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Credit risk, trade credit and finance: evidence from Taiwanese manufacturing firms

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Abstract

Trade credit does not use collateral and the hard-to-enforce contracts depend on trust and reputation. Taiwan is a small open economy and suffers more information asymmetry problems than a country with more domestic trade. Exploring this situation, this paper collects data for Taiwanese traded manufacturing firms and links this to the credit-risk index, called the TCRI, to test whether a firm's trade credit will decrease following an increase in its credit-risk index after controlling other factors. The main findings are as follows. First, TCRI adversely affects trade credit, measured as accounts payable relative to short-term debt, and the effect is larger for the small firms. Second, short-term bank loans relative to short-term debt increase with credit risk. Taiwanese banks offer more short-term credit to traded firms who experience a deterioration in their TCRI rating, a higher issuing cost of commercial paper and less access to trade credit.

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1. Introduction

Working capital, as well as physical capital, is important to manufacturing firms. Among the sources of working capital, trade credit and short-term borrowing from banks are notable. Trade credit (accounts payable) is the credit given when a firm purchases material from its suppliers with credit. In this way, firms can increase their inputs without decreasing their cash holdings. Another source of funds for working capital is short-term borrowing from banks. Especially for exporting firms, banks provide credit which allows firms not to pay until the goods exported are sold and the money is received. This too is a kind of trade finance.[1] The World Trade Organization on 12 November 2008 warned that the trade financing situation was deteriorating and world trade decreasing. It also pointed out that if the trade financing problem was not solved, the world economy faced the risk of entering a downward spiral. A shortage of liquidity and re-assessment of risks are the main reasons for trade financing problems especially in emerging market economies.

Taiwan is a small open economy whose degree of trade dependence is over 100%. Lacking natural resources and a large domestic market, Taiwanese manufacturing firms import materials and intermediate goods to process and then export. Trade credit does not use collateral and the hard-to-enforce contracts depend on trust and reputation. Since international trade suffers more information asymmetry problems than domestic trade, suppliers may be less willing to offer trade credit to their international customers than their domestic customers.

To explore this situation, our empirical strategy is to collect data for Taiwanese traded manufacturing firms and link this to the credit-risk index, called the TCRI, to test whether a firm's trade credit will decrease following an increase in its credit-risk index after controlling other factors. Since 1998, the Taiwan Economic Journal (TEJ) has published the TCRI which predicts each Taiwanese traded company's near-future financial problems. This paper uses annual data for traded manufacturing firms during 1998-2005 and fixed effects to control firm's time-invariant characteristics. We divide the period into two sub-periods: a first period of economic difficulty, 1998-2001, and a second period of recovery, 2002-2005. The 1997 Asian financial crisis was followed by a domestic financial crisis in 1998, a destructive earthquake in 1999 and the economy's worst recession in 2001, a year in which the economy shrank 2.7%. The next four years were a period of recovery. The economy grew 4.6% in 2002, 3.5% in 2003, 6.2% in 2004 and 4.1% in 2005. We also use average annual operating revenue to classify firms into three classes: small, medium and large. We hypothesize that small firms' TCRI will adversely affect trade credit more than large

[1] One type of trade finance is export-credit-insurance which protects firms' accounts receivable from the risk of buyers' failing to pay or running short of cash.

firms especially during economic hard time. Finally, we also check how the TCRI affects short-term borrowing from banks which is another fund of working capital. The main findings are as follows. First, TCRI adversely affects trade credit, measured as accounts payable relative to short-term liabilities, and the effect is larger for the small firms. Second, short-term bank loans relative to short-term liabilities increase with the credit risk, as shown by the TCRI. Taiwanese banks offer more short-term credit to traded firms who are facing deterioration in their TCRI rating, a higher issuing cost of commercial paper and less access to trade credit.

In the following section, we review the trade credit and finance literature. Then, in section 3, we introduce the data and empirical method. Section 4 shows the main results and concludes.

2. **Literature Review**

Trade credit has many functions. According to Emery (1984), since changes in prices and production are costly to suppliers, trade credit can lessen the cost of responding to fluctuations in demand since it is easy to adjust. Ng. et al. (1999) argues that transactions between firms cannot occur immediately and trade credit plays a role in guaranteeing quality. Moreover, they explain that suppliers provide their customers different trade credit policies according to product and industry characteristics and the customer's credit situation. They note that there are two kinds of trade credit policy which can be used. One is called a one-part contract which asks the customer to pay within 30 days after the date of purchase. The other is called a two-part contract in which the customer can pay within 10 days to earn a discount or pay within 30 days without earning a discount. Questionnaires were used to investigate the factors affecting trade credit policy. If a customer cannot obtain enough money to pay on time, a suppler can earn extra interest through offering trade credit with interest exceeding the opportunity cost of the supplier's liquidity reserves. Hence, trade credit also has a financial function. Some studies suggest that suppliers may face lower information costs than banks when they lend. Especially in financially depressed times, banks manifest a flight to quality, lending more to large firms and less to small firms. Therefore, some firms not receiving short-term finance from financial institutions may borrow from their suppliers. Petersen and Rajan (1997) used data for 3404 small firms in the U.S. to demonstrate that these firms do use more trade credit when credit from financial institutions is unavailable. Nilsen (2002) used US firms' semi-disaggregate time series data to show that small firms and large firms without a credit rating will increase their use of trade credit for finance after a federal funds rate increase. Mateut et. al. (2006) derived a theoretic model showing that trade credit can help a firm without access to

bank finance to invest. His empirical results using UK firms' panel data supported this conclusion. Ge and Qiu (2007) used annual data on 332 state-owned and 238 non-state own Chinese firms from 1994-1999 to show that trade credit substitutes for bank loans to finance non-state-owned firms in China. Love et al. (2007) found Mexican firms' trade credit increasing and then decreasing in the 1994 Mexican financial crisis period and this also happened to Asian firms in emerging markets during the 1997 Asian financial crisis period. These studies focus on whether trade credit acts as a financial instrument to substitute for bank loans in times such as financial depression or tight monetary environments and they provide evidence of a financial role for trade credit.[2]

Most empirical studies emphasize the trade credit channel for small less-well-known firms during financial hard times. However, to understand the customary use of trade credit, one needs both to take a longer view and to take legal institutions into account. Anderson and Marconiller (2002) observe that exporters may not understand how to deal with foreign legal systems when their counter-party defaults so this acts as a kind of trade barrier similar to a tariff. Therefore, trading across borders may make suppliers less willing to offer trade credit than when trading domestically. Thus a firm's reputation and credit rating are especially important to suppliers offering trade credit across boarders. When a firm's credit rating declines and it receives less trade credit, bank finance becomes more important for the importation of intermediate goods and materials.[3] Will banks also lend less to a firm with a bad credit rating? This question will be addressed in the next section. Because working capital is important for production and sales, exploring how the credit rating of manufacturing firms affects their trade credit and short-term bank loans is fundamental to understanding the relationship between export and finance.

3. **Data and econometric method**

According to the TEJ, after deleting the firms lacking important data during 1998-2005, there were 307 manufacturing firms traded on the Taiwan stock exchange. Due to the large variation in firm size, we have categorized these 307 firms into small (30th percentile and below), medium and large (the 70th percentile and above) using their annual average operating revenue over the eight-year period.[4] After the economy hit bottom in 2001, there was a recovers so we also separate the first four years of this period from the latter four years. The data used includes the firms'

[2] Fisman and Love (2003) found that industries with higher dependence on trade credit financing grow faster in countries with weaker financial institutions.
[3] Kletzer and Bardhan (1989) argued that the sales of firms experiencing financial problem are adversely affected in the financial crisis period.
[4] Gertler and Gilchrist (1994) classified firms by their assets. We have also tried classifying the firms by average annual assets and the main results are the same.

accounts payable, accounts receivable, short-term bank loans, short-term assets, short-term debt, capital-asset ratios, firm ages, operating revenues and credit risk ratings.[5] The interbank call rate is used to indicate the overall financial situation. Table 1 shows descriptive statistics. TCSBL is denoted as the ratio of trade credit relative to the sum of trade credit and short-term bank loans. This is higher for large firms than small firms. To examine separately the importance of trade credit and short-run bank loans as forms of short-term debt, accounts payable divided by short-term debt (TCSD) and short-term bank loans divided by short-term debt (SBLSD) are also shown. The TCSD is higher for the larger firms and SBLSD is higher for small firms. The short-term finance of small firms seems to be more dependent on short-term bank loans. SASD represents the ratio of short-term assets relative to short-term debt. The ratio of net worth divided by assets is denoted by CA. On average, these two ratios are higher for small firms reflecting the higher finance cost, both short-term and long-term, for small firms relative to large firms. NTCSD is defined as the ratio of net trade credit (accounts payable less accounts receivable) relative to short-term debt. This is negative for all firms and it shows that manufacturing firms overall are net lenders with respect to credit for transaction purposes. In other words, they offer trade credit to their downstream firms more than they receive trade credit from their upstream firms. TCRI is the credit risk index and log OR is defined as the logarithm of operating revenue. The small firms are riskier and thus have a higher credit risk index number, but age does not differ according to size. The inter-bank call loan rate (INT) was lower in the second period than in the first period. For small firms, SBLSD increased in the second period but for the larger firms, SBLSD decreased. It is worth noting that in the second period, the period of recovery, sales decreased for small firms and increased for larger firms.

Table 2 shows TCSD, SBLSD and NTCSD classified by industries. TCSD is larger for the electronics and automotive industries. The food, fiber & textile, electrical appliance & cable and glass & ceramic industries have higher SBLSD. NTCSD is negative for all industries except the automotive industry. Ratios of trade credit and short-term bank loans differ across industries, so in next section we will use the fixed effect regression method to capture the time-invariant characteristics of firms.

Petersen and Rajan (1997) suggests that liquidity and firm sales will affect how much trade credit is offered. A supplier may feel safer giving trade credit when liquidity is increasing; and an increase in sales shows more buying of inputs so, other things being the same, more trade credit would have been offered to the firm to buy

[5] The credit risk index ranges from 1 to 9 and the higher the number, the worse is the financial problem. If the index number is replaced by a "D" in the original report, this means there is a significant possibility of default in the near future. In this regression, "D" is replaced by the number 10.

inputs. Apart from these factors, TCRI provides information derived from a firm's financial ratios and experts' predictions about this firm's future performance. Suppliers may use this information to change their trade credit policy as their buyer's credit risk rating changes. Similarly, the factors affecting trade credit decisions of a supplier may also affect banks' credit policy since they too are supplying credit. In addition, we also check if the regression coefficients will be different across the two periods. Therefore, we create a dummy variable D whose value is equal to 1 during the second period and use it along with its cross-terms. The larger firms may have smaller regression coefficients than small firms since larger firms usually own much physical equipment making them less sensitive to factors affecting working capital. After controlling for the aggregate environment, the inter-bank call loan rate (INT), and firm specific effects, we regress TCSD and SBLSD on explanative variables and the results are shown in tables three and four.

4. Estimation Results and conclusions

In all cases, the Hausman test rejects the random effects model. The impact effect of each independent variable in the second period is shown by the sum of the coefficient of the independent variable and the coefficient of its cross dummy term. The results are as follows. First of all, TCSD does not have a significant relationship with INT, but for small firms, SBLSD decreases with an increasing INT in the first period. This indicates that short-term bank loans given to small firms will be negatively affected by the aggregate financial condition. Secondly, an increase in SASD of firms will increase their TCSD in the first period and decrease their SBLSD. A firm which improves its liquidity can buy inputs using more credit in the recession period and needs less short-term borrowing from banks. A firm's TCSD is decreasing with a rise in its credit risk and a firm's SBLSD is increasing with a rise in its credit risk. When operating revenue increases, a firm's TCSD increases and a firm's SBLSD decreases. This seems to be consistent with the results in Robert et al.(2004), which used firm-level data from TEJ and found that firms were more closely related to domestic banks in financially difficult times and firms' performance worsened as the number of its domestic-bank relationships increased.

In sum, credit market friction plays an important role in the transmission of nominal shocks to the real economy. Recent studies have used panel data to understand the trade finance effect on international trade. Trade credit and trade finance (one form of which is short-term bank loans) are funds for working capital which is important for production and sales. Hence, this paper explores the determinants of trade credit for Taiwanese traded manufacturing firms which often import inputs and export outputs. Since information asymmetry is more serious for

international trade than domestic trade, we highlight the credit rating change effect on trade credit and short-term bank loans. Primary result shows that trade credit is decreasing with a firm's credit risk while short-term bank loans are increasing with this risk. This result is most obvious for small firms. Small manufacturing firms are more sensitive to their credit risk rating and short-term bank loans are increasingly important sources of working capital when a firm's credit rating worsens.

References

Anderson, J.E. and D. Marconiller (2002) "Insecurity and the pattern of trade" *Review of Economics and Statistics* 84, 345-352.

Emery, G.W. (2001) "A pure financial explanation for trade credit" *Journal of Financial and Quantitative Analysis* 19, 271-285.

Fisman, R. and I. Love (2003) "Trade credit, financial development and industry growth" *Journal of Finance* 58, 353-373

Fok, R. C. W., Chang, Y. C. and W. T. Lee (2004) "Bank relationship and their effects on firm performance around the Asian financial crisis: evidence from Taiwan" *Financial Management* 33, 89-102

Ge, Y. and J. Qiu (2007) "Financial development, bank discrimination and trade credit" *Journal of Banking and Finance* 31, 513-530

Gertler, M. and S. Gilchrist (1994) "Monetary policy, business cycles, and the behavior of small manufacturing firms" *Quarterly Journal of Economics* 109, 309-340

Kletzer, K. and P. Bardhan (1989) "Credit markets and patterns of international trade" *Journal of Economic Development* 27, 57-70

Love, I., Preve, L. and V. Sarria-Allende (2007) "Trade credit and bank credit: evidence from recent financial crisis" *Journal of Finance* 83, 453-69

Mateut, S., Bougheas, S. and P. Mizen (2006) "Trade credit, bank lending and monetary policy transmission" *European Economic Review* 50, 603-629

Ng, C. K., Smith, J. K. and R. L. Smith (1999) "Evidence on the determinants of credit terms used in interfirm trade" *Journal of Finance* 54, 1109-1129

Nilsen, J. H. 2002, Trade credit and the bank lending channel, *Journal of Money, Credit and Banking*, 34, 226-253.

Petersen, M. and R. Rajan (1997) "Trade credit: theories and evidence" *Review of Financial Studies* 10, 661-691

Table 1 Descriptive Statistics

Firm size	Small		Medium		Large	
Period	1998-2001	2002-2005	1998-2001	2002-2005	1998-2001	2002-2005
TC	0.282	0.287	0.286	0.331	0.357	0.400
	(0.205)	(0.232)	(0.195)	(0.208)	(0.233)	(0.222)
NTC	-0.407	-0.339	-0.349	-0.319	-0.210	-0.174
	(0.454)	(0.502)	(0.364)	(0.396)	(0.252)	(0.302)
SBL	0.323	0.356	0.304	0.290	0.235	0.205
	(0.248)	(0.272)	(0.237)	(0.241)	(0.242)	(0.194)
SASD	2.214	2.714	1.834	1.920	1.774	1.805
	(1.793)	(5.953)	(1.333)	(1.492)	(1.118)	(1.297)
INT	4.938	1.379	4.938	1.379	4.938	1.379
	(1.031)	(0.397)	(1.031)	(0.397)	(1.031)	(0.397)
AGE	26.120	30.120	25.541	29.541	26.424	30.424
	(10.32)	(10.32)	(10.40)	(10.40)	(12.31)	(12.31)
CA	65.97	63.27	59.34	58.22	58.75	58.11
	(15.06)	(17.42)	(14.17)	(15.42)	(13.19)	(13.14)
TCRI	6.321	6.505	5.667	5.705	4.109	4.285
	(1.499)	(1.509)	(1.602)	(1.584)	(2.050)	(1.884)
Log (OR)	14.006	13.930	15.034	15.293	16.548	16.984
	(0.495)	(0.841)	(0.432)	(0.435)	(0.846)	(0.957)
No. of Obs.	92 * 4	92 * 4	123 * 4	123 * 4	92 * 4	92 * 4

Note: TCSD stands for the ratio of trade credit (accounts payable) to the short-term debt. NTCSD stands for the ratio of net trade credit (accounts payable minus accounts receivable) to short-term debt. SBLSD stands for the ratio of short-term bank loans to the short-term debt. SASD stands for the ratio of short-term assets to the short-term debt. INT stands for the interbank call loan rate, AGE stands for the years the firms have existed, CA stands for the capital-asset ratio. TCRI stands for the credit risk index and Log (OR) stands for the logarithm of operating revenue. The standard deviations are in parentheses.

Table 2 Descriptive Statistics by Industry

Industry	No. of Firms	TCSD		SBSD		NTCSD	
		1998-2001	2002-2005	1998-2001	2002-2005	1998-2001	2002-2005
Electronics	108	0.427	0.463	0.217	0.188	-0.318	-0.255
		(0.228)	(0.223)	(0.195)	(0.198)	(0.340)	(0.385)
Cement	8	0.158	0.161	0.167	0.257	-0.390	-0.244
		(0.094)	(0.091)	(0.194)	(0.205)	(0.311)	(0.215)
Food	19	0.221	0.252	0.427	0.344	-0.495	-0.505
		(0.143)	(0.157)	(0.350)	(0.245)	(0.329)	(0.350)
Plastic	17	0.323	0.373	0.205	0.180	-0.277	-0.248
		(0.188)	(0.177)	(0.188)	(0.159)	(0.521)	(0.306)
Fiber &	46	0.203	0.245	0.349	0.391	-0.167	-0.159
Textile		(0.158)	(0.206)	(0.247)	(0.278)	(0.210)	(0.292)
Electrical	23	0.348	0.353	0.277	0.293	-0.378	-0.238
Machine		(0.189)	(0.185)	(0.218)	(0.221)	(0.350)	(0.210)
Electrical	13	0.252	0.260	0.371	0.402	-0.453	-0.349
Appliance		(0.177)	(0.177)	(0.223)	(0.271)	(0.320)	(0.275)
Chemical	24	0.283	0.339	0.271	0.268	-0.482	-0.551
		(0.172)	(0.196)	(0.212)	(0.243)	(0.549)	(0.624)
Glass &	6	0.138	0.172	0.384	0.398	-0.271	-0.195
Ceramic		(0.119)	(0.123)	(0.295)	(0.228)	(0.186)	(0.221)
Paper	7	0.300	0.298	0.223	0.227	-0.358	-0.546
		(0.185)	(0.198)	(0.191)	(0.193)	(0.533)	(1.140)
Steel	23	0.123	0.134	0.488	0.510	-0.302	-0.258
		(0.106)	(0.100)	(0.264)	(0.203)	(0.379)	(0.293)
Rubber	9	0.210	0.271	0.322	0.284	-0.357	-0.300
		(0.133)	(0.113)	(0.236)	(0.113)	(0.342)	(0.252)
Automotive	4	0.473	0.503	0.146	0.175	0.017	0.229
		(0.105)	(0.174)	(0.161)	(0.209)	(0.283)	(0.204)

Table 3 Regression results for TCSD

Independent variables	All	Small	Medium	Large
AGE	0.005	0.004	0.006	0.004
	(1.53)	(0.68)	(1.12)	(0.65)
INT	0.006	0.009	-0.001	0.014*
	(1.44)	(1.05)	(-0.19)	(1.68)
INT*D	-0.007	-0.005	-0.002	-0.014
	(-0.82)	(-0.29)	(-0.18)	(-0.86)
SASD	0.027***	0.017***	0.037***	0.057***
	(9.53)	(3.82)	(7.63)	(7.87)
SASD*D	-0.021***	-0.012***	-0.016***	-0.016**
	(-7.29)	(-2.85)	(-2.71)	(-2.13)
TCRI	-0.023***	-0.029***	-0.019***	-0.018***
	(-6.67)	(-4.11)	(-3.61)	(-3.14)
TCRI*D	0.000	0.004	0.007	-0.006
	(0.02)	(0.53)	(1.23)	(-0.96)
Log (OR)	0.036***	0.032**	0.030**	0.062***
	(5.02)	(1.96)	(2.07)	(4.24)
(Log (OR))* D	0.001	-0.005	0.020	-0.020*
	(0.32)	(-0.28)	(1.10)	(-1.73)
D	0.057	0.099	-0.299	0.467**
	(0.64)	(0.39)	(-1.04)	(2.08)
R-squared	0.793	0787	0.778	0.813
F statistic	18.62	18.15	17.57	21.60
No. of Obs.	307 * 8	92 * 8	123 * 8	92 * 8

Note: D=1 is the period 2002-2005. The number in parentheses is the t-statistic. * indicates significance at the 10% level. ** indicates significance at the 5% level. *** indicates significance at the 1% level.

Table 4 Regression results for SBLSD

independent variables	All	Small	Medium	Large
AGE	0.002	0.004	-0.001	0.004
	(0.39)	(0.52)	(-0.14)	(0.50)
INT	-0.021***	-0.036***	0.015*	0.010
	(-3.73)	(-3.45)	(-1.75)	(-1.05)
INT*D	0.024**	0.047**	0.019	0.004
	(2.18)	(2.18)	(1.12)	(0.19)
SASD	-0.025***	-0.020***	-0.033***	-0.033***
	(-6.81)	(-3.58)	(-5.38)	(-3.78)
SASD*D	0.017***	0.014**	-0.003	-0.017*
	(4.55)	(2.52)	(-0.37)	(1.83)
TCRI	0.024***	0.025***	0.025***	0.020***
	(5.48)	(2.74)	(3.69)	(2.78)
TCRI*D	0.003	0.000	-0.005	0.001
	(0.65)	(0.05)	(-0.66)	(0.10)
Log (OR)	-0.023***	-0.045**	-0.025	-0.040
	(-2.58)	(-2.18)	(-1.38)	(-2.23)
(Log (OR))* D	-0.009	0.035	-0.002	-0.009
	(-1.52)	(1.67)	(-0.11)	(-0.59)
D	-0.024	-0.709**	-0.014	0.038
	(-0,21)	(-2.19)	(-0.04)	(0.14)
R-squared	0.739	0.754	0.743	0.695
F statistic	10.70	13.07	9.68	8.62
No. of Obs.	307 * 8	92 * 8	123 * 8	92 * 8

Note: D=1 is the period 2002-2005. The number in parentheses is the t-statistic. * indicates significance at the 10% level. ** indicates significance at the 5% level. *** indicates significance at the 1% level.