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**Article**

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FINANCIAL ECONOMICS | RESEARCH ARTICLE

# Impact of financial development and credit information sharing on the use of trade credit: Empirical evidence from Pakistan

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**Abstract:** Pakistan is an emerging economy and characterized by a less developed financial system where trade credit is extensively used by listed manufacturing firms (LMFs). This study is focused to investigate the effect of financial development (FD) and credit information sharing (CIS) on the trade credit used by LMFs. For this purpose, dynamic panel model is estimated by applying system GMM (two-step) estimator on the financial data of 327 manufacturing firms listed in PSX Pakistan for the period 2005–2015. Results of the study reveal that FD and CIS have significant effect on the use of trade credit by LMFs in Pakistan. It is found that increase in financial depth increases the supply of funds to the private sector, and resultantly suppliers provide more trade credit to LMFs. While in response to increase in the lending rate, suppliers reduce the transfer of costly funds to LMFs through trade credit. Furthermore, negative relationship between CIS and the use of trade credit is in accordance with the substitution hypothesis. Results of the study have practical implications for the managers of firms and policy makers alike.

**Subjects: Monetary Economics; Corporate Finance; Credit and Credit Institutions**

**Keywords: trade credit financing; financial development; credit information sharing; listed manufacturing firms; system GMM**

## ABOUT THE AUTHORS

The principal author is an Assistant Professor at Hailey College of Commerce, University of the Punjab Lahore, Pakistan. Previously, he has worked in the Department of Economics at premier Government College University, Lahore. He has submitted his PhD thesis for evaluation to the Department of Management Sciences, COMSATS Institute of Information Technology, Lahore, Pakistan. Earlier, he has worked in the field of working capital management, determinants, and impact on profitability. The current study is an output of his PhD thesis. His research interests include working capital, trade credit, financial policies of services, and manufacturing companies.

## PUBLIC INTEREST STATEMENT

Granting trade credit has been an important issue for the manufacturing companies. Considering the principles of credit management, obtaining information about the prospective customers is very essential in economies where high information asymmetry prevails. In this context, role of information sharing by some established institutions is of high significance. Moreover, being spontaneous mode of financing, trade credit has always been considered as a substitute of bank credit, and with the fast-paced development of financial sector can replace the significance of trade credit. So, considering the importance of financial development and role of credit information sharing, the present study investigates their role in trade credit policies of manufacturing companies of Pakistan.

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## 1. Introduction

Trade credit is an important constituent of corporate finance (Rajan & Zingales, 1995) and is widely used by firms as a major source of short-term financing in all countries (Seifert, Seifert, & Protopappa-Sieke, 2013). However, its usage is high in developing economies, where stock market and financial institutions are less developed (Fisman & Love, 2003). Most of the previous studies emphasized more on firm-specific determinants of trade credit financing in the context of developed countries. A few studies are found in existing literature which have tested the effect of country-specific factors on trade credit used (TCU), e.g. monetary policy (Mateut, Bougheas, & Mizen, 2006; Schwartz, 1974), financial crises (Alatalo, 2010; Coulibaly, Sapriza, & Zlate, 2013), and tax rate (Desai, Foley, & Hines, 2016). In addition to these factors, use of trade credit is likely to be influenced by the level of financial development (FD) (Petersen & Rajan, 1997; Shimizu, 2012) and credit information sharing (CIS) in a country (Zhang, 2011). With the increase in the FD and CIS, supply of funds from the financial sector to real sector increases (La Rocca, La Rocca, & Cariola, 2010) which reduces the credit constraints of firms (Alessandrini, Presbitero, & Zazzaro, 2009). Consequently, the use of trade credit is reduced. A few studies are found in existing literature which have studied the effect of FD and CIS on trade credit (see, for example, Ge & Qiu, 2007; in China; Zhang, 2011; in Thailand; Deloof & La Rocca, 2015; in Italy, etc.). However, due to the existence of larger disparity among countries regarding the characteristics of their financial system, economic conditions, legal infrastructure, and CIS, the findings of these studies cannot be generalized. Moreover, country-specific studies provide opportunity to consider within-country variations and reduce the problem of omitted variable bias (Deloof & La Rocca, 2015).

Pakistan is a developing country characterized with less developed financial system. However, during last two decades significant reforms were observed in the financial sector of Pakistan. These reforms include relaxation of entry restriction into banking industry, privatization of public financial institutions to stimulate competition, purging of direct lending, reduction in statutory reserve requirements, interest rate liberalization, prudential regulation measures, openness of capital accounts, and stock market development. For detail, see Khan and Qayyum (2007). Despite these reforms, Pakistan is still ranked among 10 least financially developed countries (World Economic Forum, 2012).

CIS in Pakistan has been remarkably improved during the last couple of decades. It is evidenced by the establishment of Public Credit Information Bureau (PCIB) in January 1992. At present, four credit registries are working in Pakistan: one is in public sector and three in private sector. The number of individuals and firms registered with PCIB has increased from 0.2% to 9.4% of total adult population. This increase in coverage of PCIB shows substantial improvement in CIS in Pakistan. Above illustrated FD and CIS in Pakistan during the period of study provide a unique and ideal setting for testing the effect of these factors on TCU by manufacturing firms listed in PSX. Thus, this study is aimed to investigate the impact of FD and CIS on the use of trade credit in the context of Pakistan where financial institutions and financial market are less developed. According to the best of our knowledge, previously, no such effort is made.

After describing the motivation of this study in the introduction section, a brief discussion on the relationship of FD and CIS with trade credit is provided in the literature review and hypotheses section. Data sources, variables, and empirical model are explained in data and methodology section. After data and methodology, results of the analysis are discussed. At last, results of the study are concluded.

## 2. Literature review and hypotheses

### *2.1. Relationship between financial development and trade credit financing*

TCU by firms is influenced by the accuracy of information generated by financial market and the development of financial institutions (Fisman & Love, 2003); enforcement of legal rules for recovery of overdue accounts (Carmignani, 2004). Van Horen (2007) found that usage of trade credit is high in developing countries where institutional developments are in the early stages. Quality of

financial structure is negatively related to trade credit financing (Couppey-Soubeyran & Hericourt, 2011). FD increases the supply of bank credit and market credit to firms (Mc Kinnon, 1973), and resultantly these firms face less financing constraints (Levine, 2005). With the increase in FD and reduction in financial market imperfections, firms decrease the use of trade credit as a substitute for bank credit (Couppey-Soubeyran & Hericourt, 2011). They provided empirical evidence of a significant negative relationship between FD and the use of trade credit by firms. Furthermore, in less developed financial markets, firms face credit rationing from financial institutions due to higher costs of monitoring and bankruptcy (Jain, 2001). Later, Fisman and Love (2003) observed that in countries where financial institutions are weak, bank credit is substituted by trade credit. Firms working in a less developed banking environment are credit rationed (Alessandrini et al., 2009) and they use trade credit financing as an alternative to bank credit (Demirguç-Kunt & Maksimovic, 2001). Couppey-Soubeyran and Hericourt (2011) documented the negative effect of FD on the use of trade credit by firms. They explained that FD increases the supply of bank credit to firms, and consequently the use of trade credit is decreased. On the contrary, banking development increases the supply of formal funds to firms (Deloof & La Rocca, 2015). They established a positive relationship between banking development and the use of trade credit. Their findings support the complementary hypothesis, i.e. the use of trade credit fortifies the impact of banking development on company financing arrangements.

The rise in lending rate (LR) causes an increase in the borrowing cost of firms. Consequently, bank credit becomes less affordable for the firms and they increase the use of trade credit or vice versa (Fitzpatrick & Lien, 2013). Cull, Xu, and Zhu (2009) found that increase in the efficiency of the financial system increases the flow of funds from the financial sector to nonfinancial sector. They established that with the improvement in efficiency of the banking system, firms increase the use of bank credit, and resultantly they decrease the use of trade credit. Furthermore, they highlighted that with an increase in LR, the opportunity cost of funds is increased. Consequently, suppliers reduced the supply of trade credit to firms. Conversely to these studies, Niskanen and Niskanen (2006) found that interest rate has a significant but unexpectedly negative relationship with TCU by firms. They provided evidence in support of the complementary hypothesis of trade credit. They emphasized that increase in LR causes an increase in the opportunity cost of funds of suppliers, and resultantly they decrease the supply of trade credit to LMFs.

### *2.2. The relationship between credit information sharing and trade credit financing*

Similar to FD, CIS influences the use of trade credit by firms. Several previous studies highlighted the role of CIS in the reduction of financial constraints. For instance, Djankov, McLiesh, and Shleifer (2007) reported that CIS has a positive and significant effect on bank credit. They established that creditors' protection right and CIS are positively related to the supply of private credit to firms. Jappelli and Pagano (2002) reported that greater CIS results in increased LR and reduced the default rate.

Brown, Jappelli, and Pagano (2009) found that improvement in CIS facilitates the access of firms to bank credit and market credit, and resultantly ease their liquidity constraints. Therefore, firms receiving more credit from banks due to improvements in CIS are likely to depend less on trade credit. Later, similar findings were reported by Doblas-Madrid and Minetti (2013) and Zhang (2011). They established that increase in CIS improves the access of firms to financial institutions and consequently, they reduce the use of trade credit, whereas Brown and Zehnder (2007) found that CIS is positively related to payment behavior of creditors. Thus, borrowers make timely payments to improve their payment record. The empirical results on the impact of information sharing are mixed.

In the light of above discussion on the relationships of FD and CIS with the use of trade credit, we developed two sets of hypotheses, i.e. substitution hypothesis and complementary hypothesis.

#### *2.2.1. Substitution hypothesis*

According to this hypothesis, credit rationed firms use trade credit as a substitute for bank credit and market credit. Increase in the depth of financial institutions (DFIs) and depth of financial market (DFM) increases the supply of bank credit and market credit to firms and resultantly, they reduce the use of TCU or vice versa. Furthermore, a decrease in LR causes a decrease in the borrowing cost of firms. Thus, firms increase the use of bank credit and market credit, and reduce the use of TCU in response to decrease in LR or vice versa. CIS increases the access of firms to bank credit and market credit. Resultantly, firms use more formal credit and reduce the use of trade credit. According to this hypothesis, we expect the negative effect of DFIs, DFM, and CIS on trade credit, whereas the positive effect of LR on TCU.

$H_{a1}$: Depth of financial institutions is negatively related to the use of trade credit.

$H_{a2}$: Depth of financial market is negatively related to use of trade credit.

$H_{a3}$: Lending rate is positively related to the use trade credit.

$H_{a4:}$ Credit information sharing is negatively related to the use of trade credit.

#### *2.2.2. Complementary hypothesis*

This hypothesis highlights that firms which have access to multiple sources of funds use trade credit as a complement of bank credit and market credit. It means these firms prefer to use mixture of all available sources of funds to seek their optimal capital structure. This hypothesis implies that increase in DFIs, DFM, and CIS increases the supply of bank credit and market credit to firms and resultantly, these firms increase the use of trade credit to pursue optimal capital structure or vice versa. Similarly, with a decrease in LR, demand for trade credit and bank credit is increased and accordingly, firms increase the use of trade credit financing to maintain their capital structure. Thus, according to the complementary hypothesis, we expect the following relationships of DFIs, DFM, LR, and CIS with TCF.

$H_{a5}$: Depth of financial institutions is positively related to the use of trade credit.

$H_{a6}$: Depth of financial market is positively related to the use of trade credit.

$H_{a7:}$ Lending rate is negatively related to the use of trade credit.

$H_{a8}$: Credit information sharing is positively related to the use of trade credit.

## 3. Data and methodology

### *3.1. Data and sample*

For investigating the impact of FD and CIS on TCU in Pakistan, we used the data of FD indicators, CIS, and financial characteristics of manufacturing firms listed on PSX (formerly known as Karachi Stock Exchange) Pakistan for the period 2005–2015. The data regarding financial characteristics of listed firms are obtained from Balance Sheet Analysis reports published in 2010 and 2016 by the statistical division of State Bank of Pakistan. For the data regarding improvements in credit information coverage in Pakistan, World Development Indicators online database is used. The data about FD indicators are retrieved from Pakistan Economic Surveys issued by Ministry of Finance, Pakistan. Similar to Vaidya (2011), this study focused on listed manufacturing firms (LMFs). *First*, these firms are the recipient of more than 50% of credit allocated by banks to private sector in Pakistan. *Second*, these firms are listed on stock exchange and have access to financial market. *Third*, due to their larger size and market power, these firms are likely to receive more trade credit from their suppliers. Thus, significant changes in FD and improvement in CIS have been observed in Pakistan during 2005–2015. Hence, the empirical analysis of this study is confined to this period.

For a selection of the appropriate sample of LMFs for this study, we applied two filtering criteria. *At first step*, in line with previous studies (Guy & Mazra, 2012; Akinlo, 2012), we ignored the firms belonging to trading and services business due to specific nature of their business activities. We selected 362 LMFs as a part of the initial sample from 384 nonfinancial firms, which were found to be listed on PSX in 2015. *At the second step*, like Guy and Mazra (2012); Kwenda and Holden (2014), LMFs which have missing data of variables for five or more than five consecutive years are not considered because the system GMM dynamic estimation technique applied in this study requires the use of instrument variables (one or more years' lag of variables at level and also at their first difference). Furthermore, firms take some years in establishing trade credit relationship with their customers and suppliers (Yang, 2011; Vaidya, 2011). The final sample provided balanced panel data (like Kwenda & Holden, 2014) which consists of 327 LMFs and period of 11 years.

### *3.2. Variables*

We used trade credit financing availed by firms as a dependent variable. The size of trade credit financing used by firms is more closely related to their trading activities (purchases and sales) rather than the value of their assets. Data about purchases were not available, thus, like Desai et al. (2016), we used trade payables to sales ratio. Higher the value of trade payables to sales ratio indicates, more trade credit financing used by firms or vice versa.

With reference to findings of previous empirical studies and question under investigation, following independent variables are selected for the current study.

#### *3.2.1. Financial development*

In existing literature, FD is described in terms of four characteristics of financial institutions and financial markets, namely, depth, access, efficiency, and stability. From among these four characteristics of the financial sector, financial depth and financial efficiency are focused on this study due to their relevance and close effects on trade credit financing. Consistent with a previous study (Couppey-Soubeyran & Hericourt, 2011), we used private credit to GDP ratio for describing the DFIs and market capitalization to GDP ratio for measuring the DFM. Consistent with existing financial literature, LR is used to describe the financial efficiency of credit markets. The rise in LR causes an increase in the borrowing cost of firms. Consequently, bank credit becomes less affordable for the firms and they use more trade credit from their suppliers or vice versa.

#### *3.2.2. Credit information sharing*

The improvement in CIS increased the access of firms to bank credit; thus, they need less to depend on trade credit or vice versa. Consistent with Baliamoune-Lutz, Brixiova, and Ndikumana (2011), we used Public Credit Information Bureau Coverage ratio to measure the CIS.

#### *3.2.3. Control variables*

In existing literature, handful studies reported some financial characteristics of firms which have a significant effect on trade credit financing used by firms. These financial characteristics include first lag of TCU by firms, trade credit extended, short-term bank credit, sales growth, liquidity, profitability, size, stock-in-trade, collateral, and financial leverage. In order to control the effect of these variables, we added these variables in our regression model.

### *3.3. Regression models specification*

Trade credit financing used by firms is observed to be dynamic and is likely to depend upon its past realizations. Generally, firms use trade credit in accordance with their previously established trade credit policy or they emphasize on the stability of their contract regarding trade credit financing. It implies temporal dependency of trade credit financing used by firms and necessitates the use of dynamic panel model to control for the dynamics of the process.

Model 1: Effect of DFIs on TCU

$$\mathrm{TCU}_{it} = \beta_0 + \sum_{j=1}^{N} \beta_j X_{j,it} + \theta\,\mathrm{DFI} + \eta_k \mathrm{ID}_k + \mu_{it} \tag{1}$$

Model 2: Effect of DFM on TCU

$$\mathrm{TCU}_{it} = \beta_0 + \sum_{j=1}^{N} \beta_j X_{j,it} + \lambda\,\mathrm{DFM} + \eta_k \mathrm{ID}_k + \mu_{it} \tag{2}$$

Model 3: Effect of LR on TCU

$$\mathrm{TCU}_{it} = \beta_0 + \sum_{j=1}^{N} \beta_j X_{j,it} + \varphi\,\mathrm{LR}_t + \eta_k \mathrm{ID}_k + \mu_{it} \tag{3}$$

Model 4: Effect of CIS on TCU

$$\mathrm{TCU}_{it} = \beta_0 + \sum_{j=1}^{N} \beta_j X_{j,it} + \gamma\,\mathrm{CIS}_t + \eta_k \mathrm{ID}_k + \mu_{it} \tag{4}$$

where $i$ = 1……..$N$ (Firm) and $t$ = 1……..T (Year); $\beta_0$ = it is an intercept of the model.

$$\sum_{j=1}^{N} \beta_j X_{it} = (\beta_1\,\mathrm{TCU}_{i,t-1} + \beta_2\,\mathrm{TCE}_{it} + \beta_3 \mathrm{SBC}_{it} + \beta_4\,\mathrm{SG}_{it} + \beta_5\,\mathrm{PR}_{it} + \beta_6\,\mathrm{SIZ}_{it} + \beta_7 \mathrm{ST}_{it} + \beta_8 \mathrm{RLIQ}_{it} + \beta_9 \mathrm{COLLA}_{it} + \beta_{10} \mathrm{FL}_{it})$$

$\mathrm{TCU}_{it}$ Trade credit used by LMFs; $(\mathrm{TCU}_{it})_{t-1}$ First lag of trade credit used by LMFs; $\mathrm{TCE}_{it}$ Trade credit extended by LMFs. $\mathrm{SBC}_{it}$ Short term bank credit to sales, $\mathrm{SG}_{it}$ Sales growth rate; $\mathrm{PR}_{it}$ The profitability of a firm $i$ at time $t$. It is measured by operating profit before depreciation to sales ratio. $\mathrm{SIZ}_{it}$ = Size of a firm. $\mathrm{ST}_{it}$ Stock-in-trade $\mathrm{RLIQ}_{it}$ Relative liquidity of a firm $i$ at time $t$, $\mathrm{COLLA}_{it}$ The value of collateral $\mathrm{FL}_{it}$ Financial leverage of a firm $i$ at time $t$. Debt equity ratio is used as a measure of financial leverage. $\mathrm{DFIs}_t$ Depth of financial institutions $\mathrm{DFM}_t$, Depth of financial market, LR is lending rate and CIS is credit information sharing. $\mathrm{ID}_k$ indicates dummies for $k$ industries that are added in the model to control the effects of observable and unobservable variables that change across the industry but remain same for all firms within the same industry. $\mu_{it}$ Random error term explaining the effect of unobserved random variables.

### *3.4. Estimation choice*

Some causality is expected to exist between TCU by firms and its firm-specific determinants. For instance, according to credit redistribution hypothesis, firms receiving more trade credit are likely to extend more trade credit. So, both are likely to be the counterpart of each other. According to capital structure theory, firms prefer a mixture of alternative sources of credit instead of relying on a single source of credit. For maintaining an optimal mix of capital, firms receiving more trade credit are expected to increase the use of bank credit. Firms which are offered liberal credit term are likely to wait for the good price of their stock and resultantly stock level is increased. Contrary to this, firms which are offered tight credit terms are expected to increase the turnover of their stock-in-order to avoid their default.

Similarly, firms receiving more trade credit are likely to have high sales growth. Firms which are offered discount term as part of credit term can affect their profitability and relative liquidity position by adopting either early or delayed payment policies. Firms receiving liberal credit from their suppliers have more potential to invest a more significant part of their available funds in machine and plant assets (used as a proxy for collateral). Lastly, as trade credit is part of the total debt, delaying payment to suppliers is likely to aggravate the financial leverage of firms. On the basis of above-stated theoretical justification, the presumption of the existence of causality between TCU and its determinants is quite convincing.

Thus, trade credit extended, short-term credit received from banks, sales growth, profitability, relative liquidity position, stock level, collateral, and financial leverage are used as endogenous, while the size of firms, industry dummies, and year dummies are used as exogenous regressors in each model. Hence, using these endogenous variables as determinants of TCU by firms in regression model gives rise to simultaneity bias. Furthermore, these endogenous variables are more likely to be serially correlated with the current and even with past residuals, and are expected to produce biased and inconsistent estimates. The existence of unobserved heterogeneity among firms and expected presence of simultaneity bias gives rise to endogeneity.

In case of endogeneity, estimates of coefficients produced by Pooled OLS, FE, and RE estimators are inconsistent and biased. Under these conditions, system GMM estimator is more reliable one, particularly if the lag coefficient is of interest. Moreover, if the time dimension *T* in the data set is small, the inconsistency becomes more severe. Arellano and Bover (1995) as well as Blundell and Bond (1998) proposed the use of system GMM estimator (thereafter called BB estimator) to control the endogeneity problem particularly when panel data set has finite *T* but infinite *N*. There are two versions of system GMM estimator, i.e. one-step system-GMM and two-step system GMM developed by Blundell and Bond (1998). In case of heteroskedasticity estimated coefficients produced by two-step estimator is considered more efficient. Therefore, for investigating the effect of FD and CIS on TCU, we used system GMM estimator with two-step option to estimate the regression models specified above.

## 4. Results of data analysis and discussion

### *4.1. Descriptive analysis*

We performed one-way ANOVA and its results are reported in Table 1. Average TCU is 12.71% of sales with standard deviation 14.38%. The results of one-way ANOVA of TCU over years show that TCU does not vary significantly over years during the period of study. It implies long-term stability of TCU by LMFs. During the period of financial crises 2007–2008, the supply of credit from the financial sector is squeezed and resultantly firms used more trade credit. Maximum mean value of TCU during 2008 shows on average the highest level of TCU used by listed firms during 2008. The results of one-way ANOVA of TCU also show that the average value of TCU used by LMFs varies across industries during the period of study. Table 1 implies the existence of significant differences in the mean values of TCU across industries. The results are according to the reality that firms included in the sample belong to different manufacturing industries. For controlling the effect of industry-specific factors, industry dummy variables are added to each equation. Moreover, results are consistent with the findings of previous studies (see, for example, Delannay & Weill, 2004; Ge & Qiu, 2007; Niskanen & Niskanen, 2006).

Descriptive statistics reported in Table 2 show that overall, firms have access to short-term bank credit, demonstrated positive sales growth during the period of the study. Furthermore, firms included in the sample are on average profitable, larger in size, managing their stock-in-trade efficiently, have satisfactory liquidity positions, the appropriate value of collateral in terms of tangible assets, and have high financial leverage.

FD indicators (DFI, DFM, and LR) are improved over the period of study. The DFM has improved from minimum value 14.95% to maximum value 37.52% during the period of study. High LR shows that credit market does not work efficiently in Pakistan during the period of study and firms are paying high borrowing cost. Small mean values of DFI and DFM show that the financial sector is less developed in Pakistan and is not fully meeting financing needs of firms. Further, results show that CIS has improved in Pakistan from 0.3% to 8.0% over the period of study. Before doing empirical analysis, we applied Cook's *D* test to examine the presence of outliers and leverage observations in the data set. Similar to Desai et al. (2016), we managed the effect of outliers by winsorizing each firm-specific variable at 5% from both lower and upper tails of the distribution.

**Table 1. One-way ANOVA of TCU**

| $H_0$= Means are equal over years | | | | $H_0$ = Means are equal across industries | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year** | **No. of firms** | **Mean** | **SD** | **Sectors** | **No. of firms** | **No of obs.** | **Mean** | **SD** |
| 2005 | 327 | 0.1335 | 0.1370 | Textiles | 133 | 1463 | 0.1255 | 0.1246 |
| 2006 | 327 | 0.1239 | 0.1267 | Sugar | 32 | 352 | 0.1347 | 0.1391 |
| 2007 | 327 | 0.1331 | 0.1317 | Other food pro. | 15 | 187 | 0.1202 | 0.1777 |
| 2008 | 327 | 0.1360 | 0.1229 | Chemicals & pharma. | 37 | 407 | 0.1261 | 0.1812 |
| 2009 | 327 | 0.1241 | 0.1371 | Manufacturing | 26 | 286 | 0.1074 | 0.1353 |
| 2010 | 327 | 0.1184 | 0.1458 | Cement | 18 | 198 | 0.2041 | 0.2061 |
| 2011 | 327 | 0.1186 | 0.1473 | Other nonmetallic mineral products | 06 | 66 | 0.1721 | 0.1826 |
| 2012 | 327 | 0.1300 | 0.1648 | Motor vehicles, and auto parts | 20 | 231 | 0.1100 | 0.1302 |
| 2013 | 327 | 0.1267 | 0.1737 | Fuel energy | 14 | 154 | 0.1202 | 0.1066 |
| 2014 | 327 | 0.1314 | 0.1420 | Petroleum products | 9 | 99 | 0.0567 | 0.0478 |
| 2015 | 327 | 0.1193 | 0.1376 | Paper and others | 9 | 77 | 0.0903 | 0.0984 |
| | | | | Electrical machin. | 8 | 88 | 0.1697 | 0.1219 |
| Total | 3597 | 0.1268 | 0.1438 | | 327 | 3597 | 0.1271 | 0.1438 |
| Analysis of Variance | | | | Analysis of Variance | | | | |
| *F*-value | | | 0.6600 | *F*-value | | 8.4300 | | |
| Prob > *F* | | | 0.7297 | Prob > *F* | | 0.0000 | | |
| Critical *F*-statistic at the 0.05 significance level | | | 3.0302 | Critical *F*-statistic at the 0.01 significance level | | 4.6870 | | |

Critical *F*-statistic at the 0.05 significance level is 3.030248; Critical *F*-statistic at 1% significance level is 4.687072.

**Table 2. Descriptive analysis**

| Variable | Mean value | Standard deviation | Mini. value | Maxi. value |
|---|---|---|---|---|
| TCU | 0.1271 | 0.1438 | 0.0212 | 0.7986 |
| TCE | 0.1073 | 0.1128 | 0.0103 | 0.9865 |
| SBC | 0.2714 | 0.3440 | 0.0000 | 3.9511 |
| SG | 0.1547 | 0.3214 | −0.5737 | 0.9133 |
| PR | 0.0575 | 0.1581 | −0.6332 | 0.6132 |
| SIZ (Thousand Rs.) | 8,889,201 | 28,756,432 | 1,263 | 410,486,745 |
| ST | 0.1790 | 0.1196 | 0.0005 | 1.5937 |
| RLIQ | 0.4916 | 0.5771 | 0.02 | 2.82 |
| COLLA | 0.4773 | 0.2161 | 0.0462 | 0.8695 |
| FL | 1.683 | 1.9388 | −4.17 | 6.63 |
| DFIs | 0.23034 | 0.04883 | 0.1603 | 0.2873 |
| DFM | 0.2417 | 0.08631 | 0.1495 | 0.3725 |
| LR | 12.5852 | 1.7070 | 9.0716 | 14.5375 |
| CIS | 0.04844 | 0.02637 | 0.003 | 0.08 |

Source: Author self-calculation; No. of firms = 327; Years = 11; No. of firm year observations: 3597.
TCU: trade credit financing; $TCU_{t-1}$: trade credit used in year t-1. TCE: trade credit extended; SBC: short-term bank credit; SG: sales growth rate; PR: profitability of a firm; SIZ: size of a firm; ST: stock in trade; RLIQ: relative liquidity position; COLLAT: value of collateral; FL: financial leverage; DFI: depth of financial institutions; DFM: depth of financial market; LR: lending rate; CIS: credit information sharing.

Results of Harris–Tzavalis panel unit root test reported in Table 3 show that all independent variables included in the models are integrated of order zero and imply the absence of unit roots.

### *4.2. Empirical analysis and discussion*

For investigating the relationships of FD and CIS with TCU used by LMFs, we performed correlation and regression analysis.

**Table 3. Harris–Tzavalis panel unit root test for trade credit used**

| Variables | Rho statistics | *Z* | Order of integration |
|---|---|---|---|
| TCE | 0.4477 | −15.1221*** | 0 |
| TCU | 0.4606 | −14.3495*** | 0 |
| SBC | 0.5813 | −7.1126*** | 0 |
| SG | −0.0341 | −43.9959*** | 0 |
| PR | 0.2949 | −24.2798*** | 0 |
| SIZ | 0.3851 | −18.8718*** | 0 |
| ST | 0.4566 | −14.5871*** | 0 |
| RLIQ | 0.3248 | −22.4839*** | 0 |
| COLLA | 0.4818 | −13.0736*** | 0 |
| FL | 0.4208 | −16.7326*** | 0 |
| DFIs | 0.9346 | −7.0976*** | |
| DFM | 0.8917 | −11.7460*** | |
| LR | 0.5317 | −10.0886*** | |
| CIS | 0.1673 | −7.1171*** | |

****p < 0.01; **p < 0.05; *p < 0.10.*

#### *4.2.1. Correlation and VIFs analysis*

The coefficients of correlation presented in Table 4 show that the association of financial characteristics of firms with TCU is significant at the 0.05 level. Furthermore, the coefficients of correlation for all indicators of FD are significant at the 0.05 level. Results show that DFIs and DFM are positively associated with TCU. The findings are consistent with the complementary hypothesis. The negative coefficient of LR implies that with the increase in LR, firms decrease the use of trade credit. However, the small size of coefficients indicates weak association between the indicators of FD and TCU. Correlation between CIS and TCU is negative and insignificant at the 0.05 level. Correlation between CIS and TCU is negative and insignificant at 0.05 level of significance. It means that no clear relationship exists between CIS and TCU by firms. The insignificant association might be due to a couple of reasons. First, no public or private credit registry is maintaining the record about the overdue accounts of trade payables. Second, firms have a close relationship with their customers and needless to depend on credit information bureau.

Moreover a, high degree of association is observed only among DFI, DFM, and CIS. Results of VIF analysis reported in Table 4 shows the absence of high correlation among firm-specific financial characteristics. However, for the indicators of FD and CIS, VIFs' values are near to 10 and 1/VIF ratios are less than 0.30 that shows the presence of weak multicolinearity. Thus, in order to avoid multicolinearity, we included one indicator of FD at a time in one equation for estimating their effect on TCU by LMFs.

### *4.3. Regression analysis and discussion*

In order to investigate the effect of financial characteristics of firms, FD and CIS on TCU used by LMFs, we estimated the models 1–4, by applying system GMM (two-step) with 321 instruments and results are presented in Table 5. Results of the diagnostics test for system GMM estimations are reported in Table 5. Wald test shows that all estimated coefficients are jointly significant at the 0.01 level. Test of serial correlation AR (1) and AR (2) shows the absence of serial correlation at second order. It is a sufficient evidence for the validity of instruments and correct specification of system GMM. Furthermore, Hansen J statistic shows evidence of the validity of instruments used in two-step system GMM. To control the heteroskedasticity, robust option is used in each estimation. Industry dummies are found to have an effect on TCU used by firms but are not reported in Table 5 for the sake of brevity.

The results of models (1–4) show that the coefficient of first lag of TCU ($TCU_{t-1}$) is positive and significant at the 0.01 level. Consistent with the findings of Kwenda and Holden (2014), the coefficient for the first lag of TCU lies between 0 and 1, which shows that firms' policy for trade credit used is dynamic in nature. The results are consistent with the findings of Gibilaro and Mattarocci (2011). The coefficient for TCE is positive and statistically significant at the 0.01 level. The results are consistent with the findings of previous studies (for instance, Kwenda & Holden, 2014; Murfin & Njoroge, 2015). The positive relationship between TCE and TCU implies that firms follow maturity matching principle established by Morris (1976). Short-term bank credit used by firms is found positively related to TCU. The findings of this study support the complementary hypothesis of trade credit proposed by Burkart and Ellingsen (2004) and are consistent with the evidence reported by previous studies (Agostino & Trivieri, 2014; Giannotti, Gibilaro, & Mattarocci, 2011). Furthermore, results revealed that of financial characteristics[1] of LMFs used as a control variables that have significant impact on trade credit financing used by LMFs.

The results of models 1 and 2 show that DFI and DFM are positively related to TCU used by LMFs. The coefficients for DFI and DFM are significant at the 0.05 level and lead to the acceptance of $H_{a4}$ and $H_{a5.}$ The results are also in accordance with expectations, i.e. increase in financial depth causes increase in the supply of credit from the financial sector to nonfinancial sector. Resultantly, suppliers of LMFs supply more trade credit to them. Alternatively, LMFs receive more trade credit from their suppliers in response to increase in the DFIs and financial market.

**Table 4. Pairwise correlation matrix for trade credit used**

| Variable | TCU | $TCU_{t-1}$ | TCE | SBC | SG | PR | SIZ | ST | RLIQ | COLLA | FL | DFI | DFM | LR | CIS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TCU | 1 | | | | | | | | | | | | | | |
| $TCU_{t-1}$ | 0.788*** | 1.0000 | | | | | | | | | | | | | |
| TCE | 0.2855*** | 0.2311*** | 1.000 | | | | | | | | | | | | |
| SBC | 0.5849*** | 0.5028*** | 0.2146*** | 1.000 | | | | | | | | | | | |
| SG | −0.2476*** | 0.0123 | −0.1572*** | −0.1507*** | 1.000 | | | | | | | | | | |
| PR | −0.6026*** | −0.4924*** | −0.1990*** | −0.4138*** | 0.2230*** | 1.0000 | | | | | | | | | |
| SIZ | 0.7754*** | 0.6458*** | 0.3156*** | 0.5270*** | −0.2294*** | −0.4422*** | 1.000 | | | | | | | | |
| ST | 0.2896*** | 0.2030*** | 0.2265*** | 0.2729*** | −0.1223*** | −0.1986*** | 0.2805*** | *1.000* | | | | | | | |
| LIQ | −0.2185*** | −0.2009*** | 0.2767*** | −0.2350*** | −0.0213 | 0.3231*** | −0.0106 | −0.1375*** | 1.000 | | | | | | |
| COLLA | 0.1890*** | 0.1915*** | −0.1926*** | 0.1520*** | 0.0064 | −0.2873*** | 0.2338*** | −0.1514*** | −0.4023*** | 1.0000 | | | | | |
| FL | −0.1312*** | −0.1378*** | −0.0241 | 0.0093 | 0.0598*** | 0.0468*** | −0.1344*** | 0.0753*** | −0.2107*** | 0.0071 | 1.000 | | | | |
| DFIs | 0.0229*** | 0.0227*** | −0.0479*** | 0.0235 | 0.1209*** | 0.0581*** | 0.0015 | 0.0480*** | −0.0072 | 0.0758*** | 0.0664*** | 1.0000 | | | |
| DFM | 0.0241*** | 0.0090*** | −0.0583*** | 0.0122 | 0.1293*** | 0.0717*** | −0.0073 | 0.0359* | 0.0066 | 0.0740*** | 0.0493*** | 0.8914*** | 1.0000 | | |
| LR | −0.0228*** | −0.0134 | 0.0505*** | −0.0396* | −0.1199*** | −0.0856*** | −0.0010 | −0.0380** | −0.0213 | −0.0602*** | 0.0105 | −0.5495*** | −0.7291*** | 1.0000 | |
| CIS | −0.0111 | −0.0216*** | 0.0546*** | −0.0362* | −0.1817*** | −0.0870*** | 0.0045 | −0.0413** | 0.0011 | −0.0685*** | −0.0301 | −0.7940*** | −0.7895*** | 0.7503*** | 1.0000 |
| VIF | | 2.29 | I.41 | 1.64 | 1.29 | 1.72 | 2.52 | 1.29 | 1.720 | 1.49 | 1.12 | 7.64 | 10.02 | 3.28 | 2.93 |
| 1/VIF | | 0.4364 | 0.7096 | 0.6101 | 0.7753 | 0.5802 | 0.3970 | 0.7774 | 0.5802 | 0.6692 | 0.8893 | 0.1309 | 0.0997 | 0.3047 | 0.3418 |
| Mean VIF | 2.88 | | | | | | | | | | | | | | |

****p < 0.01; **p < 0.05; *p < 0.10..*

**Table 5. Effects of financial development and credit information sharing on TCU**

| Independent variables | Exp. sign | Effect of financial development | | | Effect of CIS | Acceptance/ rejection of hypotheses |
|---|---|---|---|---|---|---|
| | | Model 2 | Model 3 | Model 4 | Model 5** | |
| TCU $_{t-1}$ | + | 0.3697*** | 0.3692*** | 0.3686*** | 0.3702*** | |
| | | (0.0396) | (0.0394) | (0.0394) | (0.0395) | |
| TCE | + | 0.0631*** | 0.0653*** | 0.0652*** | 0.0631*** | |
| | | (0.0229) | (0.0232) | (0.0226) | (0.0229) | |
| SBC | ± | 0.0386** | 0.0387** | 0.0383** | 0.0387** | |
| | | (0.0174) | (0.0173) | (0.0173) | (0.0174) | |
| SG | +/− | −0.0564*** | −0.0566*** | −0.0551*** | −0.0565*** | |
| | | (0.0074) | (0.0074) | (0.0074) | (0.0074) | |
| PR | +/− | −0.1443*** | −0.1448*** | −0.1443*** | −0.1437*** | |
| | | (0.0260) | (0.0263) | (0.0264) | (0.0257) | |
| SIZ | +/− | 0.0487*** | 0.0487*** | 0.0489*** | 0.0486*** | |
| | | (0.0065) | (0.0065) | (0.0065) | (0.0064) | |
| ST | −/+ | −0.0070 | −0.0084 | −0.0065 | −0.0058 | |
| | | (0.0194) | (0.0191) | (0.0193) | (0.0192) | |
| RLIQ | + | −0.0268*** | −0.0273*** | −0.0272*** | −0.0265*** | |
| | | (0.0051) | (0.0052) | (0.0053) | (0.0051) | |
| COLLA | | −0.0394*** | −0.0407*** | −0.0389*** | −0.0381*** | |
| | | (0.0131) | (0.0133) | (0.0129) | (0.0131) | |
| FL | | −0.0026* | −0.0027* | −0.0024* | −0.0025* | |
| | | (0.0013) | (0.0013) | (0.0013) | (0.0013) | |
| DFIs | +/− | **0.0951*** ** | | | | Accepted |
| | | **(0.0288)** | | | | |

(*Continued*)

**Table5. (*Continued*)**

| Independent variables | Exp. sign | Effect of financial development | | | Effect of CIS | Acceptance/ rejection of hypotheses |
|---|---|---|---|---|---|---|
| | | Model 2 | Model 3 | Model 4 | Model 5** | |
| DFM | +/− | | **0.0885*** ** | | | Accepted |
| | | | **(0.0170)** | | | |
| LR | −/+ | | | **−0.4752*** ** | | Accepted |
| | | | | **(0.1169)** | | |
| CIS | − | | | | **−0.2632*** ** | Accepted |
| | | | | | **(0.1116)** | |
| Constant | | 0.0217** | 0.0240 *** | 0.1046** | 0.0591** | |
| | | (0.0101) | (0.0102) | (0.0185) | (0.0130) | |
| Wald chi2(9) Prob > chi2 | | 1675.69 (0.000) | 1652.18 (0.000) | 1500.62 (0.000) | 1646.77 (0.000) | |
| AR(1) first-order serial correlation of error term | | −3.98 (0.000) | −3.97 (0.000) | −3.97 (0.000) | −4.00 (0.000) | |
| AR(2) second-order serial correlation of error term | | −0.45 (0.656) | −0.46 (0.646) | −0.45 (0.656) | −0.44 (0.658) | |
| Hansen J statistic | | 320.94 (0.308) | 320.38 (0.302) | 322.92 (0.308) | 320.39 (0.316) | |
| No. of observations | | 2,943 | 2,943 | 2,943 | 2,943 | |

*Significant at level 10%; **significant at level 5%; ***significant at 1%.
Heteroskedasticity robust standard errors are reported in parenthesis. The annual time coverage for all the models is 2005–2015.

The results are consistent with the findings of Deloof and La Rocca (2015). The results also support the complementary hypothesis, i.e. firms receiving more credit from financial sector use more trade credit to maintain its proportion in their capital structure. As the study is focused on listed manufacturing which has access to multiple sources of funds, they prefer to use a mixture of funds instead of relying on a single source of capital. The results of model 3 revealed that the relationship between LR and TCU is negative and significant at the 0.05 level. It implies that $H_{a6}$ is true. The findings are in accordance with the expectations, i.e. increase in LR causes increase in the cost of funds and resultantly, suppliers of LMFs transfer fewer funds through trade credit. Furthermore, the findings of this study are also supported by complementary hypothesis. Thus, we establish that LR is a significant predictor of TCU in Pakistan. Surprisingly, we did not find empirical evidence in support of the negative relationship between LR and TCU.[2]

The results of model 4 show that the relationship between CIS and TCU is negative and significant at the 0.05 level. The findings are in accordance with the expectations, i.e. increase in CIS reduces the information asymmetry between borrowers and lenders, and facilitates the access of firms to bank credit. Thus, our findings confirm the $H_{a7}$. It implies that improvement in CIS increases the access of firms to bank credit (Brown et al., 2009) and resultantly, they use less trade credit. The results are consistent with the findings of Zhang (2011). He accentuated that improvements in CIS increase the availability of credit to LMFs and they need less to depend on trade credit.

## 5. Conclusion and recommendations

In order to investigate the impact of FD and CIS on the use of trade credit by LMFs in Pakistan, we used a sample of 327 manufacturing firms listed in PSX, Pakistan. We established that trade credit policy of firms is dynamic. The use of trade credit by firms is found sensitive to changes in the demand for trade credit by their customers, availability of short-term bank credit, their sales growth, profitability, creditworthiness, liquidity position, collateral, and financial leverage. In addition to financial characteristics of firms, level of FD and CIS are also observed influencing the TCF used by LMFs in Pakistan. The results show that FD increases the ability of suppliers to supply more credit to LMFs. Alternatively, we established that LMFs increase the use of TCU in response to increase in depth and efficiency of the financial sector in Pakistan. CIS has a negative impact on TCU by firms. It implies that improvement in CIS improves the access of firms to bank credit and they decrease the use of trade credit.

Findings of this study have significant implications. For instance, managers have the opportunity to make partial adjustments in the use of TCU over time for attaining its optimal level. While making adjustments in the trade credit policy, managers should consider their experience about past trade credit relationships with suppliers, demand for trade credit from their customers, availability of credit from banks, growth needs, profitability, liquidity position, collateral, and financial leverage. Moreover, results show that financial sector of Pakistan is less developed and is not playing its role of credit allocation efficiently. We recommend that managers should consider FD and improvements in CIS while making adjustments in their trade credit policy.

LMFs are found using and extending trade credit simultaneously, but this study focused only on the use of trade credit. Moreover, these firms play a significant role in credit redistribution in the less developed financial market. For future study, we suggest the investigation of the effect of FD on the credit redistribution behavior of firms.

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**Notes**

1. Sales growth, profitability, firms' size, relative liquidity position, collateral value, and financial leverage.
2. A number of previous studies found that TCU is positively related with LR (see, for example, Cull et al., 2009; Gertler & Gilchrist, 1993; Meltzer, 1960; Nilsen, 2002). These studies supported the substitution hypothesis and documented that due to increase in lending rate, firms increase the use of TCU as a substitute of bank credit.

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