

# An Empirical Analysis of the Effect of Credit Rating on Trade Credit

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**Abstract.** This study uses disaggregated panel data from Taiwan manufacturing firms and examines how firms change the trade credit in response to a tightening monetary policy. The results show that both accounts receivable and accounts payable are increased with a tightening monetary policy, implying that trade credit helps firms to absorb the effect of a credit condensation. Additionally, we find that the Taiwan corporate credit rating index (TCRI) variable, which is the first time being used in literatures, has a strong positive effect on the account receivable for all groups of firms, and has a strong positive effect on the account payable for the large firms.

**Keywords:** trade credit, tightening monetary policy, accounts receivable, accounts payable, TCRI

## 1. Introduction

Tightening monetary policy affects the real economy by reducing the financial resources available to enterprises. Therefore, financially constrained firms cut down on their inventory holdings. The impact of a monetary restriction, however, may be mollified the availability of trade credit (TC). Firms that are financially constrained may increase working capital by borrowing more TC (i.e. further delaying payment of their notes). Thus, the net impact of a monetary restriction depends on the use of accounts receivable and accounts payable.

Nilsen(2002) shows that the percentage is high in accounts payable to the total liability. In particular, U.S. manufacturing firms, about 13%. This paper finds that the share of accounts payable in the total liability is about 25% among Taiwan's firms (with the exclusion of financial industry). Such widespread trade credit warrants deeply analyze both its nature and its effects on the economy.

Meltzer's (1960) redistribution hypothesis presumes that large suppliers pass funds via trade credit (their accounts receivable) to less liquid customers (buyers) during tight money, thereby mitigate the effect of monetary policy. However, empirical studies find mixed results regarding trade credit increases during monetary contractions (see. e.g., Ramey (1992), Gertler and Gilchrist (1993) and Nilsen (2002)). Using semi-aggregated data, Nilsen (2002) finds that both small and large firms use more accounts payable during monetary contractions. Choi (2005) find that both accounts payable and accounts receivable increase with tighter monetary policy, implying that trade credit helps firms to absorb the effect of a credit contraction. Further, the smaller firms increase net trade credit (accounts receivable minus payable), making up for the reduced liquidity associated with tighter policy. However, they find no evidence that large firms play this role more actively than smaller firms.

TCRI (Taiwan Corporate Credit Risk Index) is a corporate credit rating system, which was developed by TEJ. The main risk assessment factors include: profitability, security, activity and scale. Each factor has several representative financial ratios. TCRI assesses risk by firstly obtaining a basic rank by the financial material that estimates a basic synthesis score by 10 financial values and the ratio, then determines a

preliminary basic rank. The next rating depends on the risk and the scale obtains the threshold rank which is, finally decided by TCRI using the non-quantification factor.

## 2. Empirical Methods

### 2.1. Regression Models

Transaction costs theory predicts that both accounts receivable and payable would be increased when the financial market tightens. According to this theory, trade credit helps to reduce cash flow uncertainty between the seller and the buyer, thereby reducing the need for precautionary cash holdings for both parties. A distinct characteristic of this prediction is that all firms increase accounts receivable and payable when tighter monetary markets occur. Ferris (1981) presents evidence in support of this theory using industry-level data. Alternatively, accounts receivable (payable) is affected by the operation scale, by including sales (or cost for accounts payable) in the explanatory variables. For firm  $j$  at time  $t$ , the asset-normalized accounts receivable are given by

$$\begin{aligned} \ln AR_{j,t} = & \alpha^R + \beta_1^R CPR_{j,t-1} + \beta_2^R \ln Cash_{t-1} + \beta_3^R \frac{INV_{j,t-1}}{A_{j,t-1}} + \beta_4^R \ln A_{j,t-1} \\ & + \beta_5^R \frac{STD_{j,t-1}}{A_{j,t-1}} + \beta_6^R \frac{RE_{j,t-1}}{A_{j,t-1}} + \beta_7^R \frac{Sale_{j,t-1}}{A_{j,t-1}} + \beta_8^R TCRI_{j,t-1} + \varepsilon_{j,t-1}^R \end{aligned} \quad (1)$$

where  $AR_{j,t}$  is nominal accounts receivable,  $CPR_{j,t-1}$  is commercial paper rate-90 days,  $Cash_{j,t-1}$  is cash and cash equivalent,  $INV_{j,t-1}$  is nominal inventories,  $A_{j,t-1}$  is ending-of-period nominal total assets,  $STD_{j,t-1}$  is short-term debts,  $RE_{j,t-1}$  is retained earnings,  $Sale_{j,t-1}$  is nominal sales,  $TCRI_{j,t-1}$  Taiwan corporate credit rating index, and  $\varepsilon_{j,t-1}^R$  is an error term. Likewise, the asset normalized accounts payable are given by

$$\begin{aligned} \ln AP_{j,t} = & \alpha^P + \beta_1^P CPR_{j,t-1} + \beta_2^P \ln Cash_{t-1} + \beta_3^P \frac{INV_{j,t-1}}{A_{j,t-1}} + \beta_4^P \ln A_{j,t-1} \\ & + \beta_5^P \frac{RE_{j,t-1}}{A_{j,t-1}} + \beta_6^P \ln Cost_{j,t-1} + \beta_7^P TCRI_{j,t-1} + \varepsilon_{j,t-1}^P \end{aligned} \quad (2)$$

Where  $AP_{j,t}$  is nominal accounts payable,  $Cost_{j,t-1}$  is the nominal cost of goods sold, and  $\varepsilon_{j,t-1}^P$  an error term. As both accounts receivable and payable are incurred in transactions, their volumes are affected by the firm's operation scale. Therefore, we include the operation scale.  $Sale_{j,t-1}$ , for accounts receivable and  $Cost_{j,t-1}$  for accounts payable, both of which are normalized by the lagged asset size. Additional, we include the money market interest rate,  $CPR_{t-1}$  in place of the macro financial shocks when we want to take into consideration the effect of the external financing cost on trade credit. Norrbin and Reffett (1995) suggest that the extension of trade credit is positively related with the interest rate because of the substitution between money and trade credit as alternative means of payment. Ferris (1981) argues that both accounts receivable and payable are increased with the interest rate.

### 2.2. Determinants of Trade Credit

In order to control the fixed firm effects, we only include time-varying firm-specific variables. We use the end of period value for a regression when the use of its current value causes a possible endogenous problem.

#### A. Accounts Receivable

- a. Sales: A firm may extend trade credit more aggressively to promote sales, resulting in a positive correlation between sales and accounts receivable. Following Petersen and Rajan (1997), there will be a positive correlation between sales and accounts receivable.
- b. Cash (*log Cash*): If firms with more cash relative to assets, they would have more laid-up cash and be able willing to offer more trade credit. As this will be a positive correlation between cash and accounts receivable, this variable has a positive coefficient.
- c. Inventory ( $INV_{t-1} / A_{t-1}$ ): Inventory-based management purposes, firms with more inventories are likely to extend more trade credit than other firms. Both inventories and accounts receivable are current assets and thus are substitutes from the viewpoint of asset management.
- d. Firm Size (*log A*): The effect of firm size is the proxy for market power. From the financial assistance view suggests that large firms offer more trade credit. Contrarily, the quality verification theory suggests that small firms have a greater need to guarantee their product quality than large and more established firms, thus offer trade credit. Using the book value of total assets as a proxy for size, we include the log

of lagged assets ( $\ln A_{j,t-1}$ ) to capture possible nonlinearity in the size effect.

- e. Short-Term Debt ( $STD_{t-1} / A_{t-1}$ ): If this variable has a positive coefficient, it exhibits that firms incur short-term debt to finance accounts receivable. Contrarily, this variable has a negative coefficient; it implies that firms extend less trade credit when short-term external financing is required.
  - f. Retained Earnings ( $RE_{t-1} / A_{t-1}$ ): If firms with more retained earnings relative to assets have more internal capital and be able afford to offer more trade credit.
  - g. Taiwan corporate credit rating index (TCRI): TCRI are divided into grades 1-9 from high risk to low risk areas. As the low-risk enterprise is more able to provide trade credit, there will be a positive correlation between TCRI and accounts receivable. Therefore, this variable has a negative coefficient.
- B. Accounts Payable**
- a. Cost (*log Cost*): As firms need more vendor credit to finance a growing operation, there will be a positive correlation between the cost of goods sold and accounts payable.
  - b. Cash (*log Cash*): From the supplier's viewpoint, when the company's cash flow is high, the supplier of trade credit has an advantage over other financial institutions and will be more willing to provide credit.
  - c. Inventory ( $INV_{t-1} / A_{t-1}$ ): Inventories are easy to liquidate from the supplier's viewpoint. So when this ratio is high, the supplier of trade credit has an advantage over other financial institutions and will be more willing to provide credit.
  - d. Firm Size (*log Assets*): Assets size may have a positive effect on the willingness of the trade credit providers, since large firms usually have an established reputation, which smaller firms may not have. As Peterson and Rajan (1997) note, investment opportunities, which can be used as the proxy for a firm's credit demand, are typically thought to decline in firm size for large firms—this relationship is less likely for small firms since certain projects may become viable only after enough levels of assets and experience are acquired.
  - e. Retained Earnings ( $RE_{t-1} / A_{t-1}$ ): From the viewpoint of the suppliers of trade credit, the effect of retained earnings is positive since suppliers are more willing to extend trade credit to firms with more retained earnings and therefore lower default risk. On the other hand, the pecking order theory (Myers (1984), and Graham and Harvey (2001)) posits that firms use external financing only when internal funds are insufficient.
  - f. Taiwan corporate credit rating index (TCRI): TCRI may have a positive effect on the willingness of the trade credit providers, since high rating usually have an established reputation, which smaller firms may not yet have. So the firm of high rating has lower default risk, the supplier of trade credit will be more willing to provide credit. Therefore, this variable has a negative coefficient for large firms. On the contrary, smaller firms have a positive coefficient.

### 3. Empirical Results

#### 3.1. Data

This paper uses firm level data of Taiwan public companies that we retrieved from the Taiwan Economic Journal (TEJ) database for 1999:Q1-2009:Q4. However, we excluded firms for which relevant financial variables were missing or seemed unreliable. This approach allows us to use the data of 9,074 Taiwanese listed firms. Furthermore, we classify two different panel data sets according to the assets size. The first data set contains the top 50% of all enterprises of the firms, and the second data set contains the other 50% of all enterprises. The macroeconomic variables we used are the market interest rate and macro-financial shocks. The market interest rate, CP, is measured by the three-month Commercial Paper rate. Table 1 gives a summary of variable descriptions and sources of the data.

Table 1 Summary of Variable Descriptions and Sources

Variable	Variable symbol	Character	Source	Expected sign (+/-)
<b>A. TC Supplier</b>				
The market interest rate	CPR	Quarterly	TEJ*	+
Cash	Cash	Quarterly	TEJ	+
Inventory	INV	Quarterly	TEJ	-
Size	A	Quarterly	TEJ	+/-
Short-term Debts	STD	Quarterly	TEJ	+/-
Retained Earning	RE	Quarterly	TEJ	+
Sales	Sales	Quarterly	TEJ	+
Credit Rating Index	TCRI	Quarterly	TEJ	-
<b>B. TC Demander</b>				
The market interest rate	CPR	Quarterly	TEJ	+
Cash	Cash	Quarterly	TEJ	+

Inventory	INV	Quarterly	TEJ	+
Size	A	Quarterly	TEJ	+
Retained Earning	RE	Quarterly	TEJ	+
Cost of goods sold	Cost	Quarterly	TEJ	+
Credit Rating Index	TCRI	Quarterly	TEJ	-

Note: \* Taiwan Economic Journal database. Suppliers of trade credit are measured as natural logarithm of accounts receivable. Demanders of trade credit are measured as natural logarithm of accounts payable. The market interest rate is measured by the three-month Commercial Paper rate. Cash is the natural logarithm of net cash flow. Inventory is the ratio of total inventory to total assets. Size is the natural logarithm of total assets. Short-term debts are the ratio of short-term debts to total assets. Returning earning is the ratio of returning earning to total assets. Sales is the ratio of net sales to total assets. Cost of goods sold is the ratio of Cost of goods sold to total assets. Credit rating index is a corporate credit rating system which was developed by TEJ.

### 3.2. Regressions for the Accounts Receivable Variable

Table 2 reports the results of regressions in which the dependent variable is the accounts receivable (AR), as in equation (1). All regressions henceforth, unless otherwise indicated, control for industry-specific seasonality, thereby allowing seasonality to vary across industries, and fixed firm effects. We firstly look at the estimated effects of the monetary policy shocks. Policy shocks have a significant negative impact on the AR for all groups of firms. As for firm-specific variables, the cash has a strong positive coefficient for all groups of firms. The positive correlation between trade credit and cash is stronger for all the samples, and large enterprises are stronger than small enterprises. This result may reflect that firms with laid-up cash have extended the trade credit. The inventory has a strong negative effect for all groups of firms, especially for large firms. The negative effects may indicate that inventories, as a buffer for internal finance, are the substitutions for accounts receivable (Carpenter, Fazzari, and Petersen (1994) and Choi and Kim (2001)). The size effect is characterized by a positive and significant sign on  $\ln A_{j,t-1}$  for small enterprises. Large enterprises are not as significant as small enterprises. This findings may imply that large enterprises go through a period of fast growth during which they need as much financing as they can obtain from all sources, therefore, they refrain from offering trade credit. The short term debt has a significant positive effect on accounts receivable for all sample groups of firms, especially for large firms, implying that firms use short-term debt to finance accounts receivable. Retained earnings have no significant positive effects on accounts receivable for all the samples. In addition, large enterprises have negative correlation and small enterprises have positive correlation. The sale has a strong positive coefficient for all groups of firms. The positive link between trade credit and operation scales is stronger for total samples and large enterprises than for small enterprises. This result may reflect that firms with sales would extend trade credit to promote sales; while those with reducing sales would reject trade credit when parting with customers. This is consistent with Ferris (1981) who indicates transaction costs theory that sellers extend trade credit to customers only when they expect a continuing relationship. The Taiwan corporate credit rating index (TCRI) has a strong negative coefficient for all groups of firms, this result show that there is a positive correlation between trade credit and TCRI for total samples. Meanwhile, we conclude that the large enterprises are more significant than small enterprises.

Table 2 Regression Result for TC Supplier (AR) (Model 1)

Variable	Symbol	Total Samples	Large Enterprises ( $A \geq 50\%$ )	Small Enterprises ( $A < 50\%$ )
Commercial paper rate	CPR	0.112*** (6.538)	0.120*** (5.146)	0.103*** (4.168)
Cash	Cash	0.168*** (13.259)	0.240*** (13.375)	0.099*** (5.524)
Inventory	INV	-1.720*** (-19.842)	-1.823*** (-15.511)	-1.681*** (-13.001)
Total Assets	A	0.652*** (46.059)	0.553*** (24.557)	0.890*** (28.058)
Short-term Debts	STD	1.178*** (9.841)	2.146*** (12.297)	0.011 (0.067)
Retained Earning	RE	0.072 (1.551)	-0.841*** (-5.046)	0.108** (2.129)
Sales	Sales	1.619*** (41.598)	1.845*** (32.061)	1.396*** (26.680)
Credit Rating Index	TCRI	-0.117*** (-12.935)	-0.177*** (-13.932)	-0.058*** (-4.003)
Observations		9074	4537	4537
Adj- $R^2$		0.649	0.609	0.407

Table 2 summarizes the estimated results of equation (1), which regress the natural logarithm of AR, firm-specific variables (detailed in Section 2), and policy shocks (CPR). Regressions using ordinary least squares are performed with the Taiwan public data (9074) for the 1999Q1-2009Q4 period. All regressions control for fixed firm. The adjusted  $R^2$  excludes variance explained by the fixed firm effects. The t-values in parentheses are based on Whites correction for heteroskedasticity. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

### 3.3 Regressions for the Accounts Payable Variable

The regression results are summarized in Table 3. Tighter policy can increase the AP significantly for the total samples. First, the providers of trade credit are concerned about the default risk of the buyer. Second,

they are concerned about the possibility of selling the repossessed supplies in case of any defaults, accounts payable are constrained by the willingness of the providers of trade credit. So, we should consider about the determining factors of the suppliers and the demand of trade credit as well.

As for firm-specific variables in Table 3, the cash has a strong positive coefficient for all groups of firms. The positive correlation between trade credit and cash is stronger for the total samples, and large enterprises are stronger than for small enterprises. It implies that the providers of trade credit avoid the default risk of the buyers since they have a high cash flow. Inventory always has a positive effect on accounts payable, and its estimate is higher for large enterprises than for small enterprise. This result is consistent with the explanation that accounts payable can be issued against inventories, especially for smaller firms, since inventories can be easily liquidated. A negative and significant sign on  $\ln A_{j,t-1}$  for large firms. It implies that large firms depend less on accounts payable because large firms are more likely than small firms to obtain source of capital from other financing channels. Retained earnings have a positive effect on the accounts payable for small enterprises, reflecting that firms with more internal capital would need less external short-term financing. For large enterprises, however, retained earnings have insignificant effects on accounts payable. The cost of goods sold has a strong positive effect on the account payable for all groups of firms, and its estimate is higher for large enterprises than for small enterprise, similar to the positive relation between the cost of goods sold and the accounts payable. That is, large firms use relatively more accounts payable during their operation if compared to smaller firms, implying that large firms have the market power to squeeze more trade credit from their suppliers. The Taiwan corporate credit rating index (TCRI) has a strong negative coefficient for large firms, total samples and small firms is insignificant, this result show that the positive correlation between trade credit and TCRI is stronger for large enterprises. From the viewpoint of risk management by credit suppliers, the effect is positive since the suppliers will be more willing to extend the trade credit to firms with higher credit rating and lower default risk.

Table 3 Regression Result for TC Demander (AP) (Model 2)

Variable	Symbol	Total Samples	Large Enterprises ( $A \geq 50\%$ )	Small Enterprises ( $A < 50\%$ )
Commercial paper rate	CPR	0.089*** (5.384)	0.076*** (3.116)	0.107*** (4.956)
Cash	Cash	0.207*** (17.405)	0.287*** (15.572)	0.143*** (9.397)
Inventory	INV	1.223*** (15.965)	1.745*** (16.029)	0.529*** (4.942)
Total Assets	A	0.032** (2.063)	-0.188*** (-7.058)	0.272*** (9.298)
Retained Earning	RE	0.039 (0.861)	-1.240*** (-7.092)	0.129*** (2.907)
Cost of goods sold	Cost	0.727*** (72.278)	0.805*** (45.653)	0.662** (57.267)
Credit Rating Index	TCRI	-0.010 (-1.265)	-0.065*** (-5.074)	0.008 (0.749)
Observations		9074	4537	4537
Adj- $R^2$		0.720	0.620	0.598

Table 3 summarizes the estimated results of equation (2), which regress the natural logarithm of AP, firm-specific variables (detailed in Section 2), and policy shocks (*CPR*). Regressions using ordinary least squares are performed with the Taiwan public data (9074) for the 1999Q1-2009Q4 period. All regressions control for fixed firm. The adjusted  $R^2$  excludes variance explained by the fixed firm effects. The t-values in parentheses are based on Whites correction for heteroskedasticity. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

## 4. Conclusion

Trade credit is an important source of financing, because it represents a major portion of the short-term financing of firms and plays an important role in the monetary policy. We find that firms have increased both accounts receivable and accounts payable, which means that the interfirm liquidity market becomes more active under the tighter policy. Accounts receivable and accounts payable are also relatively increased with the interest rate; supporting the viewpoint that the trade credit is used as a substitute for bank loans in order to enhance loan efficiency.

There is particularly noteworthy in this paper. First, a strong effect between trade credit and the cash flow suggests that firms have high operating cash flow would be helpful on trade credit at the onset of recessions. Second, this study adopts the variable of credit rating (the Taiwan corporate credit rating index, TCRI), for the first time to be analyzed in the literatures, and our results show that TCRI has a strong positive effect on the account receivable for all groups of firms, as well as on

the account payable for large firms. In other words, those firms have an excellent reputation for extending the trade credit.

## 5. References

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