165 The Demand for Trade Credit: An Investigation of Motives for Trade Credit Use by Small Businesses

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The following paper, which is summarized in the *Bulletin* for October 1993, was prepared in the spring of 1993. The analyses and conclusions set forth are those of the authors and do not necessarily indicate concurrence by the Board of Governors, the Federal Reserve Banks, or members of their staffs.

Board of Governors of the Federal Reserve System
Washington, DC 20551

September 1993

The Demand for Trade Credit: An Investigation of Motives for Trade Credit Use by Small Businesses

Trade credit—credit extended by a seller who does not require immediate payment for delivery of a product—is an important source of funds for business customers. In 1987, such credit accounted for about 15 percent of the liabilities of nonfarm nonfinancial businesses in the United States, approximately the same percentage of liabilities as these firms' nonmortgage loans from banks.[1] Trade credit apparently is especially important for small businesses: In the same year, it accounted for about 20 percent of small firms' liabilities.[2]

Few would question the economic significance of trade credit. The reasons for its use by business customers are the subject of debate, however. One theory (which can be called the transaction theory) is that economies in cash management motivate its use.[3] Another theory (which can be called the financing theory) is that credit market imperfections that cause financial institutions, another major source of business credit, to ration credit lead to its use.[4] Although the theories are not mutually exclusive, no earlier study has integrated the two in a single theoretical or empirical model. Previous research has focused instead on one theory or the other, and empirical evidence on both is limited.

The lack of evidence on reasons for trade credit use is especially pronounced for small businesses.[5] Although the transaction motive probably is important for firms of all sizes, the financing motive may be particularly important for small businesses, because they are more likely than large firms to be rationed by commercial banks and other institutional sources of credit.[6] Empirical research on the subject would greatly increase understanding of the finances of small businesses.

This paper presents new evidence on small businesses' motives for using trade credit based on data from the National Survey of Small Business Finances, a nationally representative survey of firms with fewer than 500 employees.[7] The survey gathered information on the trade credit use and payment practices of a large segment of the

NOTE. The authors would like to thank Allen N. Berger, Myron L. Kwast, Stephen A. Rhoades, and participants in the 1992 International Research Symposium on Small Firm Finance and the 1992 International Symposium on Cash, Treasury, and Working Capital Management for comments on an earlier version of this paper.

1. Board of Governors of the Federal Reserve System, *Flow of Funds Accounts for the U.S. Economy. 1948–88* (Board of Governors, 1989).

2. National Survey of Small Business Finances. See footnote 7.

3. J. Stephen Ferris, "A Transactions Theory of Trade Credit Use," *Quarterly Journal of Economics*, vol. 96 (May 1981), pp. 243–70.

4. Wilbur G. Lewellen, John J. McConnell, and Jonathan A. Scott, "Capital Market Influences on Trade Credit Policies," *Journal of Financial Research*, vol. 3 (Summer 1980), pp. 105–13; Gary W. Emery, "A Pure Financial Explanation for Trade Credit," *Journal of Financial and Quantitative Analysis*, vol. 19 (September 1984), pp. 271–85; Janet Kiholm Smith, "Trade Credit and Informational Asymmetry," *Journal of Finance*, vol. 42 (September 1987), pp. 863–72; Robert A. Schwartz, "An Economic Model of Trade Credit," *Journal of Financial and Quantitative Analysis*, vol. 9 (September 1974), pp. 643–57; Robert A. Schwartz and David K. Whitcomb, "Implicit Transfers in the Extension of Trade Credit," in Kenneth E. Boulding and Thomas F. Wilson, eds., *Redistribution through the Financial System: The Grants Economics of Money and Credit* (Praeger, 1978); and Robert A. Schwartz and David K. Whitcomb, "The Trade Credit Decision," in James L. Bicksler, ed., *Handbook of Financial Economics* (North-Holland Publishing Co., 1979).

5. The role of trade credit in the financing of small firms is a longstanding issue. In the literature on monetary policy, for example, trade credit has been suggested as a way for small businesses to circumvent credit rationing. See Allan H. Meltzer, "Mercantile Credit, Monetary Policy, and Size of Firms," *Review of Economics and Statistics*, vol. 42 (November 1960), pp. 429–37; and F.P.R. Brechling and R.G. Lipsey, "Trade Credit and Monetary Policy," *Economic Journal*, vol. 73 (December 1963), pp. 618–41. Most recently the issue arose in discussions of the alleged credit crunch during the 1990–91 recession (for example, see "Banks' Service Worsening, Small Businesses Complain," *American Banker*, December 18, 1991, p. 1). However, the only available evidence on small businesses' use of trade credit comes from a study by Elizabeth M. Chant and David A. Walker ("Small Business Demand for Trade Credit"), *Applied Economics*, vol. 20 (July 1988), pp. 861–76).

6. Meltzer, "Mercantile Credit, Monetary Policy, and Size of Firms"; Brechling and Lipsey, "Trade Credit and Monetary Policy"; Emery, "A Pure Financial Explanation for Trade Credit"; John J. McConnell and R. Richardson Pettit, "Applications of the Modern Theory of Finance to Small Business Firms," in Paul M. Horvitz and R. Richardson Pettit, eds., *Small Business Finance: Problems in the Financing of Small Businesses* (JAI Press, 1984), pp. 97–126; R. Richardson Pettit and Ronald F. Singer, "Small Business Finance: A Research Agenda," *Financial Management*, vol. 14 (Autumn 1985), pp. 47–60; and James S. Ang, "On the Theory of Finance for Privately Held Firms," *Journal of Small Business Finances*, vol. 1 (1992), pp. 185–203.

7. The National Survey of Small Business Finances was a one-time survey of a nationally representative sample of about 3,400 small businesses conducted in 1988–89 for the Board of Governors of the Federal Reserve System and the U.S. Small Business Administration. See Gregory E. Elliehausen and John D. Wolken, *Banking Markets and the Use of Financial Services by Small and Medium-Sized Businesses*, Staff Studies 160 (Board of Governors of the Federal Reserve System, 1990) for basic descriptive statistics.

business population not covered by most sources of financial data on businesses.[8] We developed a model of demand incorporating the transaction and financing motives and, using the model, analyzed small businesses' decisions about using trade credit at all, making late payments on trade credit, and the amount of trade credit to use. The results of our analysis, which support the existence of both a transaction and a financing motive, provide insights on the substitutability of trade credit and institutional credit and on the relative importance of the two motives in the use of trade credit by small businesses.

Background

The practice of sellers providing trade credit to their customers is an old one, extending back to the fairs and markets of the late Middle Ages. Trade credit was vital to the establishment of commerce in the United States during the colonial period and is widely available today.[9] A recent survey of firms in a range of industries found that 87 percent offered trade credit and that 91 percent to 100 percent of these firms' sales were made on account.[10]

The terms of trade credit typically have a similar basic structure, although specific terms differ across industry groups. In many cases, sellers offer a cash discount to encourage early payment; for example, sellers in many industry groups offer a 2 percent discount from the invoice amount if payment is made within ten days of delivery. The full amount of the invoice is due after a specified number of days—thirty days is common—or at the end of the month. Sellers' policies regarding payment after the due date (late payment) vary: They may tolerate late payments, impose monetary penalties or interest, or require that future purchases be paid for in cash. Sellers sometimes enforce their policies selectively, requiring some customers to make timely payments and allowing others to pay late.

Despite the long history and importance of trade credit, most research on the topic has focused on a single issue, the effect of trade credit on the operation of monetary policy.[11] Only a few researchers have explored the microeconomics of trade credit use.

The Transaction Motive

The transaction motive is perhaps the more obvious reason business customers use trade credit. In the absence of trade credit, firms must pay for purchases upon delivery. If the timing of deliveries is uncertain and converting liquid assets into cash is costly, most firms will hold precautionary cash balances. Ferris demonstrated that trade credit in some instances enables buyers to economize on the transaction costs associated with cash management.[12] According to Ferris, the use of trade credit provides information on future cash needs by allowing buyers to accumulate invoices for payment. The information enables firms to predict their cash needs better. As a result, they are able to hold smaller cash balances and to incur lower brokerage costs than they would if they paid invoices immediately upon receipt.

Sellers also benefit from trade credit. It enables them to predict cash receipts more accurately, allowing them to reduce their precautionary cash balances as well.

The Financing Motive

Sellers that extend trade credit typically offer cash discounts to encourage early payment. The interest rates implicit in the cash discounts in most instances are considerably higher than the interest rates on loans for working capital charged by financial institutions. The financing theory attempts to explain why buyers would choose to

8. Small businesses constitute the vast majority of the business population and account for a large share of its sales. See U.S. Small Business Administration, *The State of Small Business: A Report of the President* (Government Printing Office, 1987).

9. For histories of trade credit use, see Roy A. Foulke, *The Sinews of American Commerce* (Dun & Bradstreet, 1941); Roy A. Foulke, *Current Trends in Terms of Sale* (Dun & Bradstreet, 1959); and Theodore N. Beckman, *Credits and Collections: Management and Theory* (McGraw-Hill, 1962). For recent survey evidence of the extent of use, see David A. Walker, "Trade Credit for Small Businesses," *American Journal of Small Business*, vol. 3 (Winter 1985), pp. 30–40; and Scott Besley and Jerome S. Osteryoung, "Survey of Current Practices in Establishing Trade Credit Limits," *Financial Review*, vol. 20 (February 1985), pp. 70–82.

10. Besley and Osteryoung, "Survey of Current Practices in Establishing Trade Credit Limits."

11. For example, see Meltzer, "Mercantile Credit, Monetary Policy, and Size of Firms"; Brechling and Lipsey, "Trade Credit and Monetary Policy"; Arthur B. Laffer, "Trade Credit and the Money Market," *Journal of Political Economy*, vol. 78 (March/April 1970), pp. 239–67; Dwight M. Jaffee, *Credit Rationing and the Commercial Loan Market* (Wiley, 1971); and Valerie A. Ramey, "The Source of Fluctuations in Money: Evidence from Trade Credit," Working Paper 3756 (National Bureau of Economic Research, June 1991).

12. Ferris, "A Transactions Theory of Trade Credit Use."

incur the relatively high interest costs of trade credit. Theoreticians have linked the financing motive to credit market imperfections, which may cause financial institutions to ration credit to their customers.[13]

Schwartz and Whitcomb focused on credit rationing as an explanation for trade credit use.[14] Credit rationing occurs when creditors are unable or unwilling to charge each customer an interest rate that is appropriate to the customer's risk class.[15] They refuse credit or limit the amount of credit extended to firms that, because of their risk class, have an equilibrium lending rate greater than the creditors' established lending rate. As a result, some would-be borrowers have excess credit demand, which they can meet by using trade credit.

Smith considered a case in which asymmetric information causes creditors to ration credit.[16] Borrowers have better information about their own default risk than creditors. Financial institutions, facing an adverse selection problem, charge low interest rates, supply requested amounts of credit to borrowers judged to be creditworthy, and ration credit to would-be borrowers perceived to have high risk.[17] Suppliers, in contrast, charge high implicit interest rates on trade credit and let customers sort themselves on the basis of risk: Low-risk customers take cash discounts and borrow directly from financial institutions, whereas high-risk customers forgo the cash discount, in essence borrowing from suppliers. The failure to take the cash discount signals a possible lack of creditworthiness, alerting the supplier to a need to monitor the account.

Market imperfections—such as information and transaction costs—may cause firms to use trade credit without necessarily involving credit rationing. Lewellen, McConnell, and Scott suggested that sellers might charge lower prices than financial institutions for the credit they extend to risky borrowers because they have lower credit evaluation costs than financial institutions, a possibility that Emery pursued further.[18] Suppliers can realize economies in information costs by confining their lending to borrowers with whom they have regular contact. Whether a check clears or not, for example, provides information on the likely payment practices of customers that receive trade credit. The marginal information cost of allowing customers to delay payments for somewhat longer periods than the time needed to clear a check may well be zero. Sellers may also realize economies in evaluating default risk. Generally, the seller operates in an industry related to that of its customers, and it conducts business with firms in a limited number of industries. This specialization may produce better or less costly information than that available to financial institutions.

The transaction costs of obtaining credit from a financial institution might make institutional credit more expensive than trade credit despite the high implicit interest cost. A borrower incurs costs of time and effort in arranging credit. The costs are incurred each time credit is arranged, and a large part of the costs are fixed. The combined interest and transaction costs may make closed-end credit from financial institutions more expensive than trade credit for meeting recurring needs for working capital, especially if the amount of credit needed is small.[19]

Lines of credit reduce the transaction costs of arranging credit by making it unnecessary to apply each time credit is needed. Maintaining a line of credit does, however, involve noninterest costs—commitment fees, takedown fees, and compensating balances, for example. Therefore, although

13. In a perfect capital market, a firm would be indifferent between trade credit and institutional credit because suppliers and financial institutions would charge the same price for credit. See Lewellen, McConnell, and Scott, "Capital Market Influences on Trade Credit Policies."

14. Schwartz, "An Economic Model of Trade Credit"; Schwartz and Whitcomb, "The Trade Credit Decision"; and Schwartz and Whitcomb, "Implicit Transfers in the Extension of Trade Credit."

15. Among the reasons creditors may be unable or unwilling to charge different rates to different customers are usury ceilings or other legal restrictions, social mores and considerations of good will (Jaffee, *Credit Rationing and the Commercial Loan Market*), and imperfect information (Jaffee and Russell, "Imperfect Information, Uncertainty, and Credit Rationing"; and Stiglitz and Weiss, "Credit Rationing in Markets with Imperfect Information").

16. Smith, "Trade Credit and Informational Asymmetry."

17. An adverse selection problem could occur under conditions of imperfect information if financial institutions attempt to allocate credit on the basis of price. Suppose that an institution offers a high-rate credit contract to all borrowers perceived to have high risk. The adverse selection arises when the less risky borrowers in the high-risk class do not choose the high-rate contract. With only the more risky borrowers choosing the high-rate contract, the riskiness of the contract rises, and losses increase. Ultimately, the increase in losses forces the institution to withdraw the loan from the market. For discussion, see Dwight M. Jaffee and Thomas Russell, "Imperfect Information, Uncertainty, and Credit Rationing," *Quarterly Journal of Economics*, vol. 90 (November 1976), pp. 651–66; and Joseph E. Stiglitz and Andrew Weiss, "Credit Rationing in Markets with Imperfect Information," *American Economic Review*, vol. 71 (June 1981), pp. 393–410.

18. Lewellen, McConnell, and Scott, "Capital Market Influences on Trade Credit Policies"; and Emery, "A Pure Financial Explanation for Trade Credit."

19. Much of a financial institution's costs of credit evaluation and administration are also fixed. Hence, small loans tend to have higher interest rates than large loans.

credit lines may generally have smaller effective interest rates than trade credit for meeting recurring needs for working capital, noninterest costs and transaction costs may make trade credit less expensive than credit lines for firms that need to borrow relatively small amounts or to borrow only occasionally.

Empirical Evidence

Only a few studies have investigated empirically the reasons for trade credit use by either buyers or sellers. Ferris tested the transaction and financing theories using 1945–75 aggregate industry-level data from corporate income tax returns.[20] He found that interest rates on one-year bonds and the volume of transactions were positively related to both the amount of accounts receivable and the amount of accounts payable. Arguing that the financing theory implies that interest rates on bonds should be negatively related to the amount of accounts payable, he concluded that the results provide more support for the transaction theory than for the financing theory of trade credit use.

Herbst investigated factors influencing the amount of trade credit used in the lumber and wood products industry from 1956 to 1966.[21] His regression analysis indicated that the volume of sales explained most of the amount of accounts receivable and that the amount of nonlabor costs explained most of the amount of accounts payable, results suggesting a transaction motive for both the granting of trade credit by suppliers and the taking of trade credit by buyers. The addition of several financial variables to the accounts payable regression explained somewhat more of the amount of accounts payable than did nonlabor costs alone, suggesting a financing motive as well as a transaction motive for trade credit use by buyers.

Chant and Walker investigated the demand for trade credit by small businesses in six four-digit SIC industry groups using the Dun & Bradstreet FINSTAT data base.[22] The model on which they based their analysis incorporated equations for three aspects of trade credit: (1) a firm's trade credit demand, which Chant and Walker specified to be a function of the price of trade credit, the price of bank credit, the volume of sales, and the number of employees; (2) trade credit supply, for which they hypothesized a fixed price, with suppliers rationing trade credit to the firm on the basis of risk; and (3) the amount of bank credit owed by the firm, which they assumed to be a function of an exogenous, market-determined interest rate and used as a proxy for relative prices.

From the three equations, Chant and Walker derived a reduced-form model in which the amount of trade credit used was a function of the amount of bank credit used (the proxy for relative prices), the volume of sales, the return on assets (risk), and the number of employees. The only significant variables in their model were volume of sales (positive for all six industries) and amount of bank credit owed (positive for four industries and negative for two). They concluded that trade credit is a complement to bank credit in some instances and a substitute in others. This finding suggests a role for financing in small businesses' use of trade credit. Chant and Walker did not, however, explain how their results relate to the theoretical literature on the financing motive for trade credit. The significance of the sales variable may be consistent with a transaction motive, but Chant and Walker did not discuss that possibility either.

In sum, the limited empirical evidence provides somewhat more support for a transaction motive than for a financing motive for use of trade credit by business customers, although a financing motive also seems plausible. In our study, we integrated the two motives in a single model of trade credit demand, which we then used to test the transaction and financing hypotheses.

A Model of Trade Credit Demand

Economic theory suggests the existence of both a transaction motive and a financing motive for trade credit use. The two motives need not be mutually exclusive. Consequently, the demand for trade credit TC can be written as a function of a transaction component T_d and a financing component F_d:

$$(1) \quad TC = f(T_d, F_d), \text{ with } \partial TC/\partial T_d, \partial TC/\partial F_d > 0.$$

If $\partial TC/\partial T_d > 0$, then demand attributable to the transaction motive (transaction demand) is a

20. Ferris, "A Transactions Theory of Trade Credit Use."

21. Anthony F. Herbst, "Some Empirical Evidence on the Determinants of Trade Credit at the Industry Level of Aggregation," *Journal of Financial and Quantitative Analysis*, vol. 9 (June 1974), pp. 377–94. Data were from the *Quarterly Financial Report for Manufacturing, Mining, and Trade Corporations*, published by the U.S. Department of Commerce, Bureau of the Census, Economic Census and Surveys Division.

22. Chant and Walker, "Small Business Demand for Trade Credit."

significant component of trade credit demand; similarly, if $\partial TC/\partial F_d > 0$, then demand attributable to the financing motive (financing demand) is a significant component of trade credit demand.

As discussed earlier, the transaction component of trade credit demand results from a firm's ability to accumulate bills for payment, and consequently to hold lower precautionary cash balances or avoid the expense of converting liquid assets into cash every time a bill is presented. By using a simple cash inventory approach, transaction demand for trade credit can be modeled as a function of the volume of purchases from suppliers, the uncertainty or variability in the timing of the delivery of purchases, the return on liquid assets, and the costs of converting liquid assets to cash:[23]

$$(2) \quad T_d = g(S, \sigma_S, r_{LA}, B), \text{ with } \partial T_d/\partial S, \partial T_d/\partial \sigma_S, \partial T_d/\partial r_{LA}, \partial T_d/\partial B > 0,$$

where S is the volume of purchases, σ_S is the variability in the timing of the delivery of purchases, r_{LA} is the return on liquid assets, and B is the brokerage costs of converting liquid assets into cash. The demand for trade credit grows with increases in the volume of purchases and the variability in the timing of delivery of these purchases because such increases would, in the absence of trade credit, raise the optimal level of precautionary balances held by buyers. Demand also increases with the rate of return on liquid assets and brokerage costs: A higher rate of return on liquid assets makes holding cash balances more expensive, and higher brokerage costs increase the cost of converting liquid assets to cash. Hence, demand for trade credit is directly related to all four variables.

The financing component of trade credit demand arises when credit market imperfections make it difficult for some firms to obtain credit directly from financial institutions or less costly to obtain credit from suppliers than from financial institutions.[24] The former situation is likely when buyers perceived to have high default risk are rationed at the interest rates charged by financial institutions rather than charged higher interest rates appropriate for their risk class.[25] High default risk is associated with high levels of short-term debt and financial leverage and with high-risk investment projects.[26] In the latter situation, the price of trade credit may be less than the price of institutional credit because suppliers realize economies in information costs when extending credit to firms with which they have frequent contact, as discussed earlier.[27] The financing component of trade credit demand therefore can be written as follows:

$$(3) \quad F_d = h(R_f, R_b, P_{TC}, P_{BC}), \text{ with } \partial F_d/\partial R_f, \partial F_d/\partial R_b, \partial F_d/\partial P_{BC} \lesseqgtr 0, \partial F_d/\partial P_{TC} < 0,$$

where R_f is financial risk, R_b is business risk, P_{TC} is the price of trade credit, and P_{BC} is the price of credit from financial institutions. The demand for trade credit is expected to decrease as the price of trade credit increases and to increase as financial risk and business risk increase. A priori, the relationship between the demand for trade credit and the price of bank credit is indeterminant. If financial institutions ration credit to high-risk firms, the demand for trade credit would be expected to decrease with the price of institutional credit: Increases in the price of institutional credit would reduce excess demand for institutional credit, leading to a decrease in the demand for trade credit. Thus, $\partial F_d/\partial P_{BC} < 0$, and trade credit would appear to be a ''complement'' to institutional credit. Alternatively, if financial institutions charge equilibrium credit prices, the demand for trade credit would be expected to increase with the price of institutional credit: In this instance, $\partial F_d/\partial P_{BC} > 0$, and trade credit and institutional credit would be substitutes.

Empirical Implementation

In this section we explain the derivation of our model for estimating trade credit demand, describe the survey data used, and discuss the variables constructed from the survey data to represent factors influencing demand for trade credit attributable to the transaction and financing motives.

23. See Ferris, ''A Transactions Theory of Trade Credit Use.''

24. See Lewellen, McConnell, and Scott, ''Capital Market Influences on Trade Credit Policies''; and Emery, ''A Pure Financial Explanation for Trade Credit.''

25. Schwartz and Whitcomb, ''The Trade Credit Decision.''

26. See Jaffee, *Credit Rationing and the Commercial Loan Market.*

27. See Emery, ''A Pure Explanation for Trade Credit.''

The Empirical Model

Using a partial equilibrium model of trade credit supply and demand similar to one proposed by Chant and Walker, we derived an equation for trade credit demand that incorporates the transaction and financing components contained in equations 1–3.[28] Let

QD_{TC} = realized trade credit demand

QD^*_{TC} = anticipated (ex ante) trade credit demand

QS_{TC} = trade credit actually extended by suppliers

QS^*_{TC} = trade credit available from suppliers.

QD^*_{TC} is ex ante demand for trade credit with no statistical errors. It includes unfulfilled (notional) demands, whereas QD_{TC} includes errors of specification or measurement. In equilibrium, $QD_{TC} = QS_{TC}$. We also assume that $QD_{TC} \leq QD^*_{TC}$ and $QS_{TC} \leq QS^*_{TC}$.

As indicated by equation 1, the quantity of trade credit demanded includes transaction and financing components. Assuming linearity,

$$(4)\quad QD^*_{TC} = T_d + F_d = [b_0 + b_1 S + b_2\sigma_S + b_3 r_{LA} + b_4 B] + [c_0 + c_1 R_f + c_2 R_b + c_3 P_{TC} + c_4 P_{BC}].$$

In this form, the transaction and financing components of trade credit demand are separable. As argued earlier, the prices of trade credit and credit from financial institutions are associated with the financing motive for trade credit use.[29]

For empirical implementation, we assume that the amount of trade credit used by a buyer is equal to the amount of the firm's accounts payable (AP):[30]

$$(5)\quad QD_{TC} = AP.$$

Excess demand for trade credit is zero if requests for trade credit are fully satisfied, or greater than zero if some portion of demand is not met. The primary reason a firm would have excess trade credit demand is that it is an unacceptable credit risk. Hence, we assume that excess demand is a function of financial and business risk:

$$(6)\quad QD^*_{TC} - QD_{TC} = f(R_f, R_b).$$

Assuming that excess demand is a linear function of financial and business risk, equation 6 becomes

$$(7)\quad QD^*_{TC} - QD_{TC} = e_1 R_f + e_2 R_b, \text{ with } e_1 \text{ and } e_2 > 0.$$

Riskier firms are more likely than less risky firms to have unsatisfied trade credit demand.

We assume that the quantity of institutional credit demanded (credit obtained from financial institutions) QD_{BC} is a linear function of the price of institutional credit P_{BC}. In effect, we assume that the firm behaves as a price taker of institutional credit, having little influence over the market price. Simplistically,

$$(8)\quad QD_{BC} = a_0 + a_1 P_{BC}, \text{ with } a_1 < 0.$$

Combining equations 5 and 7 yields

$$(9)\quad QD^*_{TC} = AP + e_1 R_f + e_2 R_b.$$

After substituting equations 8 and 9 into equation 4, performing some algebraic manipulation, grouping like terms, and adding the error term, we have

$$(10)\quad QD_{TC} = AP = T_d + F_d + \varepsilon = \{b_0 + c_0 - c_4(a_0/a_1)\} + \{b_1 S + b_2\sigma_S + b_3 r_{LA} + b_4 B\} + \{(c_1 - e_1)R_f + (c_2 - e_2)R_b + c_3 P_{TC} + (c_4/a_1)QD_{BC}\} + \varepsilon.$$

Equation 10 is a reduced-form model of trade credit use. Not all the parameters of the underlying demand for trade credit are identified, but generally the economic interpretation of all the parameters is straightforward. In particular, the parameters associated with financing and business risk include both demand and supply factors, which, as discussed below, could affect the decomposition of total trade credit demand into financing and transaction components.

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28. Chant and Walker, "Small Business Demand for Trade Credit."

29. The assumption that prices affect the financing component but not the transaction component influences the allocation of trade credit to the transaction and financing components but not the estimate of total trade credit demand.

30. This assumption differs from that of Chant and Walker ("Small Business Demand for Trade Credit"). They assumed that $QD_{TC} = k \cdot AP$, where $0 < k \leq 1$, with k generally thought to be close to 1. The difference in specification is not crucial, especially because this parameter is not identified in the reduced-form equation.

The terms in the first set of braces are an intercept, which represents the fixed components of transaction and financing demand. The terms in the second set of braces are the effects of the variables that determine demand for trade credit attributable to the transaction motive. The terms in the third set of braces are the effects of the variables that determine demand for trade credit attributable to the financing motive and also unmet trade credit demand arising from suppliers rationing the amount of trade credit that they extend.

To be consistent with the transaction motive for using trade credit, the coefficients for the volume of purchases (S), variability in the timing of delivery of purchases (σ_S), the return on liquid assets (r_{LA}), and brokerage costs (B) should always be positive.

The coefficient for the price of trade credit (P_{TC}), a determinant of financing demand, should always be negative. The parameters associated with risk and the quantity of institutional credit owed deserve additional discussion. The value of the coefficient for the quantity of credit obtained from financial institutions (QD_{BC}) indicates whether institutional credit is a substitute for or a ''complement'' to trade credit.[31] If these types of credit are substitutes, then in equation 4, $\partial QD^*_{TC}/\partial P_{BC} = c_4 > 0$. Standard neoclassical assumptions about demand suggest that $\partial QD_{BC}/\partial P_{BC} = a_1 < 0$. Hence, from equation 10, $\partial QD_{TC}/\partial QD_{BC} = (c_4/a_1) < 0$. In contrast, if these two sources of credit are ''complements,'' $\partial QD^*_{TC}/\partial P_{BC} = c_4 < 0$, so that $(c_4/a_1) > 0$.

The coefficients of the risk variables—R_f, R_b—are $(c_1 - e_1)$ and $(c_2 - e_2)$ respectively. Consistent with the financing motive for trade credit use, high-risk firms are more likely than low-risk firms to be rationed from traditional credit markets and may use trade credit in lieu of credit from financial institutions. Hence, c_1 and c_2 are assumed to be positive. However, suppliers of trade credit may also choose not to offer as much trade credit as their customers desire, especially if they view the customers as poor credit risks. Hence, both e_1 and e_2 are also positive. The estimated coefficients $(c_i - e_i)$ represent the sum of the effect of a firm's (financial or business) risk on its demand for trade credit and the effect of the firm's (financial or business) risk on trade credit suppliers' willingness to offer trade credit to the firm. Only $(c_i - e_i)$ is identified; neither c_i nor e_i is identified independently in our formulation. We interpret a positive coefficient for the risk variable as being consistent with the financing motive for using trade credit. For a positive coefficient to be inconsistent with the financing motive, both c_i and e_i would have to be be negative and $|c_i| < |e_i|$. For e_i to be negative, trade credit suppliers would have to ration trade credit to their least risky customers but not to their more risky customers. We view such behavior as unlikely.

Survey Data

The data for this study came from the National Survey of Small Business Finances, a nationally representative survey of about 3,400 businesses having 500 or fewer employees that were operating at the end of December 1987.[32] In addition to requesting balance sheets and income statements, the survey asked several questions concerning firms' use of trade credit and payment practices.[33] The questions included whether or not the firm had used trade credit at any time during the preceding year, the number of suppliers from which trade credit had been obtained, whether suppliers had offered cash discounts for early payment, the percentage of cash discounts taken, and the percentage of late payments on trade credit.

Survey results revealed that the use of trade credit by small businesses is widespread. Overall, 82 percent of the small businesses population took trade credit from suppliers during 1987 (table 1).[34] Corporations, firms in manufacturing and wholesale trade industries, and larger firms were more likely than other types of firms to use trade credit. However, even among groups of firms reporting the least use of trade credit, the majority of firms used trade credit. For example, 59 percent of the firms in the industry group made up of insurance

31. In effect, complementarity of institutional and trade credit in this model requires credit rationing by financial institutions. An increase in the price of institutional credit reduces excess demand for institutional credit, leading to a decrease in trade credit demand.

32. For a detailed description of the survey methods, see Brenda G. Cox, Gregory E. Elliehausen, and John D. Wolken, *The National Survey of Small Business Finances: Final Methodology Report*, RTI Report RTI/4131–00F (Research Triangle Institute, 1989).

33. The survey also collected detailed information on sources of financing, recent financial activities of the firm, owner participation in management, dispersion of ownership, and other demographic characteristics of the firm.

34. Sample percentages differ from population estimates because population estimates are weighted to account for unequal probabilities of sample selection and nonresponse. See Cox, Elliehausen, and Wolken, *The National Survey of Small Business Finances*.

1. Use of trade credit by small businesses, by selected firm characteristics, 1987[1]

Characteristic	Percentage of firms using trade credit	Mean ratio of accounts payable to assets of firms using trade credit
All firms	82	.12
Form of organization		
Proprietorship	74	.08
Partnership	81	.08
Corporation	88	.16
Industry		
Construction and mining	90	.12
Primary manufacturing	94	.11
Secondary manufacturing	92	.15
Transportation, communications, and public utilities	82	.07
Wholesale trade	95	.21
Retail trade	83	.11
Insurance agents, real estate agents, and investment offices	59	.08
Business, personal, repair, and recreation services	82	.14
Health, legal, educational, and miscellaneous services	66	.04
Assets (dollars)		
Less than 25,000	65	.22
25,000–49,999	80	.12
50,000–124,999	82	.10
125,000–499,999	87	.12
500,000–1,249,999	92	.14
1,250,000–2,499,999	93	.14
2,500,000–4,999,999	95	.20
5,000,000 or more	99	.11
Age of firm (years)		
Less than 6	81	.15
6–11	84	.14
12–20	83	.11
21 or more	80	.11

1. Data in this table have been adjusted to take into account unequal probabilities of sample selection and nonresponse.

agents, real estate agents, and investment offices used trade credit in 1987.

Not only is their use of trade credit widespread, but small businesses also have significant amounts of trade credit on their balance sheets. For small businesses using trade credit as a group, accounts payable amounted to about 12 percent of their assets at the end of 1987. The accounts payable-to-assets ratio was larger for industries in which inventories tend to constitute a relatively large share of assets (for example, construction and mining, manufacturing, and trade). Because the volume of purchases on account is closely related to inventories, such differences might be explained by the transaction theory. Users of trade credit in the smallest size group tended to have larger accounts payable-to-assets ratios than larger users, possibly indicating a financing demand for trade credit arising from credit rationing of small firms. Other than the larger accounts payable-to-assets ratio for the smallest size group, the data do not show a clear pattern of smaller firms using greater amounts of trade credit than larger firms, however. Although descriptive statistics such as these may indicate the importance of trade credit to small businesses, they do not provide much evidence on the motives for trade credit use.

Variables Affecting Demand for Trade Credit

Economic theory underlying our reduced-form model (equation 10) suggests that certain variables affect the transaction or financing demand for trade credit. The empirical definitions of these variables are discussed in the following paragraphs (table 2).

Transaction Variables

Transaction demand (that is, demand for trade credit attributable to the transaction motive) depends on the volume of transactions with suppliers, variability in the timing of those transactions, and the rate of return on and brokerage costs associated with liquid assets. The inventory-to-total assets ratio (*INVTA*) and the dollar value of inventory (*INV*) indicate the volume of transactions with suppliers. Greater levels of inventory suggest a greater volume of purchases from suppliers and hence greater demand for trade credit.[35]

Inventory turnover (*TURNOVER*), the number of suppliers relative to firm size (*SUPPLTA*), and the number of suppliers (*SUPPL*) represent variability or uncertainty in transactions with suppliers. Inventory turnover, defined as the ratio of the cost of goods sold to the dollar value of inventory, indicates the number of times a year the firm turns over its inventory. Firms having high inventory-turnover ratios relative to other firms make frequent purchases as their inventories are depleted. Because sales may be unpredictable over a short period, firms that have high inventory-turnover ratios may have greater uncertainty in

35. Inventory consists of work in process and finished goods, both of which may include direct labor costs. No information was available to separate the direct labor component from material supplies. Cost of goods sold is an alternative measure of transaction volume, but it shares the same limitation of including direct labor costs.

2. Sample means for variables affecting small-business demand for trade credit in 1987

Variable	Definition	Sample mean[1]
DEPENDENT		
ONACCT	Used trade credit during 1987 (=1 if yes)	.852
LATE	Made late payments on trade credit (=1 if yes)	.473
AP	Amount of accounts payable, in thousands of dollars	127.844
INDEPENDENT		
Transaction variables		
INVTA	Ratio of amount of inventory to total assets	.199
INV	Amount of inventory, in thousands of dollars	229.384
TURNOVER	Inventory turnover (ratio of cost of goods sold to dollar amount of inventory)	9.764
SUPPLTA	Ratio of number of trade credit suppliers to total assets	.245
SUPPL	Number of trade credit suppliers	39.722
SALES	Sales, in millions of dollars	2.527
Financing variables		
DEBTRAT	Ratio of debt (total liabilities, excluding accounts payable) to equity	3.539
QUIRAT	Modified quick ratio, highest for the sample less actual quick ratio (ratio of current assets, excluding inventory, to current liabilities)	17.367
AGE	Modified age of firm, highest for the sample less actual age, in years	12.937
OWNMGR	Manager is an owner of the firm (=1 if yes)	.897
NODISC	Suppliers do not offer cash discounts (=1 if yes)	.367
PLATE	Percentage of late payments on purchases	9.519
STLOANTA	Ratio of dollar amount of short-term loans to total assets	.083
STLOAN	Dollar amount of short-term loans, in thousands of dollars	130.065

1. Sample means in this table have not been adjusted to take into account unequal probabilities of sample selection and nonresponse.

transactions.[36] Firms that conduct business with more than one supplier face additional uncertainty from variations in the timing of deliveries because of differences in the location and behavior of suppliers. Firms dealing with a large number of suppliers therefore may face greater uncertainty in the delivery of supplies than firms dealing with a small number of suppliers. Thus, greater values of *TURNOVER*, *SUPPLTA*, and *SUPPL* suggest greater variability in transactions, and these variables were expected to be positively related to the transaction demand for trade credit.

Brokerage costs and the return on liquid assets may vary by size of firm. Larger firms may be more likely than smaller firms to keep their liquid assets in higher-yield money market securities rather than in bank accounts, and they would be more likely to incur brokerage costs associated with such securities. We measured size of firm by volume of sales (*SALES*). Because the higher returns on liquid assets and higher brokerage costs of large firms would increase these firms' incentives to accumulate bills for payment, *SALES* was expected to be positively related to demand for trade credit.[37]

Financing Variables

Financing demand (that is, demand for trade credit attributable to the financing motive) is associated with financial risk, business risk, the price of trade credit, and the price of institutional credit. Financial risk was measured by the ratio of debt to equity (*DEBTRAT*) and by a modified quick ratio (*QUIRAT*). Higher values of *DEBTRAT* are associated with greater risk of default and a greater likelihood of credit rationing by financial institutions. Thus, *DEBTRAT* was expected to be positively related to demand for trade credit.

The quick ratio (ratio of current assets, excluding inventory, to current liabilities) is an indicator of liquidity. Higher values of the quick ratio normally indicate greater liquidity and hence less risk of not being able to meet current obligations as they come due. Because we wanted to measure the effect of adding the independent variable to the amount of trade credit demanded, we modified the quick ratio variable by subtracting a firm's quick ratio from the highest quick ratio for the sample. This modification changed the expected sign of the coefficient for the quick ratio but not its absolute value. Greater values of the modified quick ratio, *QUIRAT*, indicate less liquidity (greater risk) and

36. Alternatively, a low inventory-turnover ratio may indicate difficulty in converting inventory into sales or a lengthy production process, greater business risk, and hence greater demand for trade credit attributable to the financing motive. Under the financing motive, the sign of the turnover coefficient would be negative, which is opposite of that expected under the transaction motive.

37. Alternatively, firm size may reflect a financing demand if financial institutions ration credit to small firms and the financing variables do not account entirely for this component. A negative coefficient for the size variable would be consistent with the financing motive.

were therefore expected to be positively related to demand for trade credit.

Business risk was measured by two variables. The first was a dummy variable for firms managed by owners (*OWNMGR*), who, theoretical work suggests, prefer riskier projects than firms run by hired managers.[38] The second variable was age of firm, a proxy for experience. Again, because we wanted to measure the effect of adding the independent variable to total trade credit demand, we modified the age variable by subtracting a firm's age from the highest age for the sample; therefore, larger values of *AGE* represent less experience. Larger values of *OWNMGR* and *AGE* are associated with greater business risk and thus a greater financing motive for using trade credit. Hence, both variables were expected to be positively related to demand for trade credit.

The price of trade credit was represented by two proxy variables: a cash discount dummy variable (*NODISC*) and percentage of late payments (*PLATE*). The existence of a discount for prompt payment implies a cost of using trade credit and will encourage some firms to pay early. Firms that are not offered a cash discount have no such incentive for early payment. The use of trade credit for financing is relatively more expensive when cash discounts are offered than when they are not. Hence, not being offered a cash discount was expected to be positively related to demand for accounts payable. The percentage of late payments (that is, payments after the due date) reveals a preference for using trade credit for financing. A high percentage of late payments suggests that the cost of trade credit (that is, the amount lost by forgoing cash discounts plus any additional interest and penalties for late payment) is less than the cost of credit from financial institutions (either the explicit rate or, if rationed, the implied rate). Hence, *PLATE* was expected to be positively related to demand for trade credit.

The price of institutional credit is represented by the quantity of institutional credit demanded, as specified in equation 8. The type of institutional credit most relevant to financing purchases from suppliers is short-term credit. Accordingly, we used the ratio of amount of short-term debt to amount of assets (*STLOANTA*) or the amount of short-term debt (*STLOAN*) to measure quantity of institutional short-term credit (as explained below). The sign of the coefficient depends, as discussed earlier, on whether trade credit and institutional credit are substitutes or ''complements'' (a result reflecting credit rationing by financial institutions): The sign should be negative if they are substitutes and positive if they are complements.

The amount of credit from financial institutions may also indicate financial risk. Under the credit-rationing hypothesis, firms that use relatively large amounts of institutional credit are risky and may face very high, perhaps infinitely high, interest rates for additional institutional credit. These conditions would tend to increase demand for trade credit. Thus, we expected the amount of credit from financial institutions to be positively related to financing demand for trade credit. Note that the coefficient for short-term debt—expected to be positive under the credit-rationing hypothesis—would be negative if trade credit were a substitute for institutional credit.

Results

Data from the National Survey of Small Business Finances allowed us to consider three aspects of trade credit use in testing the transaction and financing hypotheses: (1) whether or not the firm used trade credit at all, (2) whether or not the firm made late payments on trade credit, and (3) the amount of trade credit used by the firm. The estimated model for each aspect of trade credit use is based on the reduced-form model of trade credit demand (equation 10).

Probability of Using Trade Credit

We used a logit model to estimate the probability that a firm used trade credit as a function of the transaction and financing variables. The dependent variable, *ONACCT*, is a dummy variable whose value is 1 if the firm used trade credit during 1987 and 0 if it did not.

The estimated logit model for the probability that the firm used trade credit is significant at the 1 percent level (table 3). The logit R^2 for the model is 0.087.[39] The set of transaction variables

38. Agency theory suggests that hired managers—seeking greater perquisites, less effort, and greater employment security without sacrificing compensation—tend to prefer less risky investment projects than do owner managers. See Michael C. Jensen and William H. Meckling, ''Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure,'' *Journal of Financial Economics*, vol. 3 (October 1976), pp. 305–60; and Sanford J. Grossman and Oliver Hart, ''Corporate Financial Structure and Managerial Incentives,'' in John J. McCall, ed., *The Economics of Information and Uncertainty* (University of Chicago Press, 1982).

39. We used a normalization of the log likelihood function to compute an R^2 analogue for the logit equation. The logit R^2 equals $1 - L(\beta)/L_0$, where $L(\beta)$ is the maximum value of the

3. Estimated logit model for probability of small businesses using trade credit in 1987[1]

Variable	Parameter estimate	Standard error
Transaction variables		
INVTA	1.9448[2]	.2753
TURNOVER	.0101[2]	.0032
SALES	.2660[2]	.0480
Financing variables		
STLOANTA	.6190[3]	.3600
DEBTRAT	.0294[2]	.0101
QUIRAT	–.0747[2]	.0146
AGE	–.0003	.0054
OWNMGR	–.1085	.1905
Intercept	2.3774[2]	.3238
R^2	.087[4]	
–2 log likelihood	2274.101	
χ^2	216.347[2]	
Degrees of freedom	8	

1. The dependent variable, *ONACCT*, equals 1 if the firm purchased supplies on account during 1987 and 0 if it did not. *ONACCT* equaled 1 for 2,526 firms and 0 for 440 firms.
2. Significantly different from zero at the 99 percent level of confidence.
3. Significantly different from zero at the 90 percent level of confidence.
4. $R^2 = 1 - L(\beta)/L_0$, where $L(\beta)$ is the maximum value of the likelihood function of the estimated equation and L_0 is the maximum value of the likelihood function when all the coefficients except the intercept are restricted to zero. See Amemiya, "Qualitative Response Models."

is jointly significant at the 1 percent level (χ^2 = 168.51 with 3 degrees of freedom). The probability of trade credit use increases significantly with the volume of transactions (*INVTA*), the variability of transactions (*TURNOVER*), and the size of the firm (*SALES*). These results are consistent with theory, which predicts that the transaction motive is an important determinant of trade credit demand.

The set of financing variables is also jointly significant (χ^2 = 43.88 with 5 degrees of freedom). Three of the five financing variables are significantly different from zero. The short-term debt-to-assets ratio (*STLOANTA*) and the debt-to-equity ratio (*DEBTRAT*) are positive, as predicted by the financing theory. Firms having relatively high levels of short-term debt and high debt-to-equity ratios may be riskier than other firms, and therefore may be more likely to be limited in the amount of additional short-term credit they can obtain from financial institutions (that is, they are more likely to be rationed). According to the financing theory, such firms are likely to have greater demand for trade credit. Our results are consistent with a financing motive for trade credit use, but the sign of the coefficient for *STLOANTA* calls into question the view that trade credit is a substitute for credit from financial institutions.

The coefficient for the modified quick ratio (*QUIRAT*) is negative, whereas the financing motive would lead one to expect a positive sign. The negative sign suggests that firms with greater liquidity risk are less likely, not more likely, to use trade credit and may indicate that the trade credit supply rationing effect (e_1 in equation 10) is greater than the demand effect (c_1) for this variable. It seems reasonable that if supply effects dominate demand effects for any risk variable, they would do so for the quick ratio. Because typical credit periods for trade credit are one month, or possibly two months, suppliers would likely be especially concerned about liquidity risk and would refuse trade credit to customers that have relatively low levels of liquidity.

Probability of Paying Late

Making payments on trade credit after the due date may reflect a financing motive for trade credit use; firms using trade credit solely for transaction purposes would have no reason to incur additional interest and penalties by delaying payment.[40] We used a logit model to estimate the probability that firms make some of their payments after the due date as a function of the transaction and financing variables. The dependent variable, *LATE*, is a dummy variable whose value is 1 if the firm made late payments and 0 if it made all payments on time. Only the 2,526 firms that reported making payments on account (*ONACCT* = 1) were used for estimation.

The estimated logit model for the probability of making late payments is statistically significant (table 4). The logit R^2 for the model is 0.033. The set of financing variables is jointly significant at the 1 percent level (χ^2 = 112.78 with 6 degrees of freedom), but the set of transaction variables is not

likelihood function of the estimated equation and L_0 is the maximum value of the likelihood function when all the coefficients except the intercept are restricted to zero. See Takeshi Amemiya, "Qualitative Response Models: A Survey," *Journal of Economic Literature*, vol. 19 (December 1981), p. 1505.

40. This is not to say that firms using trade credit solely for transaction purposes never make late payments. Such firms may inadvertently make some late payments, but in that case transaction demand variables should not be systematically related to making late payments.

4. Estimated logit model for probability of small businesses making late payments on trade credit in 1987[1]

Variable	Parameter estimate	Standard error
Transaction variables		
INVTA	−.1317	.1761
TURNOVER	−.0010	.0017
SUPPLTA	.0298	.0359
SALES	*	*
Financing variables		
STLOANTA	−.0168	.1940
DEBTRAT	.0459[2]	.0075
QUIRAT	.0202[3]	.0097
AGE	.0102[2]	.0042
OWNMGR	.0060	.1341
NODISC	−.6016[2]	.0955
Intercept	−.2107	.2113
R^2	.033[4]	
−2 log likelihood	3353.428	
χ^2	115.954[2]	
Degrees of freedom	10	

1. The dependent variable, *LATE*, equals 1 if the firm made late payments on trade credit during 1987 and 0 if it did not. *LATE* equaled 1 for 1,405 firms and 0 for 1,121 firms.

2. Significantly different from zero at the 99 percent level of confidence.

3. Significantly different from zero at the 95 percent level of confidence.

4. $R^2 = 1 - L(\beta)/L_0$, where $L(\beta)$ is the maximum value of the likelihood function of the estimated equation and L_0 is the maximum value of the likelihood function when all the coefficients except the intercept are restricted to zero. See Amemiya, "Qualitative Response Models."

* Less than 0.00005.

($\chi^2 = 1.62$ with 4 degrees of freedom). Thus, only the financing motive appears to affect the probability of paying late. This result is consistent with expectations. Assuming that the amount lost by forgoing cash discounts plus any additional interest and penalties for late payment is generally higher than the cost of credit from financial institutions, firms that use trade credit only for transaction reasons would not, ex ante, incur the costs imposed by suppliers for using trade credit beyond the due date. Hence, the transaction component should not be related to the probability of paying late.[41]

In contrast, making late payments would generally be consistent with the financing motive. The loss of cash discounts and the added cost of interest and penalties may not discourage firms with relatively high costs for institutional credit, especially rationed firms that are not able to obtain additional institutional credit at any cost, from delaying payment on trade credit beyond the due date.

Four of the six financing variables are significant. High financial leverage (*DEBTRAT*), low liquidity (*QUIRAT*), and less experience (*AGE*) (all indicators of greater risk) are associated with a higher probability of making late payments. These results are consistent with the financing theory of trade credit use. The short-term credit-to-assets ratio (*STLOANTA*) is not significant and thus provides no evidence as to the possible substitutability or complementarity of trade credit and institutional credit. The coefficient for the cash discount dummy variable, *NODISC*, is also significant, but its sign is opposite of that hypothesized.

Amount of Accounts Payable

Finally, we estimated the amount of accounts payable, which as defined in equation 5 is a proxy for the amount of trade credit demanded. The amount of trade credit can be measured as either the absolute dollar amount of accounts payable or relative to the size of the firm (that is, the ratio of accounts payable to assets). We estimated the demand for trade credit using the absolute dollar amount because that regression explained a greater proportion of the variation in accounts payable than did the ratio of accounts payable to assets.[42]

The independent variables were the transaction and financing variables identified in equation 10 as affecting the use of accounts payable. It is reasonable to expect that the effects on the dollar amount of accounts payable of the ratios and dummy variables used to indicate transaction and financing demands in the previous regressions depend on the size of the firm. Hence, the ratios of inventory, number of suppliers, and amount of short-term debt to total assets were replaced by the dollar amount of inventory (*INV*), the number of suppliers (*SUPPL*), and the dollar amount of short-term loans (*STLOAN*). For the same reason, *TURNOVER*, *DEBTRAT*, *QUIRAT*, *AGE*, *OWNMGR*, *NODISC*, and *PLATE* were multiplied by assets in this regression. The equation for estimation, then, was

41. If suppliers tolerate late payments, however, then making late payments may be rational regardless of whether the customer can obtain credit from financial institutions.

42. The accounts payable-to-assets regression (equation 11 divided by the dollar amount of accounts payable) explained 34 percent of the variation in the *amount* of accounts payable, and the dollar level of accounts payable regression explained 59 percent. In the two regressions, the signs of the coefficients were the same, and hypothesis tests on the coefficients generally yielded the same results.

$$(11)\quad AP = a + b_1 INV + b_2 TURNOVER \cdot ASSETS + b_3 SUPPL + b_4 SALES + g_1 STLOAN + g_2 DEBTRAT \cdot ASSETS + g_3 QUIRAT \cdot ASSETS + g_4 AGE \cdot ASSETS + g_5 OWNMGR \cdot ASSETS + g_6 NODISC \cdot ASSETS + g_7 PLATE \cdot ASSETS + \varepsilon.$$

The first two columns of table 5 present the results of estimation for the 2,526 firms that used trade credit during 1987, regardless of whether they owed trade credit at the end of the year (*ONACCT* = 1). The third and fourth columns present the results for the 1,925 firms that had outstanding balances on trade credit at the end of 1987 (*AP* > 0).[43]

Both estimated equations are significant at the 1 percent level. They explain 59 percent and 60 percent of the variation in accounts payable. All the transaction variables in both equations are significant.[44] The positive coefficient for the amount of inventory suggests that greater volume of transactions is associated with greater demand for accounts payable and is consistent with a transaction motive for trade credit use. The conclusions concerning variability are less clear. Consistent with a transaction motive, firms that deal with a greater number of suppliers were estimated to have greater demand for accounts payable. However, higher inventory turnover was estimated to reduce demand for accounts payable, a result that is contrary to this variable's hypothesized effect on transaction demand. This inverse relationship may be due to a demand for credit to finance inventory resulting from a lengthy production process or from difficulty in generating sales.[45] The sales variable, hypothesized to

43. Firms that did not use trade credit at all are probably different from those that reported zero balances at the end of the year, despite both having zero balances of accounts payable. In the former case, firms make a conscious decision not to use trade credit (or suppliers refuse to extend trade credit to them). In the latter case, zero balances are more likely to be a coincidence rather than to indicate a conscious decision.

44. *F*-ratios for the test of joint significance of the transaction variables are 161.88 (4, 2514 degrees of freedom) in the first regression and 133.48 (4, 1913 degrees of freedom) in the second regression.

45. For a discussion, see footnote 36.

5. Estimated regression model for trade credit demand

Variable	Firms using trade credit in 1987[1]		Firms owing trade credit at end of 1987[2]	
	Parameter estimate	Standard error	Parameter estimate	Standard error
Transaction variables				
INV	.0605[3]	.0115	.0583[3]	.0132
TURNOVER · ASSETS	–.0001[4]	.0001	–.0001[4]	.0001
SUPPL	.6211[3]	.0876	.5568[3]	.1025
SALES	.0204[3]	.0012	.0221[3]	.0014
Financing variables				
STLOAN	.1268[3]	.0125	.1096[3]	.0142
DEBTRAT · ASSETS	.0015[3]	.0005	.0003	.0005
QUIRAT · ASSETS	.0007[4]	.0003	.0008[4]	.0004
AGE · ASSETS	.0084[5]	.0002	.0006[4]	.0003
OWNMGR · ASSETS	–.0041	.0056	–.0027	.0063
NODISC · ASSETS	–.0014	.0062	.0024	.0070
PLATE · ASSETS	.0004[3]	.0001	.0010[3]	.0001
Intercept	–.7655[3]	7.706	6.8044[3]	10.0482
R^2	.589		.602	
F-ratio	329.457[3]		265.873[3]	
Degrees of freedom	11, 2514		11, 1913	

1. The dependent variable was *AP*. The trade credit demand equation was estimated for the 2,526 firms that used trade credit during 1987, regardless of whether they had outstanding balances on trade credit at the end of the year.

2. The dependent variable was *AP*. The trade credit demand equation was estimated for the 1,925 firms that had outstanding balances on trade credit at the end of the year.

3. Significantly different from zero at the 99 percent level of confidence.

4. Significantly different from zero at the 95 percent level of confidence.

5. Significantly different from zero at the 90 percent level of confidence.

represent higher return on liquid assets and brokerage costs of larger firms, is significantly positively related to the amount of accounts payable. This result is also consistent with a transaction motive for trade credit use. On the whole, the results for amount of inventory, number of suppliers, and sales provide considerable support for the transaction motive.

The set of financing variables is also significant in both equations, suggesting that the financing motive is also an important determinant of the demand for trade credit.[46] The estimated coefficients for *STLOAN*, *QUIRAT* (higher values indicate less liquidity), and *AGE* (higher values indicate less business experience) are significant and positive in both equations. *DEBTRAT* is positive in both equations but significant in only one. Higher values for these four variables indicate greater financial and business risk, which may lead to credit rationing by financial institutions. The results support the predictions of financing models of trade credit use: High-risk firms use trade credit because, owing to credit market imperfections, institutional credit to them is rationed. The positive coefficient for *STLOAN* indicates that for small firms, trade credit is not a substitute for credit from financial institutions.

One of the two proxy variables for trade credit price, *PLATE*, is significant. Consistent with expectations, *PLATE* is positive, suggesting that firms making a greater percentage of late payments have greater financing demand for trade credit.

In sum, both the decision to use trade credit and the level of accounts payable appear to be influenced by both the transaction and financing motives. The variables used to explain one or the other motive are generally significant, and most have a sign that is consistent with the motive they are hypothesized to represent.

Relative Importance of Transaction and Financing Components of Demand

We also investigated the relative importance of the transaction and financing motives of accounts payable, by estimating (1) the size of the transaction and financing components of demand and (2) the percentage of the variation in accounts payable explained by the sets of transaction and financing variables. The variables were assigned to the transaction and financing components as hypothesized in our model. Our methods and results are described in the following paragraphs.

Size of Transaction and Financing Components

The size of the transaction and financing components of demand can be predicted from equation 11 as follows:

$$\text{(12a)}\qquad \hat{T}_d = \Sigma_j[\hat{b}_1 INV_j + \hat{b}_2 TURNOVER_j \cdot ASSETS_j + \hat{b}_3 SUPPL_j + \hat{b}_4 SALES_j]$$

and

$$\text{(12b)}\qquad \hat{F}_d = \Sigma_j[\hat{g}_1 STLOAN_j + \hat{g}_2 DEBTRAT_j \cdot ASSETS_j + \hat{g}_3 QUIRAT_j \cdot ASSETS_j + \hat{g}_4 AGE_j \cdot ASSETS_j + \hat{g}_5 OWNMGR_j \cdot ASSETS_j + \hat{g}_6 NODISC_j \cdot ASSETS_j + \hat{g}_7 PLATE_j \cdot ASSETS_j],$$

where $\hat{T}_d$ and $\hat{F}_d$ are predicted transaction and financing demand respectively; $\hat{b}_i$ and $\hat{g}_i$ are the estimated coefficients for transaction and financing variables from equation 11; $INV_j, \ldots, SALES_j$ are the values of the transaction variables for the jth firm; $STLOAN_j, \ldots, PLATE_j$ are the values of the financing variables for the jth firm; and $ASSETS_j$ is the amount of assets for the jth firm. This exercise assumes that the two components are orthogonal.

Using the estimated coefficients from the regressions in table 5, we computed two sets of estimates of the distribution of the amount of accounts payable between the transaction and financing components. The distributions are similar for the two models (table 6, upper panel). The transaction component accounts for 72 percent and 66 percent of the aggregate amount of accounts payable of small businesses, and the financing component accounts for 29 percent and 28 percent of aggregate accounts payable. The intercept, which includes both the transaction and financing elements, is relatively small, negligible in one equation and 7 percent of accounts payable in the other. These predictions suggest that the transaction and financing components of trade credit demand by small businesses not only are statistically significant but also are of an economically significant magnitude.

46. *F*-ratios for the test of joint significance of the financial variables are 44.68 (7, 2514 degrees of freedom) in the first regression and 39.68 (7, 1913 degrees of freedom) in the second regression.

6. Contribution of transaction and financing components to total trade credit demand

Component	Firms using trade credit in 1987[1]	Firms owing trade credit at end of 1987[2]
	Distribution of predicted trade credit demand between transaction and financing components, in percent[3]	
Transaction	72	66
Financing	29	28
Intercept	–1	7
Total	100	100[4]
	Increase in R^2 in trade credit demand regressions from addition of transaction and financing variables	
Transaction	.105	.113
Financing	.051	.058

1. Estimates from trade credit demand equation for the 2,526 firms that used trade credit during 1987, regardless of whether they had outstanding balances on trade credit at the end of the year.
2. Estimates from trade credit demand equation for the 1,925 firms that had outstanding balances on trade credit at the end of the year.
3. Percentages are weighted to represent the distribution of transaction and financing components of trade credit demand for the population of small businesses.
4. Components appear to sum to more than 100 percent because of rounding.

Variation in Demand Explained by Transaction and Financing Components

The second measure of the relative importance of the transaction and financing motives is the increase in the proportion of explained variation in accounts payable resulting from adding the set of transaction or financing variables to the trade credit demand model. Increases in explained variation due to the transaction and financing variables were computed by the following equations:

$$R^2(T_d \mid F_d) = R^2(T_d, F_d) - R^2(F_d)$$

and

$$R^2(F_d \mid T_d) = R^2(T_d, F_d) - R^2(T_d),$$

where $R^2(T_d, F_d)$ is the R^2 for the regression *AP* on the transaction and financing variables, $R^2(T_d)$ is the R^2 for the regression *AP* on the transaction variables, and $R^2(F_d)$ is the R^2 for the regression *AP* on the financing variables.

As reported earlier, both sets of variables significantly increase the proportion of variation in accounts payable explained. Adding the set of transaction variables explains an additional 10 percent and 11 percent of the variation in the amount of accounts payable (table 6, lower panel). Adding the set of financing variables increases the percentage of explained variation 5 percent and 6 percent.

These results do raise one caveat. The sum of the two components is substantially less than the R^2 for the full model (table 5), suggesting that the sets of transaction and financing variables are not orthogonal. Thus, each set of variables appears to account to some extent for the other motive. Despite this problem, representing the transaction and financing components by the variables assigned to them is reasonable because the effects of the individual variables are generally consistent with the motives to which they are assigned. The significance of both sets of variables and the size of the estimated increases in explained variation in accounts payable for the transaction and financing components are sufficient to conclude that both motives have an economically meaningful effect on trade credit demand.

The results presented in this section, then, seem to indicate that financing is an important component of trade credit demand by small businesses. The importance of financing does not stem from the substitutability of trade credit and institutional short-term credit, however. Rather, the results indicate that institutional and trade credit are ‘‘complements,’’ a finding that supports the credit-rationing models of trade credit demand. Firms that have relatively high levels of debt from financial institutions may face limitations on additional institutional credit. With the marginal cost of institutional credit being infinite, such firms would turn to relatively more expensive trade credit as a source of additional financing. This finding may explain the observation that many firms do not take cash discounts despite the high implicit interest cost of failing to do so.

Summary and Conclusions

Businesses that choose to finance their purchases through trade credit have several options for payment: They may pay the supplier promptly and in so doing receive a cash discount; wait until the bill’s due date and consequently pay the interest cost implicit in forgoing the cash discount, at a rate that is typically higher than the rate on credit from institutional lenders; or pay late, after the

bill's due date, and thereby risk incurring additional costs in the form of explicit interest or penalties, or both. Though trade credit is an important source of funds for small businesses, little has been known about the reasons business customers use it.

Theoreticians have linked the use of trade credit to a transaction motive—a desire to realize economies in cash management—and to a financing motive—use of trade credit because credit from other sources, particularly from financial institutions, is limited. Previous studies have focused on one or the other of these motives, and available empirical evidence on trade credit use, especially by small businesses, is limited.

We constructed a model of trade credit demand that incorporates both the transaction and financing theories of trade credit use. One important feature of the model is a link between trade credit use and credit rationing. This link enabled us to provide empirical evidence on the presence of rationing in markets for business credit.

Our analysis of data from the National Survey of Small Business Finances indicates that both the transaction and financing motives explain small businesses' use of trade credit. Characteristics of firms associated with the transaction motive—a relatively large volume of purchases and relatively great variability in the timing of delivery of purchases—were significantly related to a greater probability of using trade credit and a greater dollar amount of trade credit outstanding. Firm characteristics associated with a financing motive—relatively high business and financial risk—were significantly related to these two aspects of trade credit use as well, and also (as we hypothesized) to a greater probability that the firm made some percentage of its payments on trade credit after the due date. These results are consistent with the predictions of theoretical models of transaction and financing motives for trade credit use.

One particularly noteworthy finding is that trade credit is a ''complement'' to rather than a substitute for trade credit: Firms that use relatively large amounts of short-term institutional credit are also the largest users of trade credit. This finding is consistent with the hypothesis that small businesses are subject to credit rationing by financial institutions.

We also used our model to estimate the relative importance of the transaction and financing motives for using trade credit. The financing component was estimated to be two-fifths to one-half the estimated size of the transaction component. Clearly, each motive accounts for a sizable portion of total trade credit demand. Thus, both the transaction and financing motives appear to be economically significant determinants of trade credit use.

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