Journal of Banking & Finance 33 (2009) 300–307

Contents lists available at ScienceDirect

Journal of Banking & Finance

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

Corporate trade credit and inventories: New evidence of a trade-off from accounts payable and receivable

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ARTICLE INFO

Article history:
Received 16 April 2008
Accepted 17 July 2008
Available online 16 September 2008

JEL classification:
G31
G32

Keywords:
Trade credit
Inventories

ABSTRACT

Trade credit is an important source of finance for firms and has been well researched, but the focus has been on financial trade-offs. In this paper, we consider the trade-offs with inventories and develop a simple model that recognizes the incentives a firm faces to offer and receive trade credit. Our model identifies the response of accounts payable and accounts receivable to changes in the cost of inventories, profitability, risk and liquidity, and importantly, this influence operates through a production channel. Our results support the model and complement many existing studies focused on explaining the financial terms of trade credit.

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1. Introduction

Trade credit is a major element of corporate finance. Rajan and Zingales (1995) document that the volume of trade credit in aggregate was a significant part (17.8%) of total assets for all American firms in the early 1990s. In Germany, France and Italy, trade credit represents more than a quarter of total corporate assets, while in the United Kingdom 70% of total short-term debt (credit extended) and 55% of total credit received by firms is made up of trade credit (Kohler et al., 2000; Guariglia and Mateut, 2006). Trade credit is also important in emerging economies, like China, where firms get limited support from the banking system (Ge and Qiu, 2007). Accordingly, trade credit has been thoroughly researched but the research has focused mainly on the financial substitutes and complements to trade credit by asking what is the advantage of obtaining credit directly from sellers compared to other (often cheaper) forms of credit such as bank loans. Atanasova and Wilson (2004) find that to avoid bank credit rationing, smaller UK companies increase their reliance on inter-firm credit and Guariglia and Mateut (2006) suggest the uptake of trade credit weakens the credit channel as firms substitute trade finance for bank loans when monetary policy tightens.

The literature provides many possible explanations for uptake or offer of trade credit based on informational asymmetries (Smith, 1987; Biais and Gollier, 1997), discrimination arguments (Brennan et al., 1988), monitoring advantages (Jain, 2001; Mateut et al., 2006), insurance (Cunat, 2007), product quality (Lee and Stove, 1993; Long et al., 1993), bankruptcy (Frank and Maksimovic, 2005; Wilner, 2000), opportunistic behavior (Burkart and Ellingsen, 2004) and externalities (Daripa and Nilsen, 2005). Empirical studies explore the relationships between accounts payable and accounts receivable and other balance sheet variables to corroborate or refute these theories and examine in detail the terms and conditions of trade credit.[1] These are mostly financial theories of trade credit.

Economists have become accustomed to considering separately transactions that involve the exchange of goods from those that involve financial transactions. The separation is motivated by the benefits obtained from skill specialization: financially constrained buyers obtain funds in financial markets which they then use to buy goods from sellers in goods markets. But the trade credit bridges goods and financial markets, and there is more to that bridge than the comparison of the relative costs of alternative forms of finance to firms or the terms of trade credit agreements. We argue that fresh motivation can be found for the study of trade credit based on the advantage to the seller in inventory management from offering trade credit to the buyer. The advantage is that

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[1] See for example, Mian and Smith (1992), Rajan and Zingales (1995), Petersen and Rajan (1997), Ng et al. (1999), Demirguc-Kunt and Maksimovic (2002), Alphonse et al. (2003), Fisman and Love (2003), Giannetti (2003), Preve (2003), Burkart et al. (2005), Cunningham (2004) and Love et al. (2005).

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doi:10.1016/j.jbankfin.2008.07.019

the seller, who faces an uncertain demand for the product, may extend trade credit to financially constrained customers in order to obtain credit-financed sales rather than accumulate costly inventories of finished goods, which may or may not be sold for cash in the next period. This trade-off that the firm faces between inventories and trade credit is the focus of this paper.

Our approach provides a theoretical two-period stochastic demand model of firm behavior. Firms produce goods for sale, hold inventories of goods that were produced but unsold at a cost, and, critically, offer and receive trade credit in the middle of a credit chain. Therefore, producers facing an uncertain demand for their products face an incentive to extend trade credit to their financially constrained customers in order to promote sales rather than accumulate costly inventories of finished goods. This incentive is limited only by the need to obtain liquidity to meet their own obligations, producers might readily offer trade credit on appropriate terms to enhance cash sales and boost demand. This trade-off has not previously been explored in the economics literature.[2]

We view the analysis of the trade-off between inventories and trade credit as complementary to theories that address financial aspects of trade credit. Some early work on trade credit following a transactions costs approach has analyzed the trade-offs between the costs of financial transactions and the costs related to the exchange of goods (see, for example, Nadiri (1969), Schwartz (1974), Ferris (1981) and Emery (1987)). Only Emery (1987) considers explicitly the trade-off between trade credit and inventories but does so within a deterministic variable demand framework. More recently, Daripa and Nilsen (2005) have theoretically examined how this trade-off influences the terms of trade credit agreements. In their model suppliers offer trade credit as an incentive to buyers to hold higher inventories – shifting inventories from seller to buyer. The underlying rationale for trade credit has some similarities with ours when we consider a firm that lies in the middle of a credit chain, since suppliers reduce inventories by offering trade credit and firms that accept trade credit from their suppliers and thus increase their inventories are also in the position to offer trade credit to their own customers. In fact, the predictions of their model with respect to the effects of changes in inventories and profit margins on the levels of trade credit are the same as ours.

Our stylized model that provides directly testable predictions on the response of accounts payable and accounts receivable to changes in the cost of inventories, profitability, risk and liquidity, which operate by influencing production. Even the influence of bank loans on trade credit operates by allowing greater production, inventories and sales, financed in part through credit. Our contribution empirically is to directly test the predictions of our model using GMM estimates in first-differences on an unbalanced panel of UK firms drawn from FAME that includes larger FTSE-quoted firms and those on the smaller AIM/OFEX exchange, as well as unquoted firms.[3] The results show a direct influence of inventories on accounts receivable but a negligible effect on accounts payable even after controlling for firms characteristics such as liquidity, profitability and risk, and allowing for scale of bank borrowing. The effect of inventories on trade credit is dependent on firm size, as inventory holding costs fall with size. These results have not been published before and provide evidence in favour of an inventory management motive for offering trade credit.

In the following section, we develop a simple model that captures the trade-off between trade credit and inventory under stochastic demand. In Section 3, we present our empirical work and in the final section we conclude.

2. Inventories and trade credit

Consider the following 2-period snapshot in the life of a single-product firm that belongs in a competitive industry and lies in the middle of a trade credit chain. In period 1, when the firm decides its level of production it faces uncertainty about the price for its product. The uncertainty can be related to both firm-specific shocks and market instability. Let A denote the state of the world in period 2 and $p(A)$ the corresponding price, where $p'(A)$. Furthermore, let $\hat{q}$ denote its level of production in period 1 and $q\ (\leqslant \hat{q})$ denote sales in period 2.[4] Given that potential buyers are financially constrained in period 2 the firm faces the following trade-off. It can avoid holding costly inventories by extending trade credit to its customers, but trade credit is itself costly as the firm foregoes cash with which to repay its own creditors. By offering goods on credit the firm is trading-off potential future cash sales opportunities. We also assume that on average inventories are sold on discount. The following maximization program captures this trade-off and solves for the optimal level of sales in period 2:

$$\underset{q}{\text{Max}}\{P(A)q + p^{\text{E}}(\hat{q}-q) - v(\hat{q}-q,x) - r(p(A)q - c_{\text{R}}(m))\}.$$

The first term represents sales in period 2 (both on cash and on trade credit) while the second term captures future revenues from the sale of inventories, where p^{E} denotes the expected future price. $v(\cdot,\cdot)$ represents the holding cost of inventories, $\hat{q}-q$, and x is a shift parameter that captures other factors that influence the cost of inventories. The final term $r(\cdot)$ captures the cost of extending trade credit (accounts receivable) that depends on the amount of trade credit extended, which in turn is equal to sales minus cash receipts (assumed here to be directly related to the level of liquidity, m).[5] We impose the following restrictions on these functions: $v_1 > 0$, $v_{11} > 0$, $v_2 > 0$, $v_{12} > 0$, $1 > r' > 0$, $r'' > 0$ and $c'_{\text{R}} > 0$. Thus, we assume that inventory costs are convex in the level of inventories and that the shift parameter represents a firm characteristic that is associated with higher inventory costs. We further assume that costs related to extending trade credit (cost of receivables) are increasing at an increasing rate with the level of trade credit reflecting costs related to lack of cash (higher demand for expensive accounts payable) and higher expected bankruptcy costs. Finally, firms that target a higher liquidity will be less willing to offer trade credit.

The f.o.c. of the above program is

$$p(A) - p^{\text{E}} + v_1 - p(A)r' = 0, \tag{1}$$

that implicitly provides a solution for desired sales as a function of the state of the world, $q(A)$. Actual sales are restricted by production, thus optimal sales, q^*, are given by

$$\text{If} \quad \begin{matrix} q(A) \leqslant \hat{q} \\ q(A) > \hat{q} \end{matrix} \quad \text{then} \quad \begin{matrix} q^* = q(A) \\ q^* = \hat{q}. \end{matrix} \tag{2}$$

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[2] Two well cited theories of trade credit by Biais and Gollier (1997) on signalling and Burkart and Ellingsen (2004) on diversion, we find that both focus on the relationship between trade credit and bank loans but neither one explicitly analyzes the role of inventories. Operations research by contrast has recognized the link between trade credit and inventories but with an interest in inventory management per se. While the inventory literature acknowledges the interaction between trade credit and inventories for optimal control, it is less interested in the economic question of how a firm might consider trade-offs between greater overall sales and lower inventory costs versus lower liquidity. In this paper, we take a closer look at these trade-offs by proposing a theory and offering some evidence. See Robb and Silver (2006) who provide an extensive review of the literature that explores the advantages of alternative inventory control methods subject to the availability of trade credit.

[3] The source is the FAME (Bureau van Dijk) database collected by Electronic Publishing. See http://fame.bvdep.com.

[4] In a multi-period model sales would be restricted by the sum of production and past inventories. For our purposes, setting past inventories equal to zero is inconsequential.

[5] Accounts receivable, defined as sales minus cash receipts is directly observable in the data.

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