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Does Trade Credit Channel Operate in Turkey? An Analysis with CBRT Sector Statistics

Türkiye'de Ticari Kredi Kanalı İşliyor mu? TCMB Sektör İstatistikleri ile Bir Analiz

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ABSTRACT

This paper aims to test trade credit channel in Turkey over the period from 2008 to 2016 using two data sets at sectoral level obtained from the aggregated accounts of Central Bank of the Republic of Turkey (CBRT) statistics. First sample consists of 7 main sectors and other sample involves 12 manufacturing-sub sectors. Dynamic panel data methods were applied to test whether monetary and nonmonetary factors of trade credit had an impact on both gross and net trade credit status. According to analysis results about trade credit received (gross), monetary policy restrictions has increased the trade credit usage of SME sized firm classes. Findings for net trade credit (net) showed that main-sectors medium sized firm groups became net trade credit receiver. These findings confirming substitution hypothesis conclude that trade credit channel has operated with the strongest effects on SME firms.

Key words: trade credit channel, trade credit, credit channel

JEL Classification: E44, E52, G32.

ÖZET

Bu çalışma, Türkiye Cumhuriyet Merkez Bankası (TCMB) istatistiklerinin toplam hesaplarından elde edilen sektör düzeyinde iki veri setini kullanarak, 2008'den 2016'ya kadar olan süreçte Türkiye'de ticari kredi kanalını test etmeyi amaçlamaktadır. İlk örneklem 7 ana sektörden ve diğer örneklem 12 imalat alt sektöründen oluşmaktadır. Ticari kredilerin parasal ve parasal olmayan faktörlerinin hem brüt hem de net ticari kredi durumu üzerinde bir etkisi olup olmadığını test etmek için dinamik panel veri yöntemleri uygulanmıştır. Alınan ticaret kredisi (brüt) ile ilgili analiz sonuçlarına göre, para politikası kısıtlamaları KOBİ ölçekli firma sınıflarının ticari kredi kullanımını artırmıştır. Net ticaret kredisi (net) için bulgular, ana sektör orta ölçekli firma gruplarının net ticari kredi alıcısı olduğunu göstermiştir. İkame hipotezini doğrulayan bu bulgular, ticari kredi kanalının, en güçlü etkisi KOBİ firmaları üzerinde olmak üzere, faaliyet gösterdiği sonucuna varmıştır.

Anahtar Kelimeler: ticari kredi kanalı, ticari kredi, kredi kanalı

To explain the way how monetary policy stance affects spending, borrowings and consequently the entire economy, two basic approaches known as money channel and credit channel have been suggested. In money view (or interest rate view), monetary authorities strive to control aggregate demand and production level by basically changing money market interest rates to alter the cost of capital (Bernanke & Gertler, 1995: 27; Hong, 2017: 40). Money view disregards the financial sector and the role of bank assets (bank loans), while the credit view accepts the importance of credit market imperfections and bank loans in the monetary policy transmission (Nilsen, 2002: 226). Financial market imperfections that lie under the credit view can magnify the influence of monetary policy impulses via two channels known as balance sheet channel and bank-lending channel. The balance sheet channel emphasises the importance of borrower's financial strength as the basic factor to be affected from the monetary policy innovations, whereas the bank-lending channel stress the way how monetary policy shocks influence the bank loan supply (Bernanke & Gertler, 1995: 35; Atanasova & Wilson, 2003: 505; Hong, 2017: 4-5) and then borrowers separately from

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the cost of capital. Bank-lending channel posits that contractions in bank loans in the periods of monetary restraint force the bank-dependent firms (firms that are dependent on bank loan as most preferable external finance) to cut back spending regardless of interest rate (Nilsen, 2002: 248; Bernanke & Gertler, 1995: 35-40; Hong, 2017: 32-37). Therefore, bank-lending channel have usually the most severe effect on bank dependent borrowers (Atanasova & Wilson, 2003: 505). Trade credit as a substitute fund source may provide a solution to the liquidity shortages of bank dependent firms especially under the conditions of the intensive credit rationing or high premium on external finance[1] (Guariglia & Mateut, 2006: 2836) during economic downturns.

Trade credit received (TCR) means payables to suppliers; trade credit extended (TCE) shows the receivables from customers (Brechling & Lipsey, 1963: 620). TCR, TCE, and their changes are expressed as gross trade credits (GTC) whereas the net difference between them is called net trade credits (NTC). Movements in both gross and net trade credits may serve as a tool to frustrate the workings of monetary policy (Brechling & Lipsey, 1963; Chiplin & Wright, 1985: 221). Meltzer (1960) highlighted the trade credit role in the credit channel and firstly proposed that trade credit may work as a mechanism to offset bank-lending channel by serving as a substitute for bank loan (De Blasio, 2003; Nilsen, 2002; Guariglia & Mateut, 2006; Gama & Auken; 2015). According to the Meltzer's (1960) suggestion, small firms can make greater use of trade credit to overcome bank credit rationing during monetary contraction periods and this part of his suggestion may more relate to hypothesis known as substitution theory. Besides substitution theory, Meltzer (1960) also suggests the redistribution hypothesis meaning that trade credit should flow from larger firms to small firms. Larger firms are more liquid, less credit constrained and high access to credit market, whereas smaller firms are less liquid, more credit constrained and low access to credit market (Meltzer, 1960). Redistribution theory suggests that unconstrained firms that can readily access to bank credit will offer loans received, as trade credit, to credit rationed firms (Hong, 2017: 216) without ability to access to bank credit and with greater default risk, in order to maintain their own sales volume by helping customers with relaxed accounts receivable terms. With these features, trade credit may play a buffer role for credit channel and more generally may frustrate the monetary policy implications (Meltzer, 1960). Literature developed and used different terms that are based on Melzer's (1960) idea such as trade credit channel (TCC), trade credit offsetting effect, substitution hypothesis, redistribution or reallocation hypothesis, complementarity hypothesis and, helper theory.

Bond, equity and commercial paper markets as an alternative financing source are weak while bank loans and trade credits are dominant in financial structure of firms in Turkey. According to 2016 company accounts of CBRT, bank loans make up 32.2%, TCR from suppliers (trade debt) accounts for 13.8%, financial leasing takes percentage of 2.6% and other financial liabilities including bond, equities and commercial paper constitute only 1.5% of all sources. TCE (trade receivables) constitutes 16% of Turkish firms' assets. In spite of the critical role of inter-firm trade credit as the best alternative to bank loan, it is noticed that existence and operation of trade credit offsetting channel has not been adequately researched with Turkish data so far. Özlü and Yalçın (2012) directly investigated the TCC at the manufacturing firm level with gross trade credit terms using static panel data between 1996 and 2008. Without directly dealing with TCC, two papers (Demirgunes, 2016; Şahin, 2018) examined the trade credit determinants and theories on the data sets from Borsa Istanbul. The purpose of this paper is to examine TCC in Turkish real sector in terms of both GTC and NTC terms using dynamic panel data method on sectoral level samples. Because TCC operates mostly through bank-dependent (financially constrained) firms and small firms are most likely to be accepted as severely reliant on bank loans and as financially constrained (Gertler & Gilchrist, 1994: Atanasova & Wilson, 2003; Özlü & Yalçın, 2012:106) small firms (sector aggregations of small sized firms) are the centre of this study. Therefore, this paper aims to find out whether bank-dependent small firms have increased their trade credit usage in the wake of monetary contraction.

Trade Credit Channel and Literature Review

Trade credit provided by vendors as a short-term fund to finance purchases of customers (Nilsen, 2002: 228) is an inevitable source of finance (Chiplin & Wright, 1985: 221) and a key component of most company's activities (Gama & Auken, 2015: 888) allowing firms to borrow from each others. Suppliers are willing to grant trade credit as a relatively cheaper way of promoting sales when credit rationing decreases the demand for products during tight money periods (Meltzer, 1960: 429 - 431). Meltzer's (1960) argues that financially constrained firms substitute bank credit with trade

credit by lengthening TCR or squeezing TCE, following a tight period (De Blasio, 2003: 85). Therefore, when bank loans become rationed, expensive and not readily accessible to firms that are reliant on bank credit, these bank-dependent firms can maintain their real activities up to a level to which they can obtain trade credit. Due to the presence of TCC, impact of a monetary restriction may be weakened (Guariglia & Mateut, 2006: 2837) and a single firm can frustrate monetary policy by using NTC to finance its current activity level that would have been constrained with a restrictive monetary policy (Brechling & Lipsey, 1963: 627).

The Meltzer's (1960) intuition also suggests that trade credit imperfectly substitutes bank loans and plays a complementary sources of financing (Gama & Auken, 2015: 889) when loan constraints are imposed by financial institutions (Carbo-Valverde, Mansilla-Fernandez & Rodriguez-Fernandez, 2017: 25). Trade credit can be engaging but it also has some repellent sides. Prompt payment discounts and strict penalties for defaults cause trade credit to be more expensive than bank borrowings (Petersen & Rajan, 1997: 688). Despite the higher trade credit cost that makes it a less desirable external finance alternative to bank loan, corporations would still be willing to use this more expensive short-term financing and to make more usage when they face restrictions (Petersen & Rajan, 1997; Atanasova and Wilson, 2003; Mateut, Bougheas & Mizen, 2006; Guariglia & Mateut, 2006: 2837; Hong, 2017).

We might list three underlying factors behind the trade credit becoming attractive. First of all, monetary contractions do not increase the cost of trade credit as bank credit (Kohler, Britton & Yates, 2000: 10), delinquencies in accounts payables may be less costly (Chiplin & Wright, 1985: 223) and trade credit terms are likely to maintain the same level over time (Ng, Smith & Smith, 1999: 1128). Therefore, trade credit as the best option for bank credit (Fisman & Love, 2003: 373) may remain relatively cheaper for some firms (Atanasova & Wilson, 2003: 505). Secondly, trade credit appears to alleviate the information problems (Gama & Auken; 2015: 887) and lower the risks of trade credit suppliers than risk incurred by financial institutions (Guariglia & Mateut, 2006: 2837). Sellers have some advantages in lending over financial institutions through business relationships. Trade credit extenders have greater ability to collect current information, to monitor repayment and early-payment discount acceptance behaviours, and so to evaluate financial strength quickly, to enforce repayment, to apply precautions for defaults and to liquidate the goods sold which is a kind of collateral for vendors (Petersen & Rajan, 1997: 688; Kohler et al., 2000: 9-10). Furthermore, and as the third factor, from the profit maximizing perspective, suppliers' interests extend beyond financial institutions because they benefit from the survival of their customer relationships (Gama & Auken, 2015: 899). Future business potential in case of ongoing transaction with customer leads suppliers to finance suspect but growing firms via granting trade credit (Petersen & Rajan, 1997: 688). To conclude, owing to these costs and information advantageous over banks, vendors can adjust credit terms both for themselves and borrowers and therefore trade credit becomes the optimal external financial choice for financially constrained firms (Mateut et al., 2006, 622-627).

The structures of industries and corporations are important factors that shape their responses to monetary impulses and it is obvious that wide variations exist across different industries (Arslan & Ergeç, 2011: 90). The economy-wide total volume of NTC may remain stable because total lenders should equal total borrowers in the absence of foreign flows. However, from the sectoral viewpoint, NTC varies per sector. Some can be net receivers whereas the others can be net extenders. That is why reactions of industries to monetary policy shocks may differ from each other (Chiplin & Wright; 1985: 221). Ng et al. (1999) concluded from the survey applied to 950 US firms, that credit terms and policies differ greatly across industries while tend to be similar within the same industry. Various buyer characteristics and non-salvageable (sunk) investment requirements in industries contribute to these differences (Ng et al., 1999: 1127-1128). Dai and Yang (2015), included industry dummies while Chiplin and Wright (1985) presented regression results run for each industry in their firm-level analyses. Herbst (1974) studied on one sector and emphasized the need for empirical reports at firm or industry level.

Reviewed literature that analyse monetary policy and trade credit relations is presented according to the economies where study is conducted and a summary of them is shown at the Table 1. Meltzer (1960) investigated the trade credit behaviour of US manufacturing companies as response to the tightened monetary conditions of 1955-1957. By directly relating the money market policy to liquidity position of different size groups, Meltzer (1960) finds a reduction in liquidity level of sample firms and an increase in the bank

credit level. Large firms with easy access to bank and non-bank funds and with greater liquid assets reallocate assets towards accounts and notes receivables. According to the author, the main purpose of trade credit extension at tight periods is to avoid losses from price reduction and to overcome sales decreases. As a usual result of tight monetary controls, discrimination through credit rationing against small firms can be limited by lengthening trade credit terms (Meltzer, 1960). For the US market Meltzer's (1960) hypothesis was confirmed by Laffer (1970), Schwartz (1974), Nilsen (2002) and Choi and Kim (2003), partly supported by Herbst (1974) and Petersan and Rajan (1997), while totally rejected by Nadiri (1969) and Walker (1985).

The findings of Laffer (1970) who theoretically and empirically examined the unutilized trade credit available as a component of the total money stock, signalled the substitution between bank money and trade credit money. Laffer (1970) stated that being a close substitute for bank money and not being subject to regulations made trade credit a tool to largely avoid the policy implications to change bank money. Schwartz (1974) who mainly investigated the factors that explain differing trade credits terms between firms, sectors and time, presented results for monetary policy effect on trade credit. Schwartz (1974) indicated that small firms and unrated large firms both suffering from credit constraints met their loan demand by trade credit as the propitious but costly and unfavourable substitute credit during tight monetary episodes. These findings revealed that large firms with the advantage of financing motive were able to ease the effects of tight policies by extending trade credit terms. Nilsen (2002) revealed the irrelevance of firm size by providing evidence about increased trade credit usage of non-credible large firms that have no bond rating. Comparing quoted large firms with non-quoted small firms, Choi & Kim (2003) confirmed substitution effect of trade credit following higher interest rate and supported smoothing effect of trade credit on credit contraction. In their study, inter-firm liquidity flowed more actively but as a contrary to redistribution theory, liquidity mainly flowed to larger firms from smaller firms.

Focusing on trade credit determinants of the U.S. lumber and wood products industry, Herbst (1974) found no direct monetary influences on accounts payables but reported that higher current obligation of long-term bank loans may force firms to rely more on trade credit. Petersan and Rajan (1997) studied the determinants of trade payables and receivables with a broad SME sample for U.S. Although authors didn't directly relate monetary indicators with accounts payable, their result suggesting that small firms made a higher usage of vendor financing when financial institutions constraint credits might provide a partially support for the Meltzer's (1960) hypothesis. Nadiri (1969) found no evidence that accepts the reaction of manufacturing sector to the inflationary pressures by supplying trade credit to other sectors. In a profit maximization model while gross and net credits react to changes in their user costs, NTC seems to be insensitive to monetary policy stance (Nadiri, 1969: 421). Walker (1985), who surveyed the role of trade credit supply in SME financing with 27 firms' questionnaires, stated that besides other findings, trade credit had been relatively insensitive to interest rate changes, recession and recovery periods in related years.

Apart from Chiplin and Wright (1985) almost all trade credit researchers, involved in this study (Brechling & Lipsey, 1963; Kohler et al., 2000; Mateut & Mizen, 2003; Atanasova & Wilson, 2003, Mateut et al., 2006; Guariglia & Mateut, 2006; Hong, 2017), investigating the existence and magnitude of TCC for the UK concluded that monetary restrictions boosted the trade credit level of UK firms. With analysis of 18 industries, Chiplin and Wright (1985) showed that while inter-industries differences existed, monetary policy generally seemed to neutralize them and eliminated the balancing effect of NTC on tight politics. Brechling and Lipsey (1963) suggested that NTC rather than gross credit had a very strong potential to frustrate monetary policy and to be a source of inflationary finance. In addition, NTC signalled the redistribution of cash balances from those firms having them to those firms in need of them. Kohler et al., (2000) confirmed the argument of TCC reporting that, after tight times, publicly held UK firms became a net extender and helped bank-dependent firms to whom capital market funds are not readily available. The findings of Mateut and Mizen (2003) in absolute and relative terms, in the wake of stringent money conditions, supported indirectly that bank-lending channel operated and trade credit could offset the monetary policy implications to some degree in the UK. They indicated that vendor financing was an important short-term external source alternative of credit constrained firms (typically small, young and risky firms).

Atanasova and Wilson (2003) confirmed strongly smoothing effect of TCC showing that during mone-

tary restraints, rationed companies in UK requested trade credit, although it is an unattractive/expensive substitute, far greater than un-constrained firms did. Mateut et al. (2006) observed that, by modelling and empirically analysing UK manufacturing firms, tightened monetary policy had a reducing effect on bank loans, but mid-wealthy (mid credit rating) small firms with few assets, financed their project by trade credits. They suggested that any increase in interest rate would raise threshold wealth level for both bank loan and inter-firm credits, but bank-lending volume decreased more than trade credit because firms suffering from the decreasing bank loan resorted to trade credit. Based on investment equation Guariglia & Mateut (2006) verified both credit channel and TCC offsetting effect. More recently, using UK's SMEs, Hong (2017) analysed credit rationing and interactions between monetary implications, financing mix and trade credit usage for borrowing constrained firms. The author tested substitution hypothesis from the perspective of trade credit users, and tested redistribution theory from the side of trade credit grantor and supported both theories. Estimates revealed that credit-constrained firms substituted greatly bank loan with trade credit whereas credit-unconstrained firms were more willing to redistribute bank loan by supplying trade credit to constrained firms.

Using data from Italy (De Blasio, 2003; Marotta,1997), from Turkey (Özlü and Yalçın, 2012), from China (Dai &Yang, 2015), from Portugal (Gama & Auken, 2015), from Spain (Carbo-Valverde et al., 2017), and from multi-country samples (Fisman & Love, 2002; Saiz, Azofra, Olmo & Gutierrez, 2017), 8 articles analysing the real sector trade credit reaction to economic downturns have come to the similar conclusion that TCC operates in other countries the same way as in the US and the UK. For Italian case, examining the Italian manufacturing firms' inventory behaviour De Blasio (2003) approved TCC with findings suggesting that the restrictive effect, with a modest magnitude, of the trade credit availability on inventory investments was as twice as powerful in the periods of monetary contractions. Besides, substitution effect was more likely relevant to small firms and firms having less collateralizable assets. Evidences of Marotta (1997) documented redistribution hypothesis worked but in the opposite direction in which trade credit flows to larger firms, meaning that trade credit did not behave as a shield for small firms to protect them from monetary restrictions.

Gama & Auken (2015) examined the bank loan and trade credit interrelationship focusing on the holdup problems and credit constraints caused from the monopolistic power of a single main bank on Portuguese SME. Their findings suggested that some advantages of suppliers over banks allowed them to provide interest rate more competitive than main banks and trade credit became a solution to customers lacking liquidity. Findings of Dai & Yang (2015) for China showed that the positive relationship of accounting conservatism with trade credit was more powerful under strict monetary conditions when the need for conservative accounting to decrease information asymmetries raised. Using Spanish firm level data, Carbo-Valverde at al. (2017), concluded that in spite of increasing cost of trade credit after restrictive monetary policy, firms were still likely to become more trade credit users. While rising interest rates motive large firms to being trade credit lenders, financial crisis turns their behaviour towards being trade borrower. Crisis effect is more pronounced for SMEs that are strongly reliant on the trade credit especially during crisis in which cuts in bank lending is seen. According to their findings, restrictive policy narrows the cost distance between bank borrowing and trade credit and this result, the opposite of substitution effect, is expressed as complementary hypothesis. Fisman and Love (2002) provided country and industry level evidence for Meltzer's suggestion on a sample of 43 countries and 37 industries. They argued that in countries with poorly developed financial markets, firms financed growth by trade credit and industries heavily reliant on trade credit grew more rapidly. Saiz et al. (2017) who investigated the relation of sovereign risk with trade credit by taking the crisis and monetary contractions into consideration for non-financial firms from 12 Eurozone countries, has documented restrictive monetary stance raised the trade credit payables in lower sovereign risk countries.

Özlü and Yalçın (2012) offered supporting evidence for the trade credit offsetting effect for Turkey with a manufacturing firm level data set over 1996-2008. They documented that small firms were more prone to be credit constrained and these constraints were stronger at tight periods. Thus financially constrained firms, defined as small firms with low export sales, substituted trade credit for bank loan during hard times. Moreover, because trade credit flowed from large manufacturing firms (not bank loan constrained) to small ones, findings also confirmed the redistribution hypothesis. In addition, for Turkey trade credit markets,

Demirgunes (2016) investigated the determinants of TCR (accounts payable) for 10 publicly held SMEs between 2008-2015 and Şahin (2018) studied determinants of TCE (accounts receivable) and analysed the validity of three trade credit theories on the 23 firms from Borsa Istanbul with 2016 data.

Table 1: Trade Credit Channel, Literature Review Summary

	Paper	Country, Model, Data, Period	OE
1	Meltzer, 1960	US, man. industry, 1955-1957	Yes
2	Brencling & Lipsey, 1963	UK, Model + 75 firms, 1950-1959	Yes
3	Nadiri, 1969	US, man. industry, 1949-1964	No
4	Laffer, 1970	US, Model +1946-1966	Yes
5	Scwartz, 1974	US, Model	Yes
6	Herbst, 1974	US, one industry, 1956-1966	Partly
7	Walker, 1985	US, 27 firms, survey	No
8	Chiplin & Wright, 1985	UK, 915 firms, 1970-1977	No
9	Petersen & Rajan, 1997	US, 3404 SME 1987	Partly
10	Marotta, 1997	Italy, 1982-1993	Partly
11	Kohler et al., 2000	UK, 2000 firms, 1983-1995	Yes
12	Nilsen, 2002	US, aggregate + man. firms, 1959-1992	Yes
13	De Blasio, 2003	Italy, 3862 man. firms, 1982-1999	Yes
14	Mateut & Mizen, 2003	UK, 16,000 man. firms, 1990-1999	Yes
15	Atanasova & Wilson, 2003	UK, 639 firms, 1989-1999	Yes
16	Choi & Kim, 2003	US, 1975-1997 659 S&P + 689 non-S&P firms	Yes
17	Fisman & Love, 2003	43 countries, 37 industries	Yes
18	Mateut at al., 2006	UK, Model +16,000 man. firms, 1990-1999	Yes
19	Guariglia & Mateut, 2006	UK, 609 man. firms, 1980-2000	Yes
20	Özlü & Yalçın, 2012	Turkey, 5,655 man. firms, 1996-2000	Yes
21	Dai & Yang, 2015	China, 1880 firms, 2003-2012.	Yes
22	Gama & Auken, 2015	Portuguese, 468 SME, 1998-2006	Yes
23	Carbo-Valverde at al., 2017	Spain, Model +, 13,364 firms, 1998-2009	Yes
24	Hong, 2017	UK, 700,591 SME, 1991-2010	Yes
25	Saiz et al., 2017	12 Eurozone countries, 45,864 firms, 2005-2012	Yes

Note. Among the 25 examined TCC studies, 19 studies provided supporting evidence for Meltzer's (1960) TCC theory, whereas three of them confirmed partially and three ones found no evidence for trade credit offsetting effect. Nine of these studies were carried out in the US, eight in the UK, six in the other nations' markets (one in Turkey) and two in the cross-country samples. OE implies the existence of offsetting effect of trade credit on bank credit channel or more generally on restrictive monetary policy. Man. denotes manufacturing. In the third column Model refers to hypothetical model.

Methodology

Some researchers demonstrated that bank-lending channel and trade credit channel worked through restricted bank loan supply to bank-dependent (credit or financially constrained) firms. Since size is inversely related to the information opaqueness and inability to access credit market, small size firms are more likely to be accepted as bank-dependent firms (Gama & Auken; 2015: 892-893; Guariglia & Mateut, 2006: 2836). There has been consensus on that tight-money periods further enhances large and small firm diversity (Bernanke & Gertler, 1995: 39). Therefore, testing TCC through trade credit usage of small firms when monetary policy tightens (Nilsen, 2002: 228) seems appropriate. Following the previous literature, we tested TCC by examining two relationships, firstly between short-term interest rates and trade credit usages and the second relationship is among bank loan and trade credit usages. TCR and NTC, proxy for trade credit usages and constitute dependent variables. We regressed the trade credit variables on lags of themselves, financial variables (monetary policy indicators and bank loan) and other trade credit control variables. The dynamic panel model was applied on the 2 sector-level panel data set, derived from the CBRT databases, 7 sectors (main sectors sample) and 12 manufacturing sub-sectors (sub manufacturing sample), in Turkey over the period of 2008-2016. This section explains sample and variable set constructions, provides rationales for the methodology followed and presents the analysis results.

Sample

Industry level aggregated figures of financial tables and ratios were obtained from real sector statistics of CBRT we think as the only available and most comprehensive data source for particularly non-publicly held companies in Turkey. Since 1992, CBRT have been reporting company accounts and selected financial ratios of real sector firms set for three-year periods, aggregated based on main sector, sub-sector, scale and years. From the reporting year 2011 (including 2008-2009-2010 years), a different economic activity classification for sectors have been adopted. In CBRT database, the size classes are determined by "net sales" and "asset size" criteria[2]. Adhering with the data methodology of CBRT statistics, to ensure the data continuity, periods during which a different economic activity classification had adopted were excluded, and sectors for which aggregated data for size groups are not available were dropped. In this way, we identified

7 main sectors and 12 sub-manufacturing sectors that provide periodic data from 2008 to 2016. The analysis based on the CBRT company accounts 2011 (covering 2008-2009-2010), CBRT company accounts 2014 (covering 2011-2012-2013) and CBRT company accounts 2017 (covering 2014-2015-2016). Taking averages of the number of companies included company accounts release periods, we developed two tables shown in Appendix to clarify the sample structure. Concerning the number of companies, selected sector sets comprise to approximately 85% of all CBRT company accounts. Samples made up of relatively small and non-quoted firms. Main sector sample consists of small firms accounted for 49% and medium firms made up 35%, publicly-held company percentage[3] is %2. Similar size pattern exists for manufacturing sub-samples with small and medium sized firm that accounted for about 82 percent (www. tcmb.gov.tr).

Variable Construction

Almost all variables are in ratio formation[4] and scaled by total assets as done in Petersen and Rajan (1997), Dai and Yang (2015), Hong (2017) and Gama & Auken (2015). Ratios directly taken from the CBRT ratio reports reflect aggregated accounts rather than arithmetic mean of the individual ratios. Remaining ratios were calculated from related balance sheet and income statement accounts. Table 2 shows the names, abbreviations and calculations for variables of the analysis.

Table 2: Analysis Variables

Variable	Abbreviation	Formula
Trade Credit Received	TCR	(Accounts Payable/Total Assets) (%)
Net Trade Credit	NTC	(Accounts Payable- Accounts Receivables)/Assets %
Lagged Trade Credit Received	LTCR	One lagged value of TCR (%)
Lagged Net Trade Credit	LNTC	One lagged value of NTC (%)
Growth in Purchases	GROWP	$[(COGS_t - COGS_{t-1})/COGS_{t-1}]$ (%)
Inventory Level	STOCK	Inventories/Total Assets (%)
Internal Reserves	INTRES	Reserves from Retained Earnings / Total Assets (%)
Bank Loan	BANK	Bank Loans / Total Assets (%)
Policy Interest Rates	POIR	Average Annual Policy Interest Rates (%)
Overnight Interest Rates	ONIR	Average Annual Overnight Interest Rates (%)

Note. COGS imply cost of goods sold.

Trade credit variables

Trade credit is a comprehensive term used to express delayed payments for purchases among firms[5]. Dependent variables of this analysis are TCR and NTC. TCR is determined as the accounts payable as a percentage of total assets of industries. This ratio may represent the firms' demand for trade credit funds as in Petersen and Rajan (1997) and Hong (2017) or the credit extended to the firm by its suppliers (if there is any supplier information) (Petersen & Rajan, 1997: 667-668). Fisman and Love (2003), Nilsen (2002), Atanasova and Wilson (2003) use TCR to test conventional bank lending channel and trade credit channel too. The difference between TCR and TCE as a percentage of assets equals to NTC. Positive NTC means that the sector is a net trade credit receiver and negative NTC reflects net trade credit extender. NTC produce insight about joint or complete effect of TCR and TCE to ease the monetary pressure and verify findings[6]. Meltzer (1960), Brechling and Lipsey (1963), De Blasio (2003), Petersen and Rajan (1997), Kohler et al. (2000), Guariglia and Mateut (2006), Carbo-Valverde et al. (2017) define and measure net trade credit position.

Financial variables

Monetary policy indicator (MPI) and bank loan are classified as financial or monetary variables. However, in the empirical analyses determining a suitable MPI may be a whopping difficulty (Chiplin & Wright, 1985: 225) and different indicators proxy tighter monetary policy in the recent literature (De Blasio, 2003: 89), many researchers have used interest rate or some weighted measure of it as MPI (Nadiri, 1969: 413). Reilly and Sarte (2010) showed that for most interest rate time series over 1991 and 2009, common movements in interest rates highly reflected the monetary policy settings determined by federal funds rate. Many paper examined have utilized several type of short-term money market rates[7] directly or combining them with other monetary policy factors in a monetary policy stance index and some of them rely on predetermined tight dates[8]. Changing short-term interest rates as the monetary policy tool have been growing in importance. During transition year of 2005 and the following implementation periods, short-term interest rates have been used as a main policy instrument in Turkey (www.tcmb.gov.tr; CBRT 2005 annual report, 2006: 73-74; Eroğlu, 2009: 25; Aklan & Nargeleçekenler, 2008; 111). In this paper following the literature and CBRT monetary policy regimes in recent years[9], two short term interest rates, as policy rates and overnight rates,

were used in order to proxy tight and loose money periods. First MPI is the annual average of lending policy rates set by the CBRT as the one-week repo rate (www.tcmb.gov.tr). Annual average of lending overnight interest rates that have a 97.8% correlation[10] with policy rate is alternative MPI to verify robustness. These two MPI entered in the regressions with one period lag[11].

The ratio of bank loan over assets (BANK) is second financial variable as proxy for reduced bank loan accessibility during credit constrictions. A negative relationship between bank loan and TCR or NTC, especially for small firms, indicate that substitution hypothesis hold or trade credit channel operate. The bank loan scaled by either assets or short or long-term liabilities have been analysed in literature[12]. Dai & Yang (2015) use bank ratio to test financing substitution theory (or alternative financing theory) stating that lower bank loan raise trade credits. Guariglia & Mateut (2006) define bank loan ratio to represent bank loan dependency (level of being financially constrained). In the analysis of Gama & Auken (2015) trade credit to total debt ratio represents the bank credit or trade credit dependency. Mateut et al., (2006) and Saiz et al. (2017) expect a decline in bank loan while expecting an increase in trade credit received during tight periods, focusing on stronger effect for small firms that lack bank credit access. In consistent with the intuition of substitution hypothesis, bank loan that can be substituted with trade credit, is an influencing factor for gross or net trade credit.

Control variables

To capture the non-financial (non-monetary) factors that have ability to influence trade credit, dependent variables are regressed on the ratio of lagged trade credit variable (LTCR and LNTC), inventories (STOCK), retained earnings reserves (INTRES) as a proportion to total assets and on purchases growth rate (GROWP).

As in some other researches (Chiplin & Wright, 1985; Kohler et al., 2000), lagged ratio of trade credit (gross or net) is added to the regressions. The relationship between TCR (NTC) and LTCR (LNTC) intends to control for the industry specific intensity in trade credit usage. Trade credit ratio indicates the degree of reliance on trade credit by showing the asset proportion financed by trade credit (Gama & Auken, 2015: 892). Industries with intensive trade credit utilization are more subject to the consequences of bank loan constraints (Chiplin & Wright, 1985: 225). The higher the usage of trade credit historically in an industry, the stronger the positive relationship will be for that variables. As done in Chiplin and Wright (1985), the high correlations between TCR (NTC) and its one-period lagged amounts[13] prove that lagged values has an explanatory power but are not just critical factors.

As one of the fundamental financial relationship, TCR (TCE) is the product of sales (purchases) and credit period (Brechling & Lipsey, 1963: 620-622; Herbst, 1974: 379). Sales increases raise the firms' demand for credit (Petersen & Rajan, 1997: 683), thus, sales level (Nilsen, 2002; Kohler et al., 2000) or growth in sales level (Saiz et al., 2017) may explain the trade credit motive. From the borrower side, higher growing firms will need more TCR to finance growth (Marotta, 1997; Atanasova & Wilson, 2003; Gama & Auken, 2015; Saiz et al., 2017) and from the supplier side, growth opportunities will be more attractive to vendor financing (Dai & Yang, 2015). Growth rate in purchases of industries between two consecutive years serve as control variable to reflect this relationship. Based on the similar assumptions made by mentioned researchers, we expect *GROWP* will motive TCR.

STOCK variable is the ratio among inventory over total assets. Firms with high current assets demand significantly more trade credit (Petersen & Rajan, 1997: 684). The more a firm carry inventories, the greater are the requirements of short-term funds and trade credit. In addition, while inventory provides relatively liquid collateral in bankruptcy, greater inventory stock will attract suppliers to grant trade credit (Guariglia & Mateut, 2006: 2838; Saiz et al., 2017: 44-45). Therefore, stock level proportioned to assets (Saiz et al., 2017) or sales (Nilsen, 2002) is one of the trade credit determinants that is expected to relate dependent variables positively.

INTRES, the ratio of reserves from retained earnings to total assets is also included in the analysis to control for internal funds availability of industries. As an indicator of the strength to produce funds internally, literature[14] has used different ratio formations in which cash flows or profits became numerator. Meltzer (1960) states that firms generate finance from their liquid assets as a response to a tight monetary policy (Nadiri, 1969: 413). Petersen and Rajan (1997), Dai and Yang (2015), Gama and Auken (2015) and Saiz et al. (2017) expect a negative relation between internal reserves and TCR in consistency with the pecking order theory. Pecking order theory suggest that low-cost and low risk internal funds should take

the first order in the hierarchy of financing sources therefore firms with strong internal reserve (or having high liquidity) demand less trade credit (Kohler et al., 2000). By expecting the negative relation, Gama & Auken (2015) focus on the greater funds needs of liquidity-constrained firms. However, according to the Nilsen (2002) who relate trade credit to cash position positively, cash-rich but credit-constrained firms that are obligated to hold cash by precautionary needs, react to inventory shock with increasing trade credit usage. Kohler et al. (2000) also argue that the liquidity may attract more trade credits. Following the pecking order view, we predict that lower internal reserves may raise the usage of trade credit.

Related category, brief descriptions of all variables and their expected relationship with dependent variables are summarized in Table 3.

Table 3: Variable Groups and Expected Signs

Variable Group	Variable	Brief Description	Expected Sign
Dependent Variables	TCR	Gross trade credit	
	NTC	Net trade credit	
Financial Variables	BANK	Bank credit accessibility	-
	POIR	Monetary policy indicator	+
	ONIR	Monetary policy indicator	+
Control Variables	LTCR	Sectoral reliance on TCR	+
	LNTC	Sectoral reliance on NTC	+
	GROWP	Growth in purchases	+
	STOCK	Stock level to finance	+
	INTRES	Internal funds availability	-

Method

Since one period lagged dependent variable enter in the regressions as one of the regressors, analysis relationship characterized as dynamic and autoregressive model can be illustrated as in the first equation (Baltagi, 2005: 135; Tataoğlu, 2012: 65-66). When we apply this simple dynamic/autoregressive model to our variables, in broad terms, 2nd equation for TCR and 3rd one for NTC are set. 4th and 5th equations expanded with explanatory variables and replicated with a different money market interest rates, are derived for the first dependent variable, TCR. After repeating the same process for the second dependent variable NTC, the equations take the forms as seen in 6th and 7th equations.

$$Y_{it} = \delta Y_{it-1} + \beta X'_{it} + v_{it}, \text{ (X'= vector of regressors, } v_{it} = u_i + u_{it}), \quad (1)$$

$$TCR_{it} = \delta TCR_{it-1} + \beta X_{it} + v_{it} \quad (2)$$

$$NTC_{it} = \delta NTC_{it-1} + \beta X_{it} + v_{it} \quad (3)$$

$$TCR_{it} = \delta TCR_{it-1} + \beta(LTCR) + \beta(GROWP) + \beta(STOCK) + \beta(INTRES) + \beta(BANK) + \beta(POIR) + v_{it}, \quad (4)$$

$$TCR_{it} = \delta TCR_{it-1} + \beta(LTCR) + \beta(GROWP) + \beta(STOCK) + \beta(INTRES) + \beta(BANK) + \beta(ONIR) + v_{it}, \quad (5)$$

$$NTC_{it} = \delta NTC_{it-1} + \beta(LNTC) + \beta(GROWP) + \beta(STOCK) + \beta(INTRES) + \beta(BANK) + \beta(POIR) + v_{it}, \quad (6)$$

$$NTC_{it} = \delta NTC_{it-1} + \beta(LNTC) + \beta(GROWP) + \beta_0 (STOCK) + \beta(INTRES) + \beta(BANK) + \beta(ONIR) + v_{it}, \quad (7)$$

As indicator of bank-dependence criteria, CBTR small, medium and large size classifications were used. The last four regression equations (4th to 7th equations) were estimated separately for small, medium and large size groups. Indeed, this process created 3 sub-sample split by size, generating 6 samples. To avoid misunderstandings, main samples will be referred by adding related size sub-sample, e.g. main sector-small (or only main-small) or manufacturing sub sectors-medium (or only manufacturing-medium). 6 regressions (3 for TCR and remaining 3 for NTC) for main sectors sample (Table 5 and Table 6) and another 6 regressions for manufacturing sub-sectors sample (Table 7 and Table 8) were run. In the above regression equations, Y_{it-1} correlated with error term that violates strict exogeneity principle is the most basic problem with autoregressive panel. Two estimators that suggest to use instrumental variables to solve this autocorrelation problem are standard (or first-difference) generalized method of moments (GMM) and system generalized method of moments (system GMM), and they differ in the type of valid instruments used and in the way of determining them. GMM renders greater data loss particularly on un-balanced panel data set whereas system GMM minimizes the data loss. On the other hand, system GMM generates efficient estimates with observations having shorter time (T) compared to unit (N) (Tataoğlu, 2012: 65-104; Baltagi, 2005:135-148). Standard GMM estimates main-sectors sample with longer T (T=9, N=7) and system GMM fits for the manufacturing sub-sectors sample with small T (T=9, N=12)[15].

Findings and Discussions

This section begins with descriptive statistics of variables (Table 4 and Table 5) and continues with estimation results from GMM regressions[16] (Table 6, Table 7, Table 8 and Table 9) and discussions of findings.

Table 4: Descriptive Statistics of Main Sectors Sample

Size		TCR	NTC	GROWP	STOCK	INTRES	BANK	PR	OR
	Obs.	63	63	56	63	63	63	63	63
Small	Mean	15.08	-0.18	0.11	13.13	4.22	35.39	9.85	12.41
	Std.dev.	8.09	8.54	0.36	9.20	2.84	11.62	5.33	4.42
	Min	3.44	-10.08	-0.78	0.19	0.53	7.58	4.75	7.6
	Max	54.13	45.55	1.17	31.41	10.78	64.270	20.13	21.13
Medium	Mean	15.27	-2.93	8.37	11.68	4.96	32.85	9.85	12.41
	Std.dev.	5.28	6.25	20.42	8.69	3.11	13.31	5.33	4.42
	Min	6.45	-14.61	-39.18	1.46	0.57	4.95	4.75	7.6
	Max	29.31	11.73	83.23	26.33	13.18	67.050	20.13	21.13
Large	Mean	15.51	-3.01	15.33	11.04	7.45	24.07	9.85	12.41
	Std.dev.	8.64	6.08	29.64	8.56	4.26	13.38	5.33	4.42
	Min	4.82	-18.34	-36.31	1.48	0.29	2.12	4.75	7.6
	Max	39.73	11.69	152.51	26.72	17.79	65.600	20.13	21.13

Table 5: Descriptive Statistics of Manufacturing Sub-Sectors Sample

Size		TCR	NTC	GROWP	STOCK	INTRES	BANK	PR	OR
	Obs.	108	108	96	108	108	108	108	108
Small	Mean	15.69	-6.02	6.77	19.57	5.18	32.24	9.85	12.41
	Std.dev.	3.86	3.58	19.22	4.78	4.16	10.06	5.31	4.41
	Min	6.1	-14.91	-30.4	10.02	1.31	14.39	4.75	7.6
	Max	23.93	3.17	105.36	34.74	25.79	69.970	20.13	21.13
Medium	Mean	17.28	-8.07	7.42	20.00	6.19	30.37	9.85	12.41
	Std.dev.	3.65	4.27	16.62	4.28	2.23	6.98	5.31	4.41
	Min	11.25	-17.17	-29.72	12.78	2.74	16.85	4.75	7.6
	Max	28.46	2.52	94.82	31.16	11.18	49.550	20.13	21.13
Large	Mean	16.15	-7.56	6.77	18.92	11.27	28.04	9.85	12.41
	Std.dev.	5.63	5.82	19.22	5.64	3.85	8.51	5.31	4.41
	Min	7.52	-20.79	-30.4	9.52	4.12	9.05	4.75	7.6
	Max	32.58	7.33	105.36	44.36	20.93	52.140	20.13	21.13

In Table 4, means of TCR indicate that trade credit utilization into asset financing is approximately 15% for all size but deviate largely for small firms. Negative NTCs means that during analysis period, 7 different sectors extend more trade credit on average with stronger mean value for medium and large groups but with greatest standard deviation for small group. Means and standard deviations for the remaining variables vary between size groups, as may be expected. Main-small sample's growth performance and internal fund capacity is lower while investment need in inventory and reliance on bank loan are greater than medium and large size averages. Looking at Table 4 and Table 5 together as well as the separate evaluation reveals the differences in trade credit stance between a main-sectors sample and manufacturing industries sample. As expected within the same industry, manufacturing sector has lower standard deviations for TCR, NTC, STOCK, INTRES and BANK variables. Medium and large size groups use more trade credit with TCR means of 17.3 and 16.2 respectively. Compared to main-sectors sample, manufacturing industry extend more trade credit, make greater inventory investment, hold more retained reserves while using slightly less bank loan. Small manufacturing firms can grow faster, at a rate of 6.8% on average than their main-sector counterparts, but with a substantially high standard deviation of 19.2%. In both samples, size inversely related to the bank dependency or in other words, small companies are likely to have the highest bank dependency.

Table 6: Estimation Results of 7 Main Sectors, Dependent Variable is TCR

Variable	Main-Small		Main-Medium		Main-Large	
LTCR	0.159*	0.176*	0.706**	0.661**	-0.046	0.089
	(2.20)	(2.01)	(2.89)	(3.32)	(-0.40)	(1.03)
GROWP	11.587***	11.474***	0.583***	0.057***	0.254*	0.024**
	(3.68)	(3.70)	(3.63)	(3.66)	(2.30)	(2.38)
STOCK	0.072	0.031	0.234	0.230	-0.007	0.013
	(0.33)	(0.17)	(1.07)	(1.06)	(-0.02)	(0.05)
INTRES	-1.639	-1.573	-0.092	-0.044	-0.822***	-0.808**
	(-1.75)	(-1.71)	(-0.49)	(-0.24)	(-3.59)	(-3.44)
BANK	-0.344***	-0.350***	-0.098	-0.100	-0.304	-0.252
	(-3.65)	(-3.60)	(-1.01)	(-0.97)	(-1.62)	(-1.54)
POIR	0.137		0.001		0.483	
	(0.80)		(0.02)		(1.25)	
ONIR		0.079		-0.041		0.436
		(0.44)		(-0.48)		(1.31)
Observations	49	49	49	49	49	49
Groups/Instruments	7/7	7/7	7/7	7/7	7/7	7/7
P_AR(2)	0.518	0.510	0.164	0.160	0.893	0.621
P_Hansen	0.126	0.079	0.891	0.789	0.243	0.178

Note. Table 6 presents statistics for 6 regressions applied difference GMM for the panel data of 7 main sectors. However, observations were derived beginning from 2008 to 2016 covering 9 years, growth rate calculation induce a year loss and after the GMM differencing procedure we are left an observation of 49. Size categories represent CBTR size classifications. The regressand is TCR. First regressors are the one-lagged values of TCR. First regressions of each size include policy interest rates while next ones use overnight interest rates. T- statistics corrected for robust standard errors are presented in parentheses under coefficients. *, ** and *** denotes 10%, 5% and 1% significance level. The figures in the lowest 4 row report probability statistics (p) for autocorrelation and endogeneity tests. Ho hypothesis (no autocorrelation) of Arellano-Bond tests (AR2) exhibit no autocorrelation problem for all estimations. Ho hypothesis of Hansen test (instrument variables or over identifying restrictions are valid) are accepted for all policy rate regressions but weakly rejected at 10% significance level for one of the overnight rate regressions.

In Table 6 that shows findings for selected 7 main sectors, the responses to tight money implications are significant for small firm group however, medium and large firm groups seem irrelevant to financial variables (short-term interest rates and bank loan), hence small firms seem more influenced by changes in money policy. TCR and BANK relate negatively at 1% confidence degree meaning lower bank loan availability raise TCR. Small firms receive more trade credit to substitute bank loan during tight periods that force financially constrained firms to resort an unfavourable trade credit alternative to overcome credit constraints. The reaction of small firms to a decrease in bank loan supply as taking more trade credit or being slower to make trade credit payables and smooth the adverse effects of credit channel fits the substitution hypothesis. Substitution hypothesis predicts an increase in TCR of credit constrained firms to substitute for bank loan after strict policy. The explanatory powers of GROWP control variable are strong for all main samples. On the TCR of main-large group, INTRES has significant effect too. LTCR is positive and significant at 5% or 10% level for main-small and main-medium subgroups. Combining these results, main small and medium samples tend to take more trade credit when they depend heavily on trade credit and grow rapidly; however, for main large group lower internal fund is also a significant trade credit determinant. Non-financial factors are likely to behave as predicted by literature.

Table 7: Estimation Results of 7 Main Sectors, Dependent Variable is NTC

Variable	Main-Small		Main-Medium		Main-Large	
LNTC	0.191	0.196	-0.691**	-0.698***	-0.144	-0.146
	(0.81)	(0.85)	(-3.28)	(-3.76)	(-0.30)	(-0.31)
GROWP	8.121*	7.843*	-0.027*	-0.343*	0.017	0.019
	(2.08)	(2.02)	(-2.10)	(-2.29)	(0.72)	(0.75)
STOCK	-0.369	-0.416	0.166	0.197	0.137	0.132
	(-1.17)	(-1.37)	(0.33)	(0.40)	(0.27)	(0.26)
INTRES	-1.328	-1.282	-0.631	-0.672*	-0.690	-0.683
	(-1.16)	(-1.16)	(-1.78)	(-1.99)	(-1.80)	(-1.82)
BANK	-0.136	-0.150	-0.287*	-0.281*	0.200	0.199
	(-1.41)	(-1.50)	(-2.08)	(-2.08)	(0.94)	(0.93)
POIR	0.077		0.332*		0.035	
	((0.41)		(2.25)		(0.07)	
ONIR		-0.029		0.465*		0.137
		(-0.15)		(2.19)		(0.26)
Observations	49	49	49	49	49	49
Groups/Instruments	7/7	7/7	7/7	7/7	7/7	7/7
P_AR(2)	0.972	0.964	0.235	0.211	0.690	0.703
P_Hansen	0.603	0.704	0.296	0.262	0.624	0.619

Note. Table 7 presents the coefficients of difference GMM estimations for each size group of 7 main-sectors sample. The dependent variable is NTC. Arellano-Bond tests and Hansen test reject the presence of autocorrelation and endogeneity problems. Robust t- statistics are presented in parentheses under coefficients. *, ** and *** represents 10%, 5% and 1% significance level.

When we replaced NTC as dependent variable, we gather additional information to test existence of TCC. NTC regressions on 7 main-sectors sample presented in Table 7 indicate that main-medium group tends to be net trade credit user, meaning that even taking into account for trade credit given they still keep being a trade credit receiver. Since negative impact of BANK and positive impact of POIR and ONIR should mean net receiver, according to both negative significant (10%) sign of bank loan financial variable and positive significant (10%) sign of short-term interest rates, only main-medium is accepted as net receiver. In NTC replications, apart from bank variable, further support is given by short-term interest rates for main sectors-medium group at 10% importance level. Short-term interest rates provide confirmation of medium firms being a trade credit receiver implying that they request greater trade credit than they offer during monetary contractions.

Table 8 shows the statistics of system GMM regressions run for our second sample covering 12 sub-sector aggregations of only manufacturing industry. Consequence derived from this sample is similar with results found in the main-sectors sample but provide stronger relationship for manufacturing-medium group. Small and medium manufacturing firms experienced a significant rise in TCR during tight money periods and BANK (1%, 5% and 10%) variable confirms this finding. Large manufacturing sub-sector again does not react to monetary and credit restrictions by changing their gross trade credit usage. Signs of the control variables indicators are similar to the regressions of main sector sample.

Table 8: Estimation Results of 12 Manufacturing Sub-Sectors, Dependent Variable is TCR

Variable	Manufacturing-Small		Manufacturing-Medium		Manufacturing-Large	
LTCR	0.424**	0.412*	1.140***	1.104***	1.059***	1.073***
	(2.22)	(2.02)	(9.90)	(9.65)	(3.39)	(3.48)
GROWP	0.034***	0.038***	0.055***	0.051***	0.013	0.01
	(3.21)	(4.12)	(4.35)	(3.98)	(0.67)	(0.38)
STOCK	0.427***	0.405***	-0.049	-0.013	-0.047	-0.05
	(3.76)	(4.01)	(-0.53)	(-0.14)	(-0.44)	(-0.53)
INTRES	-0.002	-0.019	-0.004	0.093*	-0.017	-0.007
	(-0.02)	(-0.30)	(-0.07	(1.98)	(-0.22)	(-0.16)
BANK	-0.033***	-0.044**	-0.059**	-0.045*	-0.001	-0.002
	(-3.10)	(-2.90)	(-2.45)	(-1.94)	(-0.03)	(-0.08)
POIR	0.143		-0.030		0.039	
	(1.41)		(-0.83)		(0.39)	
ONIR		0.198		-0.120*		0.011
		(1.38)		(-1.90)		(0.06)
Observations	96	96	96	96	96	96
Groups/Instruments	12/8	12/8	12/8	12/8	12/8	12/8
P_AR(2)	0.132	0.098	0.382	0.232	0.644	0.635
P_Hansen	0.397	0.319	0.335	0.341	0.397	0.428
P_Diff. in Hansen	0.128	0.111	0.293	0.353	0.174	0.204

Note. Table 8 exhibits statistics for 6 regressions applied system GMM estimator for 12 manufacturing sub-industries. Panel data consists of aggregated amounts for 12 manufacturing sub-industries for small, medium and large size firms separately over 2008 and 2016. Observation number of 96 equals 12 unit times 8 periods. Dependent variable is TCR. The figures in the last 5 row report probability statistics (p) for autocorrelation and endogeneity tests. Second level Arellano-Bond tests (AR2) reject autocorrelation problem. Hansen test confirms exogeneity of instruments. t-statistics corrected for robust standard errors are presented in parentheses under coefficients. *, ** and *** implies 10%, 5% and 1% confidence level.

Table 9: Estimation Results of 12 Manufacturing Sub-Sectors, Dependent Variable is NTC

Variable	Manufacturing-Small		Manufacturing-Medium		Manufacturing-Large	
LNTC	0.901***	0.796**	0.573***	0.601***	0.611	0.0617
	(3.75)	(2.98)	(5.43)	(6.41)	(0.94)	(0.90)
GROWP	0.004	-0.004	0.027	0.028	0.006	-0.002
	(0.07)	(-0.07)	(0.95)	(1.04)	(0.20)	(-0.07)
STOCK	-0.040	-0.019	0.085	0.085	0.058	0.068
	(-0.83)	(-0.33)	(1.05)	(1.13)	(0.60)	(0.59)
INTRES	-0.014	-0.000	-0.397***	-0.313***	-0.134	-0.101
	(-0.28)	(-0.00)	(-3.90)	(-3.19)	(-0.66)	(-0.52)
BANK	0.019	0.011	-0.115	-0.101	-0.069	-0.060
	(0.41)	(0.24)	(-1.73)	(1.58)	(-0.44)	(-0.35)
POIR	-0.049		0.031		-0.030	
	(-0.46)		(1.23)		(-0.31)	
ONIR		-0.108		-0.042		-0.081
		(-0.92)		(-1.06)		(-0.80)
Observations	96	96	96	96	96	96
Groups/Instruments	12/9	12/9	12/8	12/8	12/8	12/8
P_AR(2)	0.402	0.374	0.661	0.823	0.811	0.747
P_Hansen	0.167	0.196	0.202	0.265	0.088	0.084
P_Diff. in Hansen	0.088	0.107	0.111	0.137	0.131	0.109

Note. Table 9 presents the coefficients of system GMM estimator for 12 manufacturing sub-industries when the dependent variable is NTC. Ho hypothesis of autocorrelation and endogeneity tests are mostly accepted. Robust t-statistics are presented in parentheses under coefficients. *, ** and *** refers 10%, 5% and 1% significance level.

However, coefficients of bank variable in the SME manufacturing groups in the Table 8 support the substitution hypothesis, negative TCR reaction of manufacturing-medium group to the increases on the ONIR at %10 significance level mitigates the power of substitution hypothesis. Negative sign of ONIR means that medium manufacturing firms may receive less trade credit during hard times, and we can accept this behaviour as consistent with the redistribution or helper theory. Manufacturing-medium group assumed as less financially unconstrained compared to small ones, may help their small sized suppliers by receiving less trade credits from them or making early payments to them. Despite, when we combine this weak evidence of redistribution theory at Table 8 (negative gross trade credit response of medium manufacturing group) with the net trade credit status at Table 9, we cannot provide further support for redistribution theory. The financial variables in the regressions examining the net effect of tightened periods on trade credit flowing within manufacturing industry, displayed in Table 9, lost their significances. Thus, we have no significant evidence to interpret whether manufacturing sample is net trade credit extender or net credit receiver.

Size and industry effects are obvious in the analysis. Small and medium sized samples appear to be more sensitive to monetary policy changes. In terms of gross ratios, small firm groups made more trade credit usage in both two samples, according to net terms, there is no significant evidence about their net trade credit status (receiver or extender). Medium sized group were sensitive to monetary shocks with gross figures in the manufacturing sample and engaged in trade credit flow by becoming net receiver in the main-sectors sample. Large firms group in all regressions seemed to be irrelevant. Analysis results across main sectors (multi-sectors or economy wide) and among manufacturing industry support substitution theory. Despite the trade credit user behaviour of main-medium group, net trade credit results of other sized main groups (main-small and main-large) and net trade credit findings for all manufacturing sample do not provide sufficient evidences to interpret redistribution hypothesis that can make clear the route to which trade credit flows.

Most regressions reveal that financing mix of small and medium firms shifted to trade credit from bank credit during tight periods in terms of both gross and net terms. Consequently, analysis findings support trade credit offsetting channel with the findings showing that SMEs tend to overcome credit constraints by using more trade credit (despite its disadvantages) from vendors. Trade credit can serve as a tool to dampen the effects of credit channel and to frustrate the workings of monetary policy.

Conclusion

The bank-lending channel explains the fall in the small firm's bank loan usage by the credit supply constraints rather than firms' reduced fund demand. Firms typically strive to avoid the expensive trade credit in normal times. But at times of tight policy or recessions, when lending channel begin to operate, and cut back the credits, especially bank-dependent small firms are forced to use trade credit as their most common non-bank debt alternative. (Nilsen, 2002: 228-234). Trade credit channel initiated by Meltzer (1960), suggests that wider usage of trade credit as a substitute for bank loans dampens the credit channel at tight monetary periods during which bank loan accessibility becomes more difficult for bank-dependent firms due to both severe credit rationing and flight to quality implications of financial institutions and deteriorated balance sheet structure of them. For financially constrained firms, trade credit act as a supplement source of fund to finance their activities, hence have a moderating effect on the credit channel, more broadly on monetary policy implications. Trade credit channel of monetary policy is more prone to emerge in informational opaque small firms that are in the great need of overcoming bank loan constraints with trade credit. To our knowledge, there has been no sufficient works investigating the reaction of Turkish real sector to monetary restrictions in both gross and net trade credit terms. This paper examined whether the trade credit channel weakened the bank credit channel for Turkish economy at sector level. To see whether gross and net trade credit variables have any response to tight monetary policy and bank loan constraint, dynamic panel models extrapolated data sets involving 7 sectors and 12 manufacturing sub-sectors in Turkey from 2008 to 2016.

Considering the reaction of trade credit received to strict monetary conditions, small and medium firms from main-sectors and manufacturing sub-sectors raised their trade credit usage when bank loan decreased. Bank loan level became the main determinant and short-term interest rates provide support for manufacturing-medium sample. Trade credit taken by large size firm groups appears irrelevant to monetary

contractions. If we base our assessment of substitution hypothesis on gross trade credit results, we can say substitution theory holds. Trade credit as the best substitute of bank loan for small firms alleviates credit channel effect of monetary policy that aims to restrict the bank loans available for particularly SMEs. According to net trade credit position, sector wide medium group (main-medium) acted as a net trade credit receiver that is supported both with the bank loan-trade credit relationships and with policy rates. Other findings of net trade credit status are not sufficient to support redistribution theory. Combining these results, we can conclude that trade credit channel operated and mitigated the effects of credit channel in Turkey during 2008-2016. Trade credit has helped credit-constrained small firms smooth the effects of credit channel implications.

Some more possible extensions of this paper are to analyse the bank-loan and monetary policy relationships, testing the trade credit channel by using different monetary policy indicators and if possible updating the analysis with firm level data.

REFERENCES

Aklan, N.A., & Nargeleçekenler, M. (2008). Para politikalarının banka kredi kanalı üzerindeki etkileri. İstanbul Üniversitesi *Siyasal Bilgiler Fakültesi Dergisi, (39),* 109-132.

Arslan, B.G., & Ergeç, E. H. (2011). Türkiye ekonomisinde para politikasının sektörel etkileri. *Anadolu Üniversitesi Sosyal Bilimler Dergisi*, *11* (1), 89-103.

Atanasova, C. V., & Wilson, N. (2003). Bank borrowing constraints and the demand for trade credit: Evidence from panel data. *Managerial and Decision Economics,* 24, 503–514.

Baltagi, B. H. (2005). *Econometric analysis of panel data* (3rd edition). Chichester: Wiley. ISBN: 13-978-0-470-01456-1.

Bernanke, B.S., & Gertler, M. (1995). Inside the black box: The credit channel of monetary policy transmission. *Journal of Economic Perspective, 9(4),* 27-48.

Brechling, F. P. R., & Lipsey, R. G. (1963). Trade credit and monetary policy. *The Economic Journal, 73(292),* 618-641.

Carbo-Valverde, S., Mansilla-Fernandez, J. M., & Rodriguez-Fernandez, F. (2017). Monetary policy, implicit interest rate, and relative net trade credit. *Revista De Economia Aplicada, 25(73),* 21-54.

Chiplin, B., & Wright, M. (1985). Inter-industry differences in the response of trade credit to changes in monetary policy. *Journal of Business Finance & Accounting*, *12(2),* 221-248.

Choi, W.G., & Kim, Y. (2003). Trade credit and the effects of macro-financial shocks: Evidence from US panel data. *International Monetary Fund Working Paper No. 03/127*.

Dai, B., & Yang, F. (2015). Monetary policy, accounting conservatism and trade credit. *China Journal of Accounting Research, 8,* 295-313.

De Blasio (2003). Does trade credit substitute for bank credit? Evidence from firm-level data. *International Monetary Fund Working Paper No. 03/166.*

Demirgunes, K. (2016).Determinants of access to trade credit for small and medium sized enterprises in Turkey after the 2008 global crisis. *Journal of Economics, Finance and Accounting, 4(3)*, 266-284.

Eroğlu, N. (2009). Türkiye'de 1990'lı ve 2000'li yıllarda para politikaları. Marmara Üniversitesi, İ.İ.B.F Dergisi, 26(1), 23-42.

Fisman, R., & Love, I. (2003). Trade credit, financial intermediary development and industry growth. *Journal of Finance 58,* 353–374.

Gaiotti, E., & Generale, A. (2002). Does monetary policy have asymmetric effects? A Look at the investment decision of Italian firms. *Giornale degli Economisti e Annali di Economia, 61 (1),* 29-59.

Gama, M., Paula, A., & Van Auken, H. (2015). The interdependence between trade credit and bank lending: Commitment in intermediary firm relationships. *Journal of Small Business Management, 53(4),* 886–904.

Gertler, M.& Gilchrist, S. (1993). The role of credit market imperfections in the monetary transmission mechanism: Arguments and evidence. *The Scandinavian Journal of Economics, (1),* 43-64.

Gertler, M.& Gilchrist, S. (1994). Monetary policy, business cycles, and the behaviour of small manufacturing firms. *The Quarterly Journal of Economics, (2),* 309-340.

Guariglia, A., & Mateut, S. (2006). Credit channel, trade credit channel, and inventory investment: Evidence from a panel of UK firms. *Journal of Banking & Finance, 30(10),* 2835–2856.

Herbst, F. (1974). Some empirical evidence on the determinants of trade credit at the industry level of aggregation, *Journal of Financial and Quantitative Analysis,* 377–394.

Hong, B.P. (2017). The impact of monetary policy on bank credit and trade credit for the UK's SMEs: A disequilibrium model of credit rationing. PhD Dissertation. The University of Leeds.

Kohler, M., Britton, E., & Yates, T. (2000). Trade credit and the monetary transmission mechanism. *Discussion Paper, Bank of England.*

Laffer, A. B. (1970). Trade credit and the money market. *Journal of Political Economy, (2),* 239-267.

Marotta (1997), Does trade credit redistribution thwart monetary policy? Evidence from Italy, *Applied Economics, 29(12),* 1619–1629.

Mateut, S., & Mizen, P. (2003). Trade credit and bank lending: An investigation into the determinants of UK manufacturing firms' access to trade credit. *EUI Working Paper ECO, No. 2003/3.*

Mateut, S., Bougheas, S., & Mizen, P. (2006). Trade credit, bank lending and monetary policy transmission. *European Economic Review*, *50 (3),* 603-629.

Meltzer, A.H. (1960). Mercantile credit, monetary policy, and size of firms. *The Review of Economics and Statistics, (4),* 429-437.

Nadiri, M. I. (1969). The determinants of trade credit in the U.S. Total manufacturing sector. *Econometrica, (3),* 408-423.

Ng, C.K., Smith, J.K & Smith, R.L. (1999). Evidence on the determinants of credit terms used in interfirm trade, *The Journal of Finance, 54 (3),* 1109-1129.

Nilsen, J. H. (2002). Trade credit and the bank lending channel. *Journal of Money, Credit and Banking, 34(1),* 226–253.

Petersen, M. A., & Rajan, R.G. (1997). Trade credit: Theories and evidence. *The Review of Financial Studies, (3),* 661-691.

Reilly, D., & Sarte, P. G. (2010). Changes in monetary policy and the variation in interest rate changes across credit markets. *Economic Quarterly (10697225), 96(2),* 201-229.

Romer, C.D. & Romer, D.H. (1993). Credit channel or credit actions? An Interpretation of the Postwar Transmission Mechanism. *NBER Working Paper No. 4485*.

Roodman, D. (2009a). A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics 71(1)*, 135–58.

Roodman, D. (2009b). How to do Xtabond2: An Introduction to Difference and System GMM in Stata. *The Stata Journal, 9(1),* 86-136.

Saiz, C.M., Azofra, S.S., Olmo, B.T, & Gutierrez, C.L. (2017). Trade credit, sovereign risk and monetary policy in Europe. *International Review of Economics & Finance, 52,* 39-54.

Şahin A. (2018). Firmalar arası ticari alacak kredisini açıklayan teoriler: Borsa İstanbul'da bir uygulama, *Maliye ve Finans Yazıları, 110,* 37-70.

Schwartz, Robert A. (1974). An economic model of trade credit. *The Journal of Financial and Quantitative Analysis, (4),* 643-657.

Tatoğlu, F. Y. (2012). *İleri panel veri analizi (1. basım).* İstanbul: Beta Basım A.Ş. ISBN: 978-605-377-721-2.

Özlü, P. & Yalçın, C. (2012). The trade credit channel of monetary policy transmission: Evidence from non-financial manufacturing firms in Turkey. *Emerging Markets Finance & Trade, 48(4),* 102–117.

Walker, D. A. (1985). Trade credit supply for small businesses. *American Journal of Small Business*, 9(3), 30-40.

http://www.tcmb.gov.tr (04.04.2018 - 10.11.2018)

http://www3.tcmb.gov.tr (04.11.2018- 17.11.2018)

Appendix

Table A: The average number of companies in CBRT for 7 main sectors

Main Sectors	Code	Total	Small	Medium	Large
Manufacturing	C	3322	1548	1205	569
Electricity, gas, steam and air conditioning supply	D	252	163	44	45
Construction	F	936	438	317	181
Wholesale and retail trade, repair of motor vehicles*	G	2305	1099	888	319
Transportation and storage	H	360	211	107	42
Information and communication	J	88	39	29	20
Administrative and support service activities	N	244	167	57	20
Sample Total		7507	3664	2647	1196
Size/Sample %			49	35	16
Database Total		8804			
Sample/Database %		85.3			

Note. Sector name is "Wholesale and retail trade, repair of motor vehicles and motorcycles". Table contents were derived from the company accounts statistics of CBRT, from website of www.tcmb.gov.tr.

Table B: The average number of firms in CBRT for 12 manufacturing sub-sectors

Manufacturing Sub-Sectors	Code	Total	Small	Medium	Large
Manufacture of food products	C10	483	168	205	110
Manufacture of textiles	C13	435	195	187	53
Manufacture of wearing apparel	C14	262	140	100	22
Manufacture of paper and paper products	C17	90	34	38	18
Manufacture of chemicals and chemical products	C20	145	65	45	35
Manufacture of rubber and plastic products	C22	204	95	79	30
Manufacture of other non-metallic mineral products	C23	288	147	93	48
Manufacture of basic metals	C24	194	62	64	68
Manufacture of fabricated metal products*	C25	235	118	92	25
Manufacture of electrical equipment	C27	119	44	43	33
Manufacture of machinery and equipment n.e.c.	C28	206	121	68	17
Manufacture of motor vehicles, trailers and semi-trailers	C29	138	56	46	36
Sample Total		2799	1244	1060	494
Size/Sample %			44	38	18
Database Total		3322			
Sample/Database %		84.2			

Note. Sector name is "Manufacture of fabricated metal products, except machinery and equipment". All information was derived from the website of www.tcmb.gov.tr.

(Endnotes)

1 External finance premium is the cost premium paid to raise external funds over the opportunity cost of internal funds (Bernanke & Gertler, 1995: 28-35).

2 As of the reporting year, the data of those firms with continuous data for the preceding three years are involved. From 2008, sectors have been classified based on economic activity classification of NACE Rev.2, before then, NACE Rev.1.1 had been in use. However, net

sales are the classification criteria for sizing almost all sectors except Construction Sector and Holding Companies Sector for which assets reflect the true size. Net sales (assets) less than EUR 10 million is threshold for small companies. Net sales between EUR 10-50 million (assets EUR 10-43 million) determine medium size firms. Firms with net sales greater than EUR 50 million (assets 43 million) are large ones. In determining the number of companies to be included in the CBRT reports, ensuring the highest possible level of those firms having credit balance in banks and those involved in the GDP calculations in the last years is taken account (www. tcmb.gov.tr).

3 As stated in the two available evaluation report of sector balance sheets of CBRT (2011 and 2014 reports) an average of 178 firms traded in Borsa Istanbul (account for 2%), and 727 companies identified as among the first 1000 largest industrial organization by Istanbul Chamber of Industry (make up 8.3%) were covered (www. tcmb.gov.tr).

4 Ratio formation eliminates potential demand effects controlling size level (Mateut et al., 2006) and scaling by total assets provides control over activity level variations (Gama & Auken, 2015: 892). As scaling variable Nadiri (1969), Chiplin and Wright (1985) and Saiz et al., (2017) used sales or purchases, Mateut et al., (2006) utilized liabilities but expressed that they repeat analysis by asset scaled trade credit variable and obtained the same results.

5 In examined literature, accounts payable often has similar meaning with the phrases of trade payable, trade credit taken, received, demanded or requested. For those demanding trade credit; trade credit user, taker, receiver, borrower, demander, requestor or debtor phrases have generally been used. Following the same logic, accounts receivable generally means trade receivables, trade credit given, extended, made, offered, granted or supplied. Trade creditor, trade credit giver, supplier, extender, lender or vendor expresses those supplying trade credits.

6 NTC represent extend to which trade payable finance the trade receivables. Brechling and Lipsey (1963) express this effect as passing on effect. TCR is expressed as passing on part of TCE because the difference between gross credit given and net credit is passed on to other firm (Brechling & Lipsey, 1963: 636).

7 Overnight rates, minimum bank lending rates, official interest rates, rates on three or six-month Treasury Bill, Fed fund rates, bank prime rate, LIBOR, EURIBOR, CONSOL yield, bank interest rate, the rate bankers' acceptances, four-to-six-month corporate/commercial paper rates are among the short-term interest rates to proxy for MPI.

8 Among the papers examined Choi and Kim (2003), Mateut et al. (2006), Özlü and Yalçın (2012) used both indicators by using a money market rate and adding a dummy whether determined previously or determined by themselves based on the level of interest rates. Choi and Kim (2003) used dummy for U.S. restrictive periods identified respectively by Romer and Romer (1993). De Blasio (2003) utilized only a chronology generated by Gaiotti and Generale (2002) for Italy. On the other side, Meltzer (1960), Bernanke and Gertler (1995), Kohler et al. (2000), Aklan and Nargeleçekenler, (2008), Carbo-Valverde et al. (2017), Hong, (2017), Saiz et al. (2017) all used different type of short term money market interest rates as monetary policy indicator. Kohler et al. (2000) used crisis dummy and Saiz et al. (2017) used year dummy but not for tight periods, Hong, (2017) applied quantitative easing periods. Difficulties on clearly assigning years as tight or loose after 2008 and on finding a commonly used predetermined dates led us to focus on money market rates.

9 The Central Bank manages total demand and inflation expectations by using policy interest rates and other monetary policy instruments in order to meet inflation targets. Following the crisis in February 2001, CBRT started to launch inflation targeting regime, up to 2006 implementing a transition process under implicit inflation targeting and as the beginning of 2006 fully switching to the inflation targeting. During transition year of 2005 and the following implementation periods, short-term interest rates have been used as a main policy instrument. Since 2005, monetary policy decisions including policy rates are taken by the Monetary Policy Committee at pre-scheduled meetings and announced to the public (www.tcmb.gov.tr; CBRT 2005 annual report, 2006: 73-74; Eroğlu, 2009).

10 Short-term interest rates often move closely even though they belong to different markets (Eroğlu, 2009: 27).

11 Interest rates generally affect the other variables with a one period lag (Gertler & Gilchrist, 1993: 53).

12 Herbst, (1974), Marotta (1997), Guariglia and Mateut (2006), Mateut et al. (2006), *Özlü* and Yalçın (2012), Dai and Yang (2015), Gama and Auken (2015), Saiz et al. (2017).

13 Within the main sector sample, TCR and LTCR correlations for small, medium and large size groups are respectively 0.89, 0.84 and 0.89. NTC and LNTC correlations are 0.64, 0.84 and 0.64. For the manufacturing sub-sectors sample these are 0.82, 0.82 and 0.92 for TCR and 0.70, 0.78 and 0.87 for NTC.

14 Ratios among cash flows to total assets (Dai &Yang, 2015; Saiz et al., 2017; Carbo-Valverde et al., 2017), cash to sales ratio (Nilsen, 2002), profits before taxes (Özlü & Yalçın, 2012) and earnings before interest and taxes over total assets (Gama & Auken, 2015) have been used in papers.

15 Some authors used GMM methods in studies of trade credit channel (Guariglia & Mateut, 2006, Gama & Auken, 2015; Saiz et al., 2017) and in papers about credit channel existence (Aklan & Nargeleçekenler, 2008).

16 Regressions are run through Stata "xtabond2" commands for difference GMM and system GMM (Tataoğlu, 2012; Roodman, 2009a; Roodman 2009b).