International Review of Accounting, Banking and Finance
Vol 6, No. 3 / 4, Fall / Winter 2014 Pages 33~70

I R A B F

Determinants of Trade Credit Demand and Supply: Evidence from Firm-level Panel Data in Taiwan and China

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ABSTRACT

This study constructs a trade credit supply and demand model to analyze determinants of trade credit. Using a panel analysis for listed firms in Taiwan and China, we examine different hypotheses on the use of trade credit, including transaction costs, discriminatory pricing, adverse selection, and moral hazard. In accounts receivable (supply side of trade credit), firms in Taiwan shows a substitution effect between trade credit and bank credit, while firms in China demonstrates the complementary effect. In accounts payable (demand side of trade credit), firms in both Taiwan and China indicate the substitution effects. Adverse selection and moral hazards in relation to accounts receivables and payables can be compared to the trade-off relationship between the marginal profits and costs. Lastly, we find the correlation between the book value of total assets proxy for price discrimination and net trade credit (NTC) was significantly negative, a result attributable to the rapid firm growth and limited trade credit in small businesses.

Keywords: Trade credit, Net trade credit, Accounts receivable, Accounts payable

JEL: G1, G2, G3

1. Introduction

Commercial transactions are generally conducted on cash payment or trade credit conditions. As trade credit facilities the purchase of products or supplies without immediate payment, it has gradually become the mainstream model of trade. Today, trade credit is not only a means of extending credit in business dealings but also a major source of capital for most firms; thus, trade credit is widely used in many countries around the world. Based on the non-financial industries in G7 nations, Rajan and Zingales (1995) found that accounts receivable, which comprises a majority of firm assets, varied between 13% (Canada) and 29% (Italy); while accounts payable, an important source of external funding, ranged from 11.5% (Germany) to 17% (France). Bartholdy and Mateus (2008) observed that the ratio of trade credit to total assets was between 16% and 24% in 16 European countries in 2000[1]. Beck, Demirgüç-Kunt and Maksimovic (2008) conducted a survey in 48 nations and found that an average 19.7% of funding was generated from external investment.[2] Recently, based on a total sample of 21 countries,[3] Cuñat and Garcia-Appendini (2012) concluded that eight countries had more than 20% of external funding through trade credit.

Taiwan has experienced rapid economic development since the early 1960s and much of Taiwan's economic and trade activity has been rerouted from Hong Kong to mainland China. Figure 1 shows the trends of economic trade based on statistics during 1991-2013. Over the past 11 years (2002-2012), according to the *Taiwan Economic Journal* (TEJ), the average ratio of trade credit to total assets was 23.46% in Taiwan and 18.17% in China. This highlights the significant role played by trade credit in cross-strait business, and its needs for a more in-depth analysis for the determinants of trade credit demand and supply.

Many previous studies employ a macroeconomic approach to analyse the determinants of trade credit. For example, the increase of trade credit can be regarded as a result of

1. Including Australia, Belgium, Denmark, Finland, France, Greece, Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.
2. Including Argentina, Armenia, Belarus, Belize, Bolivia, Brazil, Bulgaria, Canada, Chile, China, Colombia, Costa Rica, Croatia, Czech Republic, Dominican Republic, El Salvador, Estonia, France, Germany, Guatemala, Haiti, Honduras, Hungary, Indonesia, Italy, Lithuania, Malaysia, Mexico, Moldova, Nicaragua, Pakistan, Panama, Peru, Philippines, Poland, Romania, Singapore, Slovakia, Slovenia, Spain, Sweden, Trinidad and Tobago, Turkey, Ukraine, United Kingdom, United States, Uruguay, and Venezuela.
3. Including Germany, Pakistan, Canada, Italy, China, Spain, Czech Republic, Chile, Poland, United States, Singapore, Hungary, Argentina, Sweden, Venezuela, Colombia, Brazil, Bulgaria, England, France, and Mexico.

economic recession or tightening monetary policy (e.g., Meltzer, 1960; Blinder and Stiglitz, 1983; Ramey, 1992; Kashyap et al., 1993; Gertler and Gilchrist, 1994; Norrbin and Reffett, 1995; Oliner and Rudebusch, 1996; Nilsen, 2002; Atanasova and Wilson, 2003; Choi and Kim, 2005; Mateut, 2005; Mateut et al., 2006; Guariglia and Mateut, 2006). In this paper, the supply-demand trade credit model (see Fig. 2) proposed by Petersen and Rajan (1997) is used to determine the factors and their influence on trade credit. Meanwhile, the panel data from listed companies in Taiwan and China is employed to examine the transaction and financing motives for trade credit use by these firms.

The purpose of this paper is to develop a supply and demand side of trade credit model incorporating transaction and financing motives and to examine:

(1) Do trade credit influence the transaction costs and discriminatory pricing affect trade credit use?
(2) Do adverse selection and moral hazard affect trade credit use?
(3) Is there a substitution or complementary effect between trade credit and credit from the financial institutions?
(4) What are the determinants for net trade credit in Taiwanese and Chinese firms[4]?

The remainder of this paper is organized as follows. Section 2 describes the transaction and financing motives for firms to use trade credit; Section 3 derives the determinants of the empirical model and proposes our hypotheses; Section 4 presents our empirical results, and section 5 concludes the paper.

2. Motivation of Trade Credit Use

Why do firms use trade credit? Put simply, suppliers provide trade credit to their customers and those delayed payments for the transfer of goods and services in turn provide customers an alternative source of financing. The suppliers and customers all maintain the trade credit relationship due to transactional and financing motives. We first examine whether suppliers will provide more trade credit to their customers based on a firm's trading record, i.e., whether firms offer short-term loans depend on purchasing volume and

4. If the value is positive then it is called net provider, while the negative value is called net demander.

payment record of their customers? The aforementioned relationships among suppliers, businesses and customers are based on the transactional motive. Next, we investigate the issue of whether suppliers (businesses) are willing to provide trade credit to firms (customers) whose credit has been limited by financial institutions due to financial risk. Here the relationships among suppliers, firms, and customers are driven by the financing motive.

2.1 Transaction Motive

Transaction motive works hand in glove with trade credit in business dealings. By purchasing products with delayed payment terms, firms can usually reduce the influence of transaction costs such as uncertainty about delivery or price. This is particularly true if firms frequently purchase a product, as they can then forecast cash flow more accurately and reduce precautionary cash balance, thereby reducing transaction costs. According to Schwartz (1974), Elliehausen and Wolken (1993) and Khan et al. (2012), when product delivery time is uncertain and a firm has surplus cash on hand for payment, using trade credit can eliminate this uncertainty and simplify cash management. Ferris (1981) found that through trade credit, customers are able to negotiate uncertain payment deadlines with suppliers and save on transaction costs. Firms are thereby able to reduce precautionary cash payments and hold onto other interest-bearing assets. Pike and Cheng (1996) concluded that with an optimal precautionary cash balance, firms can reduce the unpredictability of cash flow and the cost of late payments. Kohler et al. (2000) stated that trade credit can reduce the costs of paying and administering invoices between buyers and sellers in undertaking regular exchanges of goods or services. Firms may simply want to cumulate obligations and pay them monthly or quarterly. Summers and Wilson (2002) believed that those firms purchasing in greater volume will have more trading power and use trade credit to reduce their transaction costs. Danielson and Scott (2000) described trade credit can be a useful instrument of cash management as it allows firms to reduce transaction costs by paying suppliers for goods once they have re-sold the products for cash. Nilsen (2002) proved that when there is significant uncertainty about payment figures, trade credit can relieve transaction costs between supplier-buyer and facilitate effective accounts management. Delannay and Weill (2004) stated that there exists information asymmetry between buyer-

seller, trade credit can help reduce transaction costs and contributes to effective cash management. Paul and Wilson (2007) agreed that using trade credit for accounts payable can reduce transaction costs and optimize cash flow management.

Price discrimination in respect of customers and purchase volume is another motivation to extend trade credit. Mian and Smith (1992) indicated that suppliers use discriminatory pricing through trade credit, while Ng et al. (1999) demonstrated that suppliers extend trade credit deadlines or provide discounts to those buyers with whom they have long-term relationships. Danielson and Scott (2000) argued that those sellers operating under price discrimination are more willing to offer trade credit to creditworthy customers. Fisman and Love (2003) stated that when demand from cash-paying customers is more flexible than that of customers on credit, price discrimination may be used to stabilize supplier-buyer relationships. Paul and Wilson (2006) found that suppliers may allow specific customers to delay payments beyond the terms of the loan agreement due to discriminatory pricing. Schwartz and Whitcomb (1978) stated that suppliers can promote discriminatory pricing by opting not to apply penalties for late payments or provide undeserved discounts. Brennan et al. (1988) and Petersen and Rajan (1997) explained that firms with a greater profit margin (sales minus variable costs) are more inclined to extend trade credit to keep sales up. Price discrimination may create a “subsidy effect” for risky customers, a situation where creditworthy customers find trade credit overpriced and pay immediately, while customers of weaker commercial standing continue to sell on credit. Mateut (2005) also stated that firms with a high margin between sales and variable costs have a strong incentive to make additional sales without cutting the price to existing customers. Niskanen and Niskanen (2006) found that firms with larger operating margins will have a larger incentive to generate additional cash flows by financing the sales of additional units to their poorer customers by extending trade credit. Because wealthy customers pay early and get the discount, monopolists can use trade credit as a tool for price discrimination.

2.2 Financing Motive

According to financial motives, firms benefiting from an easy access to credit markets are able to use this borrowing capacity and act as financial intermediaries in favor of firms that suffer from a limited access to credit (Schwartz, 1974; Emery, 1984; Berlin, 2003). Market imperfections may cause financial institutions (the main source of business loans) to restrict a client's borrowing, but suppliers, despite being exposed to financial risk, may be willing to provide financing to the risky customer because they have greater future long-term sale profits beyond financial transactions (Atanasova, 2007). Lewellen et al. (1980) indicated that in an imperfect credit market, financing motive leads financial institutions to ration credit to their customers, while Stiglitz and Weiss (1981) blamed asymmetric information for credit rationing. Smith (1987) indicated that asymmetric information will lead to adverse selection and moral hazards. Adverse selection happens when there is information asymmetry between the buyer and seller prior to purchase; that is to say, the buyer is unaware of the quality and attributes of the product prior to purchase (Bastos and Pindado, 2008). In an earlier paper by Myers and Majluf (1984), external financing is costly because of potential adverse selection in the market for capital. If the buyer faces greater adverse selection risk, it is more efficient for the seller to obtain external financing and advance trade credit. By contrast, if the buyer faces smaller adverse selection risk, it is more efficient for the buyer to obtain external financing. Frank and Maksimovic (2005) explained that, in case of adverse selection, firms are able to extend customer trade credit while also receiving trade credit offered by the supplier. In the study of Elliehausen and Wolken (1993), adverse selection means that more creditworthy customers will not select for high-interest loans and only those firms with higher risk of default will be offered this type of credit, thus increasing the risk of default and losses.

Moral hazard is a case of asymmetric information between buyer and seller, which can lead to bad debts from customers failing to pay accounts within the agreed upon timeframe (Bastos and Pindado, 2008). Smith (1987) explained that firms that forego the cash discount offered on condition of early payment are revealing their struggle to get cheaper finance due to economic difficulty. Moral hazard develops when low risk customers choose credit terms that include a discount and apply directly to banks for finance, while high risk customers

forego the discount and borrow from suppliers. Foregoing the discount period alerts suppliers that this customer may have a higher risk of default and should be monitored more closely. Marotta (2005) argued that there is a strong relation between cash discounts and debt periods, specifically when creditors' rights protection is more effective. These discounts must be attractive enough to convince even the risky buyer to pay sooner, because if they do, it may reduce the possibility of bad debt losses inasmuch as it restricts the amount of time available to buyers to develop more problems.

Lastly, we discuss the substitution effects or complementary effects between trade credit and financial institutions. Biais and Gollier (1997), Burkart and Ellingsen (2004) found that the use of trade credit and bank credit is complementary because it constitutes a signal to the bank about the quality of the borrower. In contrast, Petersen and Rajan (1997) found that small businesses in U.S. rely on trade credit as a source of funding in place of banks with which they have no long-term relationships. Nilsen (2002) found that, during the period of restrictive monetary policy, the use of trade credit as a substitute for bank credit was significant for both small and large firms that did not have access to the credit market. Fisman and Love (2003) also provided indirect evidence for the substitutability of bank and trade credits. Using the data from nine central and eastern European countries[5], Delannay and Weill (2004) found that firms substitute bank loans with trade credit as a source of short term funding. Blasio (2005) reported there is a substitute effect between trade credit and bank loans in the Italian manufacturing industry.

According to Elliehausen and Wolken (1993), under credit rationing, borrowers will face higher interest rates if they overuse their short term credit facility and create demand for trade credit. This leads to the substitution/complementary effects between trade credit and bank loans. Based on small firms from the Nation Survey of Small Business Finance (NSSBF) database, Alphonse et al. (2006) found that the substitution hypothesis (trade credit as a consequence of credit rationing) and the complementary hypothesis (trade credit as a signal) are not mutually exclusive hypotheses but can be observed simultaneously. In addition, Lin and Chou (2014) found that, during the 2008-2009 global financial crises,

5. Including Bulgaria, Czech Rep., Estonia, Hungary, Lithuania, Latvia, Poland, Romania and Slovakia.

Chinese firms presented a significantly positive relationship between the supply of trade credit (i.e., accounts receivable) and bank loans as well as a significantly negative relationship between the demand of trade credit (i.e., accounts payable) and bank loans. These evidences indicate a complementary/substitution effect between trade credit and bank loans.

3. Empirical models and hypotheses established

3.1 Supply of trade credit (accounts receivable)

In order to investigate the determinants that firms use supply side of trade credit driven by transaction motive, the following variables are considered in our econometric model.

The first variable is *LnCash* (cash and cash equivalents), proxy for transaction cost. When products are purchased in bulk, trade credit can help reduce transaction and cash management costs (Ferris, 1981; Summers and Wilson, 2002; Chou et al., 2011; Al Dohaiman, 2013). Thus, the expected relationship between *LnCash* and accounts receivable is positive.

The second proxy variable is *INTA* (ratio of amount of inventory to total assets). For inventory management purposes, firms with more inventories are likely to extend more trade credit than other firms. However, both inventories and accounts receivable are current assets and thus are substitutes from the viewpoint of asset management. Thus, when the inventory-asset ratio is too high, it may put negative pressure on accounts receivable to assets (Wilson et al., 2004; Choi and Kim, 2005; Bougheas et al., 2009; Chou et al., 2011). We therefore expect a negative correlation between *INTA* and accounts receivable.

The third variable *Tasset* (book value of total assets), which represents firm reputation, is used to be the proxy variable for price discrimination in relation to customers. Large firms are considered to have better creditworthiness and consequently easier to access to funds in the capital markets than smaller firms. The size of a firm indicates whether it has market power and reflects the security of a loan. Suppliers seem willing to provide more trade credit to larger firms (Petersen and Rajan, 1997; Delannay and Weill, 2004; Niskanen

and Niskanen, 2006; Vaidya, 2011; Chou et al., 2011). We expect *Tasset* to be positively correlated with accounts receivable.

We choose *Growth* (ratio of net profit to sales), measured by the quarterly sales growth, as the proxy variable for price discrimination in respect to trade volume. More trade credit offered by a firm with higher growth rates (Petersen and Rajan, 1997; Delannay and Weill, 2004; Niskanen and Niskanen, 2006; Khan et al., 2012). We expect *Growth* to be positively correlated with accounts receivable.

Another proxy variable is *GPfM* (gross profit margin), in those firms with larger profit margin tend to sell more and extend more trade credits, and exercise a greater degree of price discrimination (Petersen and Rajan, 1997; Soufani and Poutziouris, 2002; Niskanen and Niskanen, 2006; Saito and Bandeira, 2010). We also expect a positive correlation between *GPfM* and accounts receivable.

Next, we investigate the determinants of trade credit supply driven by financing motive, the following variables are included in regression analysis. The proxy variable for adverse selection is *ROA* (return on assets), calculated as earnings before interest and taxes divided by total assets. Because adverse selection will diminish firm's profitability (Bastos and Pindado, 2008), we expected a negative correlation between *ROA* and accounts receivable. Another proxy variable for adverse selection is *FIXTA* (1-fixed assets/total assets) and defined as the reverse fixed assets. Prowse (1990) argued that asymmetric information problem may well be smaller for the firms with greater proportion of fixed assets. We conclude that a reverse fixed assets ratio indicates that firms will supple more trade credit due to adverse selection. We expect this variable to be negatively correlated with accounts receivable.

The proxy variable for moral hazard is *SALTA* (ratio of sales to total assets). Those firms that actively promote sales growth in order to extend trade credit will reduce moral hazard (Petersen and Rajan, 1997; Choi and Kim, 2005; Bastos and Pindado, 2008；Wang and Lin, 2010). We expect a positive correlation between *SALTA* and accounts receivable.

Another proxy variable for moral hazard is $BDPTA$ (ratio of bad debts provision to total assets). An oversupply of credit may lead to bad debt, thus firms will offer cash discounts to entice risky customers into paying their debts. However, moral hazard leads to firms reducing the trade credit offered to their customers (Marotta, 2005; Bastos and Pindado, 2008). Therefore, we expect $BDPTA$ and accounts receivable to be negatively correlated.

The last proxy variable used in our model is *STLOANTA* (ratio of short-term loans to total assets), representing the substitution or complementary effect between trade credit and credit offered by financial institution. A positive correlation between *STLOANTA* and accounts receivable indicates a substitution effect, while a negative correlation indicates a complementary effect (Elliehausen and Wolken, 1993; Alphonse et al., 2006).

We first model the trade credit supply as a function of above variables and present the following hypotheses:

$$AR = f(Cash, INTA, Tasset, Growth, GPfM, ROA, FIXTA, SALTA, BDPTA, STLOANTA)$$
$$\qquad +\quad -\quad +\quad +\quad +\quad -\quad -\quad +\quad -\quad +/-$$

Hypothesis 1: Trade credit can reduce transaction costs, and firms with strong commercial reputations and sales growth can extend their trade credit.

Hypothesis 2: There is a negative relationship between trade credit supply and adverse selection, but a positive relationship between trade credit supply and moral hazard.

Hypothesis 3: There is a substitution or complementary effect between trade credit supply and credit offered by financial institution.

3.2 Demand of trade credit (accounts payable)

We next model the trade credit demand as a function of the following variables related to the motives that firms and customers use trade credit.

The first proxy variable in explaining transaction motive is $LnCash$ (cash and cash equivalents). Trade credit demand will reduce transaction costs (Danielson and Scott, 2000;

Summers and Wilson, 2002; Nilsen, 2002). Thus, we expected a positive correlation between *Ln Cash* and accounts payable.

The second proxy variable we use in our regression analysis is *INTA* (ratio of amount of inventory to total assets). It is because those firms with a large inventory will use more trade credit, which in turn may reduce firm's transaction costs (Wilson et al., 2004; Choi and Kim, 2005; Atanasova, 2007; Al Dohaiman, 2013). We expected a positive correlation between *INTA* and accounts payable.

The third variable *Tasset* (book value of total assets), which representing firm reputation, is used as the proxy of price discrimination in relation to customers. As a firm has larger size, it will have greater implied creditworthiness and easily obtain more trade credit from their suppliers (Petersen and Rajan, 1997; Niskanen and Niskanen, 2000).We expected *Tasset* to be positively correlated with accounts payable.

We chose *Growth* (ratio of net profit to sales) as the proxy variable of price discrimination in respect of trade volume. Firms with growing sales are eligible for more credit (Petersen and Rajan, 1997; Atanasova and Wilson, 2003; Delannay and Weill, 2004; Soufani and Poutziouris, 2004). We expected *Growth* to be positively correlated with accounts payable.

Another proxy variable in our model is *GPfM* (gross profit margin). Firms with a higher *GPfM* require more trade credit because they can use this low-cost funding source to generate more profit (Soufani and Poutziouris, 2004; Marotta, 2005). We therefore expect a positive correlation between *GPfM* and accounts payable.

Next, we investigate the determinants of trade credit demand driven by financing motive under market imperfections and asymmetric information. The following variables are included in regression analysis.

The proxy variable used for adverse selection is *ROA* (return on assets). According to the pecking order hypothesis, highly profitable firms are less dependent on trade credit and thus decrease adverse selection (Alphonse et al., 2006; Bastos and Pindado, 2008；Connors and Gao, 2011). We expect a negative correlation between ROA and accounts payable. Another proxy variable for adverse selection is *FIXTA* (1-fixed assets/total assets). Bastos and Pindado (2008) concluded that a reverse fixed assets ratio (1-fixed assets/total assets) indicates that firms will use less trade credit due to adverse selection. We expect this variable to be positively correlated with accounts payable.

The proxy variable for moral hazard is *VCOTA* (ratio of cost of goods sold to total assets). When firms require more loans to fund their greater sales, suppliers will bear the increasing sales costs and default risk (Choi and Kim, 2005; Bastos and Pindado, 2008). The correlation between VCOTA and accounts payable is expected to be negative. Another proxy variable for moral hazard is *BDPTA* (ratio of bad debts provision to total assets). When suppliers have extended many lines of credit and are concerned about incurring loss from bad debts, they offer cash discounts for early payments in an attempt to entice risky customers into paying their debts. But these firms are unable to avail themselves of this discount due to financial difficulties and in fact require more credit (Marotta, 2005; Bastos and Pindado, 2008). Therefore, we expected *BDPTA* and accounts receivable to be negatively correlated.

The last proxy variable is *STLOANTA* (ratio of short-term loans to total assets), representing the substitution or complementary effect between trade credit and credit offered by financial institution. A negative correlation between *STLOANTA* and accounts payable indicates a substitution effect, while a positive correlation indicates a complementary effect (Elliehausen and Wolken, 1993; Alphonse et al., 2006).

Based on the above discussion, we model the trade credit demand as a function of above proxy variables and present the following hypotheses:

$$AP = f(Cash, INTA, Tasset, Growth, GPfM, ROA, FIXTA, VCOTA, BDPTA, STLOANTA)$$
$$\quad + \quad + \quad + \quad + \quad + \quad - \quad + \quad + \quad - \quad +/-$$

Hypothesis 4: Trade credit can reduce transaction costs, and firms with strong commercial reputations and sales growth can expand their trade credit demand.

Hypothesis 5: There is a positive relationship between trade credit demand and adverse selection, but a negative relationship between trade credit demand and moral hazard.

Hypothesis 6: There is a substitution or complementary effect between trade credit demand and credit offered by financial institution.

3.3 Net trade credit model and hypotheses

Net trade credit (NTC) is set as the difference between accounts receivable and accounts payable. We develop an NTC model based on the proxy variables of transaction and financing motives described above. The proxy variables for transaction motive, including $Cash$, $INTA$, $Tasset$, $Growth$ and $GPfM$, are all positively correlated with NTC except for $INTA$. In addition, the proxy variables for financing motive are $FIXTA$, $BDPTA$ and $STLOANTA$; $FIXTA$ and $BDPTA$ are negatively correlated with NTC, while $STLOANTA$ reflects the substitution or complementary effect between NTC and bank credit. A positive relationship between *STLOANTA* and NTC indicates the substitution effect, while the reverse indicates a complementary effect

The foregoing leads us to suggest the net trade credit as a function of above proxy variables and present the following hypotheses as follows:

$$NTC = f(Cash, INTA, Tasset, Growth, GPfM, FIXTA, BDPTA, STLOANTA)$$
$$\qquad\quad + \quad - \quad + \quad + \quad + \quad - \quad - \quad +/-$$

Hypothesis 7: Firms can reduce transaction costs through net trade credit, and those firms with strong commercial reputations and sales growth can extend trade credit.

Hypothesis 8: There is a positive relationship between net trade credit and adverse selection, but a negative relationship between net credit demand and moral hazard.

Hypothesis 9: There is a substitution or complementary effect between net trade credit and credit offered by financial institution.

4. Empirical Results

4.1 **Data collection and descriptive statistics**

From the Taiwan Economic Journal (TEJ) database, we use the panel data for relatively large and listed firms from the Taiwan Stock Exchange (TWSE), Shanghai Stock Exchange (SSE) and Shenzhen Stock Exchange (SZSE) over the period 2002:Q1 to 2012:Q4. We exclude the observations in financial and insurance firms and then obtain a pooled sample with 90,508 entries in total. The total samples are divided into two groups by firm size (total assets), i.e., large firm and small firm. Descriptive statistics are shown in Panel A of Table 1. To examine the degree of multicollinearity may be great enough or not, the variance inflation factor (VIF) of ordinary last squares (OLS) regression is used to determine whether severe multicollinearity exists among the independent variables. From the results shown in Panels B and C of Table 1, we observe that all VIFs are less than 10, and therefore, we conclude that severe multicollinearity is avoided in our regression analysis.

In order to control the fixed firm effects, only the time-varying firm-specific variables are included in this paper. In addition, the Durbin-Wu-Hausman test is used to test for endogeneity problem of all regression variables (e.g., Choi and Kim, 2005; Chou et al., 2011) using end-of-quarter data[6]. Empirical evidences are shown in Table 2, Panel A is the data from Taiwanese firms and Panel B from Chinese firms. We observe that there is no significant endogeneity problem for all these variables.

6. Durbin-Wu-Hausman test: Based on OLS regression analysis, first step is to obtain the residual of each variable, and then use these residuals as for explained variable in the original regression equation to test for significance.

4.2 Regression for the Accounts Receivable

In this paper, we use a fixed-effect regression model to test Hypotheses 1-3[7], and Table 3 shows the empirical results when accounts receivable (AR) is used as dependent variable. Based on transaction motive, *LnCash* is shown to be significantly and positively correlated with accounts receivable and large firms have higher estimated values than small firms. The result is consistent with our proposed hypothesis.

Correlation between *Inventory* and accounts receivable is significantly negative. A higher estimate indicates firms with a larger inventory will help firms to extend trade credit and reduce costs, increasing trade but straining accounts receivable. The estimated regression coefficient for small firms in Taiwan is higher than large firms, indicating that small firms endeavor to increase trade volume and reduce firm costs.

Book value of total assets was shown to be significantly and positively correlated with accounts receivable, indicating that large firms are able to extend more trade credit. In Taiwan, the estimated regression coefficient for small firms is higher than large firms, indicating that small firms seek to extend trade credit through increasing sales.

Sales growth is significantly and positively correlated with accounts receivable. This means that firms with higher growth rates are able to extend more trade credit; therefore, the estimated regression coefficient for large firms is higher than small firms.

The correlation between gross profit margin and accounts receivable is significantly positive in small firms in Taiwan. However, it is significantly negative in large firms in Taiwan and all firms in China. This is inconsistent with the findings of Petersen and Rajan (1997), who posited that firms with larger profit margin tend to sell more and extend more trade credits and thus shows a positive relationship. The possible reason is large firms in

7. Fixed effect estimation assumes firm specific intercepts, which capture the effects of those variables that are particular to each firm and that are constant over time. An important feature of the fixed effects model is that it concentrates on differences 'within' firms. The fixed effects model is estimated by (1) computing the means for each variable by firm, (2) subtracting the firm means from each variable and (3) running a regression on the transformed data. Fixed effects estimation explains why the variables differ from their means, but not why the firm means differ from each other (see Deloof,2003).

Taiwan and China have the monopoly powers will enable them to maintain higher prices and dominate the market share. Large firms may not prefer to price discriminate as this strategy may invite criticism from consumer groups and potential government intervention, especially if there is a violation of laws that prohibit price discrimination (see Soufani and Poutziouris, 2002). Small firms in China with lower profit margin tend to extend less trade credits. Smaller firms may prefer to cut their cost as opposed to increasing their profit by discriminating prices among different customers. Smaller firms are less likely to price discriminate because they may be more vulnerable in the market to existing competition therefore, offering a uniform price disseminate signals of efficiency and credibility to existing and potential customers (see Soufani and Poutziouris, 2002).

When the gross profit margin squared is considered, we observe that when the gross profit margin of Chinese small firms is sufficiently high, the nonlinear relationship is positive (estimated coefficient is 0.001). In the case of large firms, however, it still shows a negative relationship (estimated coefficient is -0.039).

Return on assets, which is the proxy variable of adverse selection under financing motive, is significantly and negatively correlated with accounts receivable. The estimated regression coefficient (absolute value) for large firms is higher than those of small firms in both Taiwan and China, indicating that large firms will suffer considerable loss of profit from adverse selection and require more trade to boost profitability. This is consistent with the viewpoints of Petersen and Rajan (1997), who believed that firms extend trade credit when facing with loss of profit.

The reverse ratio of fixed to total assets (i.e., 1-fixed assets/total assets), another proxy variable of adverse selection, is also significantly and negatively correlated with accounts receivable. The estimated regression coefficient (absolute value) for large firms is higher than small firms. This shows that large firms are more capable of extending trade credit, consistent with Prowse (1990) who suggested that the greater the ratio of fixed to total assets the smaller the asymmetric information problem.

Sales revenue is found to be significantly and positively correlated with accounts receivable, demonstrating that firms actively promote sales in order to extend trade credit and reduce moral hazards.

Provision for bad debts is positively correlated with accounts receivable in large firms only. This result is consistent with Choi and Kim (2005), large firms have more ability to accommodate short-term debt and are able to absorb the bad debts caused by moral hazard. On the contrary, moral hazard leads to the small firms to have a reduction in trade credit supply.

Lastly, we use the ratio of short-term loans to total assets to test for substitution or complementary effect between firm-to-firm trade credit and credit from financial institutes. The Taiwanese firms show a positively correlated substitution effect, indicating that banks set high thresholds for business finance, small firms rely on trade credit to drive their sales growth. In contrast, Chinese firms show a complementary effect. It is because Chinese capital market has not yet full matured, Chinese firms only provide trade credit in conjunction with bank credit.

4.3 Regression for the Accounts Payable

We use a fixed-effect regression model to test Hypotheses 4-6, and Table 4 shows the empirical results when accounts payable (AP) is used as dependent variable.

Under transaction motive, *LnCash* is shown to be significantly positively correlated with accounts payable. The estimated regression coefficient for large firms is higher than small firms. This shows that large firms capitalize on their high trade volume to reduce transaction costs.

Inventory is also positively correlated with accounts payable. The estimated regression coefficient for large firms is higher than small firms. Large firms maintain a high inventory to reduce transaction costs and extend trade credit.

The book value of total assets, which is the proxy variable of price discrimination, is significantly and positively correlated with accounts receivable, indicating that larger firms are able to extend more trade credit. The estimated regression coefficient for small firms in Taiwan is higher than large firms, indicating that small firms extend trade credit through increasing sales. The correlation between sales growth and accounts payable is significantly positive. This means that firms with higher growth rates are able to extend more trade credit; therefore, regression coefficient estimate for large firms is higher than small firms.

Gross profit margin is significantly and positively correlated with accounts payable in small firms in Taiwan. However, its correlations with large firms in Taiwan and all Chinese firms are significantly negative. This possible reason is large firms have more monopoly powers will enable them to maintain higher prices or control market prices. When government regulations prohibit price discrimination, firms in general circumstances are unable to utilize lower-cost funding to generate more profit. Small firms in China encounter discriminatory trade credit are unable to effectively increase their sales, leading to a decline in profit (see Soufani and Poutziouris, 2004).

When the gross profit margin squared is considered, we observe that when the gross profit margin of Chinese small firms is sufficiently high, the nonlinear relationship is positive (estimated coefficient is 0.001). In the case of large firms, however, it still shows a negative nonlinear relationship (estimated coefficient is -0.037).

Return on assets is used as the proxy variable of adverse selection under financing motive. We find that it is significantly and negatively correlated with accounts payable. The estimated regression coefficient for large firms is higher than those of small firms, indicating that, in accordance with pecking order hypothesis proposed by Myers and Majluf (1984), highly profitable large firms are less reliant on trade credit.

The reverse ratio of fixed to total assets (i.e.,1-fixed assets/total assets), another proxy variable of adverse selection, shows a significantly positive relationship with accounts payable. Estimated regression coefficient for small firms is higher than large firms,

indicating that small firms are extended less trade credit due to adverse selection. This is consistent with the viewpoint of Bastos and Pindado (2008), who suggested that the larger the ratio of fixed to total assets (1-fixed assets/total assets), the more probable the asymmetric information problem.

Next we observe that *VCOTA* variable is significantly and positively correlated with accounts payable, indicating that firms need more suppliers to provide trade credit so that they can grow their business. However, moral hazard leads to default risk. The correlation between provision for bad debts and accounts payable is significantly negative. Estimated regression coefficient for small firms is higher than those of large firms, implying that small firms encounter moral hazards due to their financial struggles, which will increase the trade credit demand.

Lastly, we use the short-term loans proxy variable to test for substitution or complementary effect between firm-to-firm trade credit and credit from financial institutes. All firms in Taiwan and China show a negatively correlated substitution effects, indicating that banks set high thresholds for business finance, all of the firms must heavily rely on trade credit to drive future growth.

4.4 Regression for the Net Trade Credit

We use a fixed-effect regression model to test Hypotheses 7-9. Table 5 shows the empirical results when net trade credit (*NTC*) is used as dependent variable.

The correlation between *LnCash* and *NTC* under transaction motive is significantly positive. As shown in Tables 3 and 4, *LnCash* is positively related with trade credit demand and supply. It indicates that those firms have large amounts of laid-up cash will increase purchase and trade volumes, and in turn reduce transaction costs.

Inventory is significantly and negatively correlated with NTC, indicating that *INTA* has a negative effect on accounts receivable and a positive effect on accounts payable (see Tables 3 and 4). Estimated regression coefficient for large firms is higher than small firms.

Although having a large inventory can help increase trade and reduce transaction costs, firm's own need for funding will reduce its supply for trade credit.

The book value of total assets, which is the proxy variable of price discrimination, is shown to be significantly and negatively correlated with NTC. As shown in Tables 3 and 4, the estimated regression coefficient for *LnTasset* is higher in accounts receivable than accounts payable, this implies a firm with rapid growth and aggressive brand development will be likely to reduce the supply of trade credit. This finding is consistent with the work of Choi and Kim (2005), who suggested that in a period of strong growth, those firms have access to adequate sources of finance and therefore control their supply of trade credit.

The correlation between sales growth and NTC is significantly positive. *Growth* is shown to be positively related with accounts receivable and accounts payable (see Tables 3 and 4), this means that firms with higher growth rates are able to extend more trade credit; therefore, the estimated regression coefficient for large firms is higher than small firms.

The correlation between gross profit margin and NTC is significantly positive for small firms in Taiwan. However, it is significantly negative in large firms in Taiwan and China. These results are similar to those shown in Tables 3 and 4, in which the estimated regression coefficient of *GPfM* is higher in accounts receivable than accounts payable, indicating that large firms have monopoly powers will enable them to maintain higher prices or control market prices. When government regulations prohibit price discrimination, firms in general circumstances are unable to utilize trade credit funding to generate more profit.

When the gross profit margin squared is considered, we find that when the gross profit margin of Taiwan large firms is sufficiently high, the nonlinear relationship is positive (estimated coefficient is 0.004). In the case of large firms in China, however, it still shows a negative relationship (estimated coefficient is -0.002).

The reverse ratio of fixed to total assets (i.e., 1-fixed assets/total assets) is used as the proxy variable of adverse selection and shows a significantly negative relationship with NTC. This means that *FIXTA* has a negative effect on accounts receivable and positive effect on accounts payable (see Tables 3 and 4). The estimated regression coefficient (absolute value) for large firms is higher than small firms in both Taiwan and China, indicating that firms with low information asymmetry are more likely to increase the supply of trade credit.

We use the ratio of bad debt provision to total asset as the proxy variable of moral hazard, and it has a significantly positive relationship with NTC for large firms but negative for small firms in Taiwan and China. Our empirical results are consistent with Choi and Kim (2005), large firms have the ability to absorb the bad debts caused by moral hazard and use finance from accounts receivable. Small firms may suffer default losses and ae likely to reduce the supply of trade credit.

Lastly, we used the short-term loans proxy variable to test for substitution or complementary effects between NTC and credit from financial institutes. Results show a positively correlated substitution effect in Taiwanese firms, indicating that banks set high thresholds for business loans, small firms are heavily reliant on trade credit to drive their sales growth. In contrast, those firms in China show a negatively correlated complementary effect. This indicates that its capital market has not yet fully matured, Chinese firms only provide trade credit in conjunction with bank credit.

5. **Conclusion**

Trade credit has become a common tool of extending credit in business dealings and serves as an important source of working capital. In this paper, we propose an empirical supply-demand model of trade credit and examine our proposed hypotheses incorporating transaction and financing motives. Using a panel analysis for listed firms in Taiwan and China, we investigate different hypotheses related to the use of trade credit, including transaction costs, discriminatory pricing, adverse selection, and moral hazard. With respect to accounts receivable (supply), the high thresholds that Taiwanese banks set for business

loans will lead to a substitution effect between trade credit and bank credit. In Chinese firms, in which the capital market has not yet fully matured, only provide trade credit in conjunction with bank credit, leading to a complementary effect between trade credit and bank credit. As for accounts payable (demand), firms in Taiwan and China show a substitution effect between trade credit and bank credit, it is due to the high thresholds for business finance set by banks.

Other notable findings are the problems of adverse selection and moral hazard in relation to information asymmetry. We conclude that, with respect to accounts receivable, adverse selection can be expected to increase the supply of trade credit while moral hazard decrease the supply of trade credit. As for accounts payable, adverse selection can be expected to decrease the demand of trade credit while moral hazard increase the demand of trade credit. The effects of adverse selection and moral hazard between accounts receivable and payable can be compared to the trade-off relationship between marginal profit and cost[8].

Finally, we analyzed NTC relationships among firms in Taiwan and China. The book value of total assets, which is the proxy variable of price discrimination, is significantly and negatively correlated with NTC, the result attributable to firm's rapid growth and limited trade credit in small firms. As for the relationship between NTC and bank credit, firms in Taiwan show a substitution effect while firms in China demonstrate a complementary effect.

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8. The trade-off relationship: One additional unit of output (marginal cost) for every additional unit of profit (marginal profit)

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Figure 1 Cross-strait trade via Hong Kong

The cross-strait trade data between Taiwan and China via Hong Kong are obtained from the Mainland Affairs Council, Taiwan. During the period between 1991 and 2013, economic and trading activities among Taiwan, China and Hong Kong show a steadily increasing trend. The horizontal axis indicates years while the vertical axis is units in millions of USD.

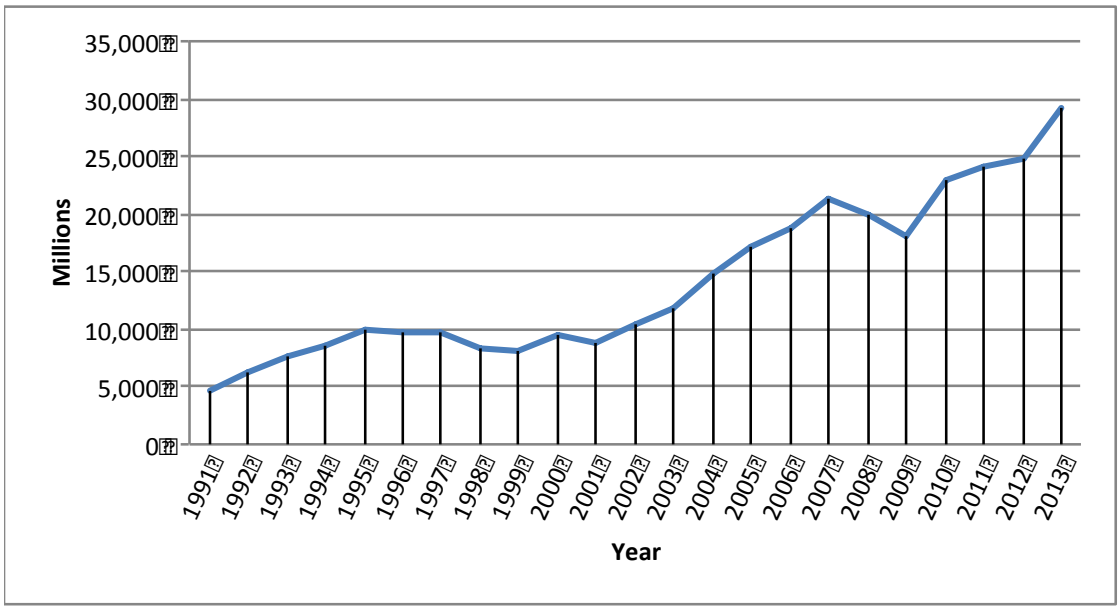

Figure 2. Correlation between AR and AP

According to Petersen and Rajan (1997), the trade credit relationships, the credit provided by front-end suppliers will appear as the accounts payable on the balance sheet of the firm. Customer demand for credit will appear as the accounts receivable on the balance sheet of the firm.

Table 1 Summary Statistics and Multicollinearity Test

Panel A：Summary Statistics

Variables	Statistics	Taiwan			China		
		All samples	Small Firms	Large Firms	All samples	Small Firms	Large Firms
LnAR	Mean	**12.836**	**12.071**	**13.599**	**11.414**	**10.795**	**12.033**
	Median	**12.997**	**12.357**	**13.744**	**11.902**	**11.415**	**12.513**
	Std. Dev.	**1.973**	**1.697**	**1.930**	**2.714**	**2.580**	**2.704**
LnAP	Mean	**12.381**	**11.479**	**13.280**	**11.535**	**10.852**	**12.219**
	Median	**12.428**	**11.736**	**13.298**	**11.789**	**11.216**	**12.535**
	Std. Dev.	**1.953**	**1.686**	**1.776**	**2.365**	**2.069**	**2.445**
LnNTC	Mean	**0.455**	**0.591**	**0.318**	**-0.121**	**-0.056**	**-0.185**
	Median	**0.513**	**0.579**	**0.432**	**0.170**	**0.255**	**0.083**
	Std. Dev.	**1.464**	**1.107**	**1.448**	**1.851**	**1.816**	**1.884**
LnCash	Mean	**12.200**	**11.462**	**12.938**	**12.057**	**11.281**	**12.832**
	Median	**12.099**	**11.540**	**12.815**	**12.418**	**11.738**	**13.116**
	Std. Dev.	**1.666**	**1.295**	**1.669**	**2.345**	**2.178**	**2.247**
INTA	Mean	**0.134**	**0.126**	**0.143**	**0.171**	**0.158**	**0.183**
	Median	**0.090**	**0.101**	**0.082**	**0.128**	**0.123**	**0.135**
	Std. Dev.	**0.155**	**0.124**	**0.181**	**0.163**	**0.147**	**0.176**
LnTasset	Mean	**14.100**	**13.038**	**15.155**	**12.848**	**12.314**	**13.382**
	Median	**14.022**	**13.103**	**15.035**	**12.894**	**12.506**	**13.489**
	Std. Dev.	**1.628**	**1.068**	**1.384**	**1.794**	**1.560**	**1.854**
Growth	Mean	**0.767**	**0.690**	**0.844**	**0.793**	**0.722**	**0.864**
	Median	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
	Std. Dev.	**0.422**	**0.462**	**0.363**	**0.405**	**0.448**	**0.342**
GPfM	Mean	**0.155**	**0.149**	**0.161**	**0.253**	**0.258**	**0.249**
	Median	**0.156**	**0.157**	**0.156**	**0.208**	**0.205**	**0.210**
	Std. Dev.	**3.672**	**2.394**	**4,603**	**1.282**	**1.748**	**0.483**
GPfM2	Mean	**13.510**	**5.755**	**21.216**	**1.709**	**3.122**	**0.295**
	Median	**0.026**	**0.027**	**0.026**	**0.045**	**0.045**	**0.045**
	Std. Dev.	**1942.500**	**474.990**	**2702.600**	**146.960**	**207.140**	**16.840**
ROA	Mean	**1.012**	**0.463**	**1.569**	**0.867**	**0.187**	**0.548**
	Median	**1.140**	**0.790**	**1.450**	**0.580**	**0.350**	**0.830**
	Std. Dev.	**4.199**	**5.260**	**2.648**	**39.455**	**34.997**	**43.449**
FIXTA	Mean	**0.767**	**0.761**	**0.772**	**0.667**	**0.683**	**0.652**
	Median	**0.808**	**0.802**	**0.814**	**0.700**	**0.712**	**0.684**
	Std. Dev.	**0.184**	**0.184**	**0.183**	**0.216**	**0.197**	**0.233**
SALTA	Mean	**0.208**	**0.213**	**0.204**	**0.266**	**0.259**	**0.273**
	Median	**0.174**	**0.184**	**0.164**	**0.134**	**0.123**	**0.146**
	Std. Dev.	**0.158**	**0.152**	**0.164**	**7.942**	**10.162**	**4.785**
VCOTA	Mean	**0.175**	**0.177**	**0.172**	**0215**	**0.211**	**0.219**
	Median	**0.138**	**0.145**	**0.131**	**0.100**	**0.092**	**0.108**
	Std. Dev.	**0.148**	**0.144**	**0.151**	**6.725**	**8.666**	**3.919**
BDPTA	Mean	**0.007**	**0.011**	**0.003**	**0.017**	**0.028**	**0.005**
	Median	**0.002**	**0.003**	**0.001**	**0.000**	**0.000**	**0.000**
	Std. Dev.	**0.044**	**0.061**	**0.006**	**0.277**	**0.390**	**0.037**
STLOANTA	Mean	**0.082**	**0.087**	**0.078**	**0.218**	**0.195**	**0.240**
	Median	**0.039**	**0.041**	**0.037**	**0.144**	**0.155**	**0.135**
	Std. Dev.	**0.112**	**0.115**	**0.107**	**3.840**	**0.627**	**5.394**

Observations	**38,060**	**19,008**	**19,052**	**52,448**	**26,224**	**26,224**

Table 1 (cont.)
Panel B： VIF Test for Multicollinearity in Taiwan

Variables	Taiwan								
	All Samples			Small Firms			Large Firms		
	LnAR	*LnAP*	*LnNTC*	*LnAR*	*LnAP*	*LnNTC*	*LnAR*	*LnAP*	*LnNTC*
LnCash	**1.759**	**1.749**	**1.694**	**1.304**	**1.303**	**1.280**	**1.650**	**1.641**	**1.562**
INTA	**1.372**	**1.372**	**1.372**	**1.229**	**1.229**	**1.223**	**1.837**	**1.836**	**1.831**
LnTasset	**1.746**	**1.707**	**1.635**	**1.342**	**1.318**	**1.263**	**1.930**	**1.899**	**1.784**
Growth	**1.400**	**1.389**	**1.091**	**1.394**	**1.376**	**1.119**	**1.534**	**1.534**	**1.110**
GPfM	**1.256**	**1.275**	**1.226**	**2.749**	**2.875**	**2.631**	**5.009**	**5.207**	**4.570**
GPfM2	**1.202**	**1.204**	**1.197**	**2.593**	**2.668**	**2.526**	**4.813**	**4.960**	**4.488**
ROA	**1.462**	**1.458**	—	**1.424**	**1.419**	—	**1.629**	**1.617**	—
FIXTA	**1.170**	**1.165**	**1.113**	**1.331**	**1.315**	**1.258**	**1.250**	**1.254**	**1.176**
SALTA	**1.171**	—	—	**1.236**	—	—	**1.248**	—	—
VCOTA	—	**1.138**	—	—	**1.234**	—	—	**1.246**	—
BDPTA	**1.111**	**1.111**	**1.026**	**1.131**	**1.131**	**1.032**	**1.068**	**1.068**	**1.056**
STLOANTA	**1.403**	**1.407**	**1.399**	**1.320**	**1.328**	**1.305**	**1.624**	**1.620**	**1.610**
Observations	**38,060**	**38,060**	**38,060**	**19,008**	**19,008**	**19,008**	**19,052**	**19,052**	**19,052**

Table 1 (cont.)
Panel C：VIF Test for Multicollinearity in China

Variables	China								
	All Samples			Small Firms			Large Firms		
	LnAR	*LnAP*	*LnNTC*	*LnAR*	*LnAP*	*LnNTC*	*LnAR*	*LnAP*	*LnNTC*
LnCash	**1.871**	**1.871**	**1.870**	**1.481**	**1.481**	**1.481**	**2.005**	**2.005**	**2.004**
INTA	**1.388**	**1.388**	**1.387**	**1.245**	**1.245**	**1.243**	**1.599**	**1.599**	**1.595**
LnTasset	**1.896**	**1.896**	**1.889**	**1.642**	**1.642**	**1.624**	**2.047**	**2.047**	**2.041**
Growth	**1.081**	**1.081**	**1.078**	**1.076**	**1.076**	**1.067**	**1.084**	**1.084**	**1.083**
GPfM	**2.233**	**2.233**	**2.233**	**2.670**	**2.670**	**2.670**	**3.065**	**3.066**	**3.062**
GPfM2	**2.227**	**2.227**	**2.227**	**2.666**	**2.666**	**2.666**	**3.010**	**3.011**	**3.008**
ROA	**1.528**	**1.515**	—	**1.719**	**1.761**	—	**1.773**	**1.694**	—
FIXTA	**1.484**	**1.484**	**1.481**	**1.472**	**1.471**	**1.464**	**1.713**	**1.713**	**1.705**
SALTA	**1.488**	—	—	**1.695**	—	—	**1.688**	—	—
VCOTA	—	**1.475**	—	—	**1.735**	—	—	**1.613**	—
BDPTA	**1.006**	**1.006**	**1.005**	**1.013**	**1.013**	**1.011**	**1.030**	**1.030**	**1.029**
STLOANTA	**1.044**	**1.044**	**1.004**	**1.037**	**1.037**	**1.012**	**1.096**	**1.092**	**1.007**
Observations	**52,448**	**52,448**	**52,448**	**26,224**	**26,224**	**26,224**	**26,224**	**26,224**	**26,224**

Note: Summary statistics and multicollinearity are presented in Table 2. Companies are categorized by total assets as small firms ($A<50\%$) and large firms ($A\geq 50\%$). Panel A provides the mean, the median, and the standard deviation. Panel B and C provides the indicators of multicollinearity at Taiwan and Mainland China, respectively. The dependent variables are defined as follows: *LnAR* is natural log of nominal accounts receivable. *LnAP* is natural log of nominal accounts payable. *LnNTC* is natural log of net trade credit. The independent variables are defined as follows: *LnCash* is natural log of cash and cash equivalents. *INTA* is ratio of amount of inventory to total assets. *LnTasset* is natural log of book value of total assets. *Growth* is ratio of net profit to sales. *GPfM* is gross profit margin. *GPfM2* is gross profit margin square. *ROA* is return on assets. *FIXTA* is reverse ratio of fixed to total assets, *SALTA* is ratio of sales to total assets. *VCOTA* is ratio of cost of goods sold to total assets. *BDPTA* is ratio of bad debts provision to total assets. *STLOANTA* is ratio of short-term loans to total assets. VIF is variance inflation factor and must be less than 10.

Table 2 Durbin-Wu-HausmanTest

Panel A：Taiwanese Firms

	Dependent Variables								
	Whole Enterprises			Small Enterprises($A<50\%$)			Large Enterprises($A\geq 50\%$)		
	LnAR	*LnAP*	*LnNTC*	*LnAR*	*LnAP*	*LnNTC*	*LnAR*	*LnAP*	*LnNTC*
LnCash_res	**1.9596**	**2.6844**	**2.1252**	**-0.6318**	**1.0715**	**0.5432**	**-0.6948**	**0.2961**	**1.5623**
	(1.0700)	**(1.5850)**	**(1.2300)**	**(-0.2518)**	**(0.4378)**	**(0.2760)**	**(-0.2774)**	**(0.1337)**	**(0.6883)**
INTA_res	**-2.4849**	**-0.7755**	**-1.4178**	**2.4067**	**-0.2903**	**0.4874**	**2.9519**	**2.5298**	**0.05584**
	(-1.0620)	**(-0.3542)**	**(-0.6202)**	**(0.9150)**	**(-0.1994)**	**(0.2733)**	**(1.2010)**	**(1.1300)**	**(0.0240)**
LnTasset_res	**-1.5021**	**-1.3031**	**1.6010**	**1.6860**	**-2.2537**	**1.5505**	**-1.3629**	**-2.7677**	**-1.1018**
	(-0.8183)	**(-0.7705)**	**(0.9293)**	**(0.6692)**	**(-0.9196)**	**(0.7997)**	**(-0.5592)**	**(-1.2500)**	**(-0.4838)**
Growth_res	**-1.6487**	**-1.6838**	**-1.1557**	**-0.8656**	**4.7776**	**2.5780**	**-4.9749**	**-6.6459**	**2.3207**
	(-0.6348)	**(-0.7071)**	**(-0.4748)**	**(-0.5254)**	**(1.3750)**	**(0.9342)**	**(-1.4520)**	**(-0.2119)**	**(0.7175)**
GPfM_res	**-1.3103**	**1.8279**	**-1.9101**	**0.8894**	**-1.8908**	**0.3080**	**-0.1135**	**2.8196**	**-1.8784**
	(-0.7139)	**(1.0750)**	**(-1.1060)**	**(0.3526)**	**(-0.7618)**	**(0.1583)**	**(-0.0469)**	**(1.1290)**	**(-0.8221)**
GPfM2_res	**0.1484**	**0.2363**	**0.0502**	**0.0445**	**3.7357**	**0.0646**	**54.3341**	**12.2175**	**3.4919**
	(0.8746)	**(0.8469)**	**(0.1521)**	**(0.5409)**	**(0.8966)**	**(1.423)**	**(1.386)**	**(0.3137)**	**(0.1062)**
ROA_res	**0.3599**	**-1.0668**	—	**0.0854**	**-3.6301**	—	**1.7501**	**-1.3643**	—
	(0.1426)	**(-0.4545)**		**(0.0240)**	**(-1.0540)**		**(0.5061)**	**(-0.4357)**	
FIXTA_res	**-0.0487**	**-0.5574**	**0.9748**	**-1.0135**	**-1.6044**	**0.8127**	**0.6920**	**-0.2312**	**2.9867**
	(-0.2879)	**(-0.3284)**	**(0.5326)**	**(-0.4172)**	**(-0.0656)**	**(0.4157)**	**(0.2840)**	**(-0.1051)**	**(1.3060)**
SALTA_res	**2.5669**	—	—	**-1.0858**	—	—	**3.2393**	—	—
	(1.4020)			**(-0.4308)**			**(1.3260)**		
VCOTA_res	—	**-1.2235**	—	—	**3.2507**	—	—	**-0.3976**	—
		(-0.7182)			**(1.3100)**			**(-0.1797)**	
BDPTA_res	**-16.5995**	**-10.9497**	**-15.3843**	**0.7005**	**-18.5632**	**-6.3608**	**18.0352**	**8.5439**	**-9.9596**
	(-1.1370)	**(-0.7489)**	**(-0.9326)**	**(0.04857)**	**(-1.5670)**	**(-0.5681)**	**(1.5610)**	**(0.8095)**	**(-0.0908)**
STLOANTA_res	**-3.9605**	**0.3747**	**-1.4174**	**1.3937**	**2.2164**	**0.2511**	**-6.5671**	**-0.7833**	**0.6573**
	(-1.3320)	**(0.1235)**	**(-0.4527)**	**(0.5020)**	**(0.8266)**	**(0.1171)**	**(-1.3690)**	**(-0.1798)**	**(0.2490)**
Observations	**38,060**	**38,060**	**38,060**	**19,008**	**19,008**	**19,008**	**19,052**	**19,052**	**19,052**

Table 2 (cont.)

Panel B：Chinese Firms

	Dependent Variables								
	All Samples			Small Firms			Large Firms		
	LnAR	*LnAP*	*LnNTC*	*LnAR*	*LnAP*	*LnNTC*	*LnAR*	*LnAP*	*LnNTC*
LnCash_res	**0.5417**	**-1.5933**	**0.5334**	**-1.1329**	**-3.9111**	**-5.6824**	**-1.9724**	**2.0867**	**-0.5069**
	(0.2035)	**(-0.7167)**	**(0.2772)**	**(-0.7167)**	**(-0.9335)**	**(-1.4950)**	**(-0.5287)**	**(0.6525)**	**(-0.1870)**
INTA_res	**-0.8280**	**2.3368**	**-1.4380**	**-1.4669**	**-3.7891**	**0.0539**	**0.4223**	**1.6668**	**1.1034**
	(-0.3076)	**(1.0500)**	**(-0.7471)**	**(-0.2769)**	**(-0.9058)**	**(0.0142)**	**(0.1131)**	**(0.5233)**	**(0.4055)**
LnTasset_res	**-3.4537**	**-3.4232**	**0.6872**	**0.1209**	**6.4514**	**1.8677**	**2.3478**	**0.3114**	**1.5789**
	(-1.2950)	**(-1.5460)**	**(0.3584)**	**(0.0228)**	**(1.5440)**	**(0.4895)**	**(0.6416)**	**(0.0984)**	**(0.5852)**
Growth_res	**-0.7249**	**0.4014**	**3.1294**	**-7.6173**	**-5.9059**	**-1.4225**	**-0.3135**	**0.61235**	**-5.6488**
	(-0.1916)	**(0.1283)**	**(1.1590)**	**(-1.4370)**	**(-1.1100)**	**(-0.3738)**	**(-0.0598)**	**(1.3640)**	**(-1.4830)**
GPfM_res	**-5.5923**	**1.5266**	**0.3958**	**4.8143**	**4.9863**	**1.0748**	**4.7340**	**2.1453**	**1.1389**
	(-0.2084)	**(0.6856)**	**(0.2072)**	**(0.9109)**	**(1.1880)**	**(0.2829)**	**(1.2860)**	**(0.6756)**	**(0.4235)**
GPfM2_res	**-0.6359**	**-0.1681**	**-1.3546**	**9.6137**	**3.5557**	**7.1331**	**-0.03204**	**-0.0222**	**0.0153**
	(-0.1720)	**(-0.0508)**	**(-0.4765)**	**(0.9420)**	**(0.3414)**	**(1.1650)**	**(-0.6353)**	**(-0.7239)**	**(0.4195)**
ROA_res	**-1.8935**	**0.4265**	—	**-7.6462**	**-1.6152**	—	**6.0035**	**-0.6783**	—
	(-0.5031)	**(0.1360)**		**(-1.4510)**	**(-0.3849)**		**(1.1490)**	**(-0.1520)**	
FIXTA_res	**0.5694**	**-1.5883**	**3.3454**	**-2.4646**	**-1.7512**	**-5.2534**	**-0.2473**	**-1.2708**	**2.8472**
	(0.2130)	**(-0.7133)**	**(1.2390)**	**(-0.4641)**	**(-0.4169)**	**(-1.3820)**	**(-0.0665)**	**(-0.3996)**	**(1.0520)**
SALTA_res	**0.4115**	—	—	**-0.1019**	—	—	**0.3434**	—	—
	(0.2427)			**(-0.4735)**			**(1.0620)**		
VCOTA_res	—	**-0.46613**	—	—	**-0.22542**	—	—	**-0.5973**	—
		(-0.2855)			**(-1.3610)**			**(-1.3510)**	
BDPTA_res	**-5.2300**	**7.8478**	**16.6003**	**26.7351**	**27.8786**	**27.8322**	**8.0122**	**14.0454**	**-13.1965**
	(-0.4405)	**(0.4670)**	**(1.1390)**	**(1.0070)**	**(-1.3230)**	**(1.4660)**	**(0.3394)**	**(0.6922)**	**(-0.7626)**
STLOANTA_res	**-0.6327**	**-1.5975**	**0.9821**	**-2.2554**	**2.9980**	**3.7761**	**2.8896**	**-4.1386**	**-2.6486**
	(-0.2299)	**(-0.6997)**	**(0.4987)**	**(-0.4219)**	**(0.7142)**	**(0.9967)**	**(0.7644)**	**(-1.2690)**	**(-0.9586)**
Observations	**52,448**	**52,448**	**52,448**	**26,224**	**26,224**	**26,224**	**26,224**	**26,224**	**26,224**

Table 2 shows the results of the Durbin-Wu-Hausman test. Companies are categorized by total assets as small firms ($A<50\%$) and large firms ($A\geq 50\%$); Panel A shows firms in Taiwan while Panel B shows firms in China. The dependent variables are defined as follows: *LnAR* (natural log of accounts receivable), *LnAP*(natural log of accounts payable), and *LnNTC* (natural log of net trade credit). The independent variables are defined as follows: *LnCash_res* is the error term of the natural log of cash and cash equivalents. *INTA_res* is the residual of the ratio of amount of inventory to total assets, *LnTasset_res* is the residual of the natural log of book value of total assets, *Growth_res* is the residual of the ratio of net profit to sales, *GPfM_res* is gross profit margin of error term. *GPfM2_res* is gross profit margin square of error term. *ROA_res* is return on assets of error term. *FIXTA_res* is the residual of the reverse ratio of fixed to total assets. *SALTA_res* is the residual of the ratio of sales to total assets, *VCOTA_res* is the residual of the ratio of cost of goods sold to total assets, *BDPTA_res* is the residual of the ratio of bad debts provision to total assets, *STLOANTA_res* is the residual of the ratio of short-term loans to total assets. The *t-values* are in parenthesis. ***, ** and * indicate statistical significant at the 1%, 5% and 10% levels, respectively.

Table 3 The estimation results of fixed-effect regression for trade credit supply (accounts receivable)

Variables	Taiwan			China		
	All Samples	Small Firms	Large Firms	All Samples	Small Firms	Large Firms
LnCash	0.287***	0.086***	0.260***	0.303***	0.258***	0.291***
	(47.850)	(8.535)	(33.100)	(46.650)	(29.560)	(29.930)
INTA	-1.657***	-2.407***	-1.974***	-1.130***	-0.900***	-1.771***
	(-29.520)	(-27.460)	(-25.660)	(-14.410)	(-7.808)	(-16.460)
LnTasset	0.522***	0.510***	0.482***	0.258***	0.197***	0.209***
	(86.490)	(44.730)	(47.220)	(30.710)	(15.730)	(17.740)
Growth	0.237***	0.220***	0.240***	0.605***	0.581***	0.707***
	(11.350)	(8.514)	(6.910)	(21.530)	(16.380)	(15.330)
GPfM	0.014***	0.018***	-0.023***	-0.136***	-0.069***	-1.684***
	(10.580)	(13.340)	(-3.221)	(-10.820)	(-4.879)	(-31.050)
GPfM2	0.000***	0.000***	-0.000***	0.001***	0.000***	-0.039***
	(6.274)	(8.904)	(-3.605)	(7.929)	(3.989)	(-25.730)
ROA	-0.009***	-0.007**	-0.026***	-0.001***	-0.001***	-0.002***
	(-4.139)	(-3.136)	(-5.480)	(-3.834)	(-3.184)	(-5.052)
FIXTA	-0.973***	-0.753***	-1.226***	-1.422***	-0.600***	-1.257***
	(-22.010)	(-11.340)	(-19.650)	(-23.290)	(-6.396)	(-14.960)
SALTA	4.379***	3.837***	4.208***	0.006***	0.003*	0.008**
	(86.030)	(53.470)	(61.890)	(3.857)	(1.695)	(2.059)
BDPTA	-0.686***	-0.617***	39.720***	-0.200***	-0.175***	0.994**
	(-3.833)	(-3.527)	(23.060)	(-5.128)	(-4.462)	(2.437)
STLOANTA	0.959***	0.675***	0.292**	-0.021***	-0.116***	-0.024***
	(12.180)	(6.679)	(2.415)	(-7.495)	(-4.727)	(-8.301)
Observations	38,060	19,008	19,052	52,448	26,224	26,224
R^2	0.485	0.384	0.477	0.189	0.100	0.221
$adj-R^2$	0.484	0.382	0.476	0.188	0.098	0.219

Note：The regression equation estimated is：

$$LnAR_{j,t} = \alpha_0^R + \beta_1^R LnCash_{j,t-1} + \beta_2^R \frac{INV_{j,t-1}}{Tasset_{j,t-1}} + \beta_3^R LnTasset_{j,t-1} + \beta_4^R Growth_{j,t-1} + \beta_5^R GPfM_{j,t-1} + \beta_6^R GPfM_{j,t-1}^2$$

$$+ \beta_7^R ROA_{j,t-1} + \beta_8^R \left(1 - \frac{FIX_{j,t-1}}{Tasset_{j,t-1}}\right) + \beta_9^R \frac{Sale_{j,t-1}}{Tasset_{j,t-1}} + \beta_{10}^R \frac{BDP_{j,t-1}}{Tasset_{j,t-1}} + \beta_{11}^R \frac{Stloan_{j,t-1}}{Tasset_{j,t-1}} + \varepsilon_{j,t}^R .$$

Table 3 summarizes the fixed effect model estimated results of regression equation. Companies were categorized by total assets as small firms ($A < 50\%$) and large firms ($A \geq 50\%$). We analyzed panel data from listed firms in Taiwan and China (excluding firms in the financial, securities and insurance industries) from 2002:Q1-2012:Q4. The dependent variable was *LnAR* which is natural log of nominal accounts receivable. The independent variables are defined as follows: *LnCash* is natural log of cash and cash equivalents. *INTA* is ratio of amount of inventory to total assets. *LnTasset* is natural log of book value of total assets. *Growth* is ratio of net profit to sales. *GPfM* is gross profit margin. *GPfM2* is gross profit margin square. *ROA* is return on assets. *FIXTA* is the reverse ratio of fixed to total assets. *SALTA* is ratio of sales to total assets. *BDPTA* is ratio of bad debts provision to total assets. *STLOANTA* is ratio of short-term loans to total assets. The *t-values* are in parenthesis. ***, ** and * indicate statistical significant at the 1%, 5% and 10% levels, respectively.

Table 4 The estimation results of fixed-effect regression for trade credit demand (accounts payable)

Variables	Taiwan			China		
	All Samples	Small Firms	Large Firms	All Firms	Small Firms	Large Firms
LnCash	0.111***	0.021**	0.174***	0.255***	0.188***	0.273***
	(17.920)	(2.180)	(22.110)	(48.100)	(27.530)	(33.290)
INTA	0.483***	0.475***	0.525***	2.534***	2.000***	2.404***
	(9.763)	(5.553)	(8.318)	(39.470)	(22.130)	(26.500)
LnTasset	0.859***	1.012***	0.761***	0.324***	0.253***	0.275***
	(120.900)	(64.540)	(69.920)	(47.070)	(25.750)	(27.650)
Growth	0.136***	0.169***	0.182***	0.420***	0.274***	0.660***
	(7.233)	(5.529)	(7.270)	(18.270)	(9.865)	(17.930)
GPfM	0.009***	0.013***	-0.012**	-0.123***	-0.063***	-1.575***
	(8.038)	(9.520)	(-2.002)	(-11.980)	(-5.662)	(-34.470)
GPfM2	0.000***	0.000***	-0.000**	0.001***	0.000***	-0.037***
	(4.849)	(6.511)	(-1.999)	(8.940)	(4.768)	(-28.850)
ROA	-0.016***	-0.012***	-0.032***	-0.001***	-0.001***	-0.002***
	(-8.189)	(-5.346)	(-7.625)	(-3.098)	(-3.110)	(-4.614)
FIXTA	0.797***	1.052***	0.511***	2.688***	1.398***	1.235***
	(20.120)	(18.230)	(9.435)	(41.100)	(15.820)	(3.544)
VCOTA	4.183***	4.090***	4.113***	0.008***	0.003*	0.008*
	(88.270)	(56.260)	(65.860)	(5.294)	(1.922)	(1.941)
BDPTA	-0.925***	-0.934***	-0.636***	-0.795***	-0..886***	-0.580***
	(-5.714)	(-5.457)	(-5.934)	(-17.110)	(-13.520)	(-8.723)
STLOANTA	-0.784***	-1.077***	-0.720***	-0.019***	-0.080***	-0.020***
	(-10.920)	(-10.850)	(-6.744)	(-8.188)	(-4.121)	(-8.322)
Observations	38,060	19,008	19,052	52,448	26,224	26,224
R^2	0.547	0.382	0.519	0.284	0.158	0.323
$adj-R^2$	0.546	0381	0.518	0.283	0.156	0.322

Note：The regression equation estimated is：

$$LnAP_{j,t} = \alpha_0^P + \beta_1^P LnCash_{j,t-1} + \beta_2^P \frac{INV_{j,t-1}}{Tasset_{j,t-1}} + \beta_3^P LnTasset_{j,t-1} + \beta_4^P Growth_{j,t-1} + \beta_5^P GPfM_{j,t-1} + \beta_6^P GPfM_{j,t-1}^2$$

$$+ \beta_7^P ROA_{j,t-1} + \beta_8^P \left(1 - \frac{FIX_{j,t-1}}{Tasset_{j,t-1}}\right) + \beta_9^P \frac{Cost_{j,t-1}}{Tasset_{j,t-1}} + \beta_{10}^P \frac{BDP_{j,t-1}}{Tasset_{j,t-1}} + \beta_{11}^P \frac{Stloan_{j,t-1}}{Tasset_{j,t-1}} + \varepsilon_{j,t}^P .$$

Table 4 summarizes the fixed effect model estimated results of regression equation. Companies were categorized by total assets as small firms ($A < 50\%$) and large firms ($A \geq 50\%$). We analyzed panel data from listed firms in Taiwan and China (excluding firms in the financial, securities and insurance industries) from 2002:Q1-2012:Q4. The dependent variable was *LnAP* which is natural log of nominal accounts payable. The independent variables are defined as follows: *LnCash* is natural log of cash and cash equivalents. *INTA* is ratio of amount of inventory to total assets. *LnTasset* is natural log of book value of total assets. *Growth* is ratio of net profit to sales. *GPfM* is gross profit margin. *GPfM2* is gross profit margin square. *ROA* is return on assets. *FIXTA* is the reverse ratio of fixed to total assets, *VCOTA* is ratio of cost of goods sold to total assets. *BDPTA* is ratio of bad debts provision to total assets. *STLOANTA* is ratio of short-term loans to total assets. The *t-values* are in parenthesis. ***, ** and * indicate statistical significant at the 1%, 5% and 10% levels, respectively.

Table 5 The estimation results of fixed-effect regression for net trade credit

Variables	Taiwan			China		
	All Samples	Small Firms	Large Firms	All Samples	Small Firms	Large Firms
LnCash	0.014**	0.059***	3.089***	0.036***	0.069***	0.612***
	(2.161)	(8.515)	(24.560)	(7.852)	(11.170)	(6.554)
INTA	-3.576***	-2.086***	-3.954***	-3.019***	-2.898***	-4.151***
	(-69.070)	(-29.680)	(-56.520)	(-62.000)	(-35.300)	(-52.140)
LnTasset	-0.107***	-0.118***	-0.110***	-0.027***	-0.055***	-0.063***
	(-14.480)	(-14.220)	(-12.240)	(-4.748)	(-6.248)	(-7.282)
Growth	0.156***	0.087***	0.166***	0.177***	0.306***	0.846***
	(8.873)	(4.832)	(6.074)	(8.792)	(12.160)	(13.830)
GPfM	0.006***	0.002*	-0.236***	-0.010	-0.006	-0.113***
	(4.781)	(1.915)	(-5.788)	(-1.081)	(-0.613)	(-2.880)
GPfM2	0.000***	0.000*	0.004***	0.000	0.000	-0.002**
	(2.914)	(1.670)	(5.269)	(0.652)	(0.348)	(-2.045)
FIXTA	-0.296***	-0.063***	-0.265***	-0.199***	-0.656***	-0.812***
	(-7.234)	(-5.006)	(-4.829)	(-5.475)	(-7.334)	(-2.708)
BDPTA	0.163	-0.965***	14.513***	-0.357***	-0.329***	0.870***
	(1.003)	(-7.379)	(9.408)	(-12.700)	(-11.790)	(14.120)
STLOANTA	1.091***	1.081***	0.398***	0.310***	-0.037**	-0.002*
	(14.560)	(13.980)	(3.650)	(4.876)	(-2.115)	(-1.925)
Observations	38,060	19,008	19,052	52,448	26,224	26,224
R^2	0.144	0.053	0.226	0.099	0.096	0.132
$adj-R^2$	0.143	0.050	0.224	0.098	0.095	0.130

Note：The regression equation estimated is：

$$LnNTC_{j,t} = \alpha_0 + \beta_1 LnCash_{j,t-1} + \beta_2 \frac{INV_{j,t-1}}{Tasset_{j,t-1}} + \beta_3 LnTasset_{j,t-1} + \beta_4 Growth_{j,t-1} + \beta_5 GPfM_{j,t-1} + \beta_6 GPfM^2_{j,t-1}$$
$$+ \beta_7 \left(1 - \frac{FIX_{j,t-1}}{Tasset_{j,t-1}}\right) + \beta_8 \frac{BDP_{j,t-1}}{Tasset_{j,t-1}} + \beta_9 \frac{Stloan_{j,t-1}}{Tasset_{j,t-1}} + \varepsilon_{j,t-1}$$

Table 5 summarizes the fixed effect model estimated results of regression equation. Companies were categorized by total assets as small firms ($A < 50\%$) and large firms ($A \geq 50\%$). We analyzed panel data from listed firms in Taiwan and China (excluding firms in the financial, securities and insurance industries) from 2002:Q1-2012:Q4. The dependent variable was *LnNTC* which is natural log of net trade credit. The independent variables are defined as follows: *LnCash* is natural log of cash and cash equivalents. *INTA* is ratio of amount of inventory to total assets. *LnTasset* is natural log of book value of total assets. *Growth* is ratio of net profit to sales. *GPfM* is gross profit margin. *GPfM2* is gross profit margin square. *ROA* is return on assets. *FIXTA* is the reverse ratio of fixed to total assets, *BDPTA* is ratio of bad debts provision to total assets. *STLOANTA* is ratio of short-term loans to total assets. The *t-values* are in parenthesis. ***, ** and * indicate statistical significant at the 1%, 5% and 10% levels, respectively.