem" in The Wall Street Journal, 1997, April 14th.

economy-wide shocks allows us to avoid aggregation issues among different markets subject to idiosyncratic shocks. Furthermore, economy-wide shocks are those which trigger expansions or recessions.

In our setup, firms compete in a monopolistic competitive market, designing their inventory policy as a profit maximizing function of their financial structure, the shocks, and the market structure. We consider different financial contracts that link firms with their fund providers. This allows us to study the effect of different financial instruments (debt or equity) with different lenders (banks or market) on a profit-maximizing firm's stock policy under alternative market structures. Such an analysis has normative implications for a Central Authority that would affect firms' financial structure as a way to smooth inventory fluctuations and ultimately, cyclical fluctuations.

Four main results are obtained in our model. First, the impact of product market differentiation on inventory investment is such that, in expansions, the inventory variance increases as markets become more fragmented, and vice versa in recessions. Second, regarding the role of firms financial structure, we prove that market debt-financed firms store a lower inventory level than bank debt-financed firms, which in turn accumulate less than equity-financed firms. Third, the higher (lower) the amount of ST debt in expansions (recessions), the lower stock fluctuations in expansions (recessions) for a profit-maximizing firm. This in turn implies that firms using variable-rate credit define a smoother inventory policy than firms using fixed-rate credits. Finally, we describe a possible mechanism that would provide profit-maximizing firms with cheap financing and at the same time smooth their inventory accumulation policy.

The paper is organized as follows. Section 2 sketches our basic model. In Section 3 we solve the model and present our main findings. Section 4 concludes.

2. The basic model

We consider a one-period model populated with two agents. (i) A representative firm that follows

a profit-maximizing policy and accumulates inventories as residuals. (ii) Lenders, who compete in order to provide the firm with the required external funds, E , at the beginning of the period. These funds can be obtained making use of debt or equity. We assume feasibility, in the sense that the firm can raise all the external funds it needs. Lenders therefore play a passive role in our model, that simply consists in recovering their capital. Let B denote the firm's debt payment obligations at the end of the period. This value is composed by some inherited past LT debt, to be returned at the end of the period considered, B_p , as well as the current one-period debt, B_s .³

The representative firm is producing in a monopolistic competitive market, composed by a large number of firms, facing each a stochastic inverse demand function $\tilde{p}_i = \tilde{a} - bq_i - (1 - b)\hat{Q}$, where i indexes the generic firm, and \hat{Q} refers to the industry average output. The parameter \tilde{a} is an economy-wide stochastic variable, independently and identically distributed with a uniform distribution over an interval $[\underline{a}, \bar{a}]$. The parameter b rises with the degree of product differentiation. As b tends to 1, the product market evolves from competitive to monopolistic. Firms face a stochastic marginal production cost, \tilde{c} , subject to an economy-wide shock τ that follows an independent distribution function uncorrelated with demand shocks \tilde{a} . We assume a constant marginal storage cost A , and we consider the possibility of inheriting backlogs from the past. That is, in every period, firm's stocks may also be negative. We make a first-order analysis, and, similarly as for production costs, we consider a profit function where the marginal benefit to store stocks is constant (λ).⁴ This λ value can be interpreted as an entrepreneur stock shadow price. We are going to relate this λ with the proportion of firm's long-length financial

³ The quantities B_p and B_s result in imposing a lender zero-profit condition on the corresponding LT funds raised in the past, as well as all ST funds raised in the present, respectively.

⁴ Although we only analyze one period, there are others, otherwise firms would not store stocks. We introduce these other periods in firm profits function through firm valuation of end-of-the period inventories, $n_{i,1}$. By simplicity, I have assumed a linear function ($\lambda n_{i,1}$).

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