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Revisiting Bank Lending Channel in Turkey Through Manufacturing Firms' Balance Sheets

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Abstract

This study analyzes the efficacy of bank lending channel in Turkish setting by using panel econometric techniques over the firm balance sheet data between 1996 and 2015. To this end the study uses a battery of dependent variables, firm-specific variables, and monetary policy indicator. Since the study aims to indicate heterogeneities across firms, it uses a random coefficient model. Thus, this model makes possible the analysis of heterogeneous responses of firms with different scales to monetary policy changes. The set of regressions that incorporate the impact of the changes in monetary policy over external funding choices of firms is designated in accordance with the bank lending channel. Findings of the set of regressions show that monetary policy changes lead manufacturing firms to modify the composition of external financing. Firms rearrange their financing needs across bank credits and other debt instruments by decreasing the proportion of bank loans relative to non-bank debt instruments in both loosening and tightening periods. However, the findings indicate that non-bank debt instruments are not perfect substitutes for bank loans. Thus, empirical findings support the view that bank lending channel works in Turkish case.

JEL Codes: E52, C33, E5

Keywords: Monetary Policy, Bank Lending Channel, Random Coefficient Model, Manufacturing Firms

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1. Introduction

The dynamic mechanism through which monetary policy affects the economy has been the focus of both theoretical and empirical studies and the transmission mechanism is labeled as "black box" by Bernanke and Gertler (1995). Bank lending channel is one of the transmission mechanisms within the credit channel framework. According to the literature, there are two key assumptions for the bank lending channel to be operational. First of all, banks and nonbanks debt instruments are not a perfect substitute. When the supply of bank credit is reduced, firms or households do not have any viable options to switch from bank loans to other external financing means. Second, banks should not replace policy-induced reserve and deposit drains with other financing sources or by

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selling securities. Thus, variations in monetary policy actions will possibly change the proportion of bank loans and non-bank debts in an external funding composition. In other words, when a central bank carries out a tight policy aiming at squeezing bank credits, the relative share of bank loans to total external debt in the firms' balance sheet is expected to decline which in turn adversely affect the firms' investment and operational decisions.

In bank lending literature, two types of studies are carried out: one type concentrates on bank-specific factors (or uses bank-specific data) and the other uses firm-level data. Studies with a focus of bank-specific factors examine how different banks with different characteristics respond to monetary policy shifts. In other words, these studies aim at exploring the underlying reasons for heterogeneous responses of banks to given tight (or loose) monetary policy shocks. On the other hand, studies with a specific concentration on firm-specific variables in bank lending channel concentrate on two areas: (i) the cross-sectional differences in firms' external financing, (ii) external finance composition or the debt structure of firms. To examine the relevance of bank lending channel, in the empirical field a variety of econometric techniques have been applied albeit with conflicting results.

The review of empirical studies about bank lending channel for various countries suggest that the results are fairly in direction of favoring bank lending channel but there is also some serious evidence weakening the hypothesis. The nonuniform results stem from three factors: the method utilized, the period investigated and country-specific factors.

The current study aims at examining possible impacts of the changes in bank loan supply stemming from shifts in monetary policy stance by central bank and firms' external financing behavior in Turkey. To be more exact, this study contributes to the existing literature by re-examining the bank lending channel using firm-specific variables derived from the firm's balance sheets. Firm-specific variables are obtained from the firms' balance sheets, and the data covers the period of 1996-2015 for firms in the Turkish manufacturing sector. Three types of firms (small, medium and large) in the manufacturing sector are distinguished, and the study runs alternative panel regression models with different set of dependent and independent variable specifications to examine to what extent these firms shift their external financing position when the loan supply by banks is squeezed due to tight monetary policies implemented by Turkish Central Bank of Turkish Republic (CBRT, henceforth).

To this end, the study utilizes a recently introduced panel regression technique and carries out alternative panel regressions with alternative dependent and independent variables based on firm-specific characteristics proposed in bank lending literature. In particular, the analysis concentrates on the cross-sectional differences across both firms and time, and therefore, it uses Random Coefficient Model which allows the heterogeneity across types of firms in the sample. Since the regression models incorporate cross-sectional variations, the study does not suffer from problems of biased coefficients and unreliable inferences.

To our knowledge, this is the first study to examine the bank lending channel in the Turkish economy with aggregated firm-level data derived from firms' balance sheets. Furthermore, this study is the first analysis that assesses the validity of the bank lending channel by employing a random coefficient model; thus, to find out the effect of monetary stance on firms with different scales. More precisely, our study analyzes by discovering both cross-sectional heterogeneities across firms and time-varying differences across different monetary stance in the Turkish economy. The current study finds some evidence favoring bank lending channel for Turkey for the specified period.

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The remainder of this study is structured as follows. The following section gives a review of the existing literature. The third section introduces the data, variables and empirical models. In the fourth part of the study, the employed methodology is explained. The fifth part presents the empirical findings of the constructed regression models and gives some policy suggestions. The final section provides a general review.

2. Empirical Literature on Bank Lending Channel

2.1. Studies for Developed Countries

A large number of empirical studies examines the bank lending channel, employing different methodological tools and data coverage. Studies with a focus of a single country in addressing the validity of bank lending have frequently utilized both VAR and SVAR. Bernanke and Blinder (1992) examine to what extent monetary policy changes can affect the economy through banking mechanism in the US for 1959-1975 and the results show that after contractionary monetary policies, bank loans, bank deposits and security holdings declines considerably shrink which in turn results in an increasing unemployment and worsening the economic growth performance. Kashyap et al. (1993) distinctively examine the validity of the bank lending channel by utilizing firms aggregated balance sheet data for the period over 1964-1989 for the US. According to this study, after contractionary monetary policy, the amount of bank credit in the balance sheet of the firms declines whereas the volume of commercial papers has an upward tendency. Ludvigson (1998) examines the validity of a bank lending channel for automobile credit market for the US over 1964-1995. Due to monetary policy change, according to bank lending mechanism, automobile buyers are expected to respond by switching from bank loans to other automobile financing instruments.

By using both VAR and SVAR, Ehrmann et al. (2001) analyze the impact of monetary policy shifts on the changes in German banks' loan supply during the period of 1992-1998. The study finds that banks with liquidity constraints tend to squeeze their loan supply after the contractionary monetary policy. By using monthly data for a period of 1965-1999, Ford et al. (2003) also utilize the VAR model and analyze the simultaneous differential effects of monetary policy changes in Japan. The study finds evidence showing that the size of the bank influences the bank's reaction to monetary policy. In particular, after contraction measures were taken by the monetary authority, small banks in Japan reduce their loan supply and moreover the reduction harms the small firms.

The empirical studies by Kashyap and Stein (1995) and Favero et al. (1999) concentrate on the characteristics of banks. By using OLS regression method, both studies examine as to whether there exists some evidence showing heterogeneous responses to monetary policy changes by banks that have different characteristics. While Kashyap and Stein (1995) find evidence favoring the importance of bank characteristics in banks' lending behavior, Favero et al. (1999) failed to find such evidence. By using panel data and thus panel method, De Bondt (1999) tests the existence of bank lending channel in Euro area the results of the study suggest that the characteristics of banks in some countries indeed play a vital role on loan supply.

Another method utilized in bank lending literature is GMM. Hernando and Martinez Pegez (2001) test the existence of a bank lending channel in Spain and find that bank characteristics are significant in reaction to monetary policy changes. Gathering the balance sheet data of the UK listed non-financial firms covering 1975-1999, Huang (2003) examines bank lending mechanism by using the dynamic econometric model. The results of the study suggest that firms tend to change their behavior of the mix of bank and nonbank debt after a shift in monetary policy in the UK. Similarly, Altunbaş et al. (2004) examine the role of capitalization by using bank-level data for

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France, Italy, and Germany over the period from 1991-1999. According to this study, the bank's security holdings and the opportunity of interbank borrowing partly offset the bank lending channel.

To examine the importance of bank characteristics in the propagation of monetary shocks for four European countries France, Germany, Italy, and Spain over the pre-union period, Chatelain et al. (2006) carry out a dynamic regression model. Tight monetary policy, according to the results of this study, induces banks to reduce their lending. Valverde and Paso (2009) examine the external financing behavior of Spanish firms over the period between 1992 and 2003. The results of the study do not support bank lending channel because Spanish firms tend to substitute bank loans with other sources. Leroy (2014) examines to what extent bank lending channel works for the Eurozone countries from 1999 to 2011. According to results reported in the study, large banks operating in the Eurozone area tend to be less sensitive to monetary policy changes than those of their smaller counterparts.

Finally, Hosono (2006) utilizes panel method and investigate Japan, Brissimis and Magginas (2003) utilize multivariate cointegration analysis for six major developed countries and Cetorelli and Goldberg (2008) employ two-stage regression process for the US for the US. The findings of our review of empirical studies about bank lending channel for developed countries suggest that the results are fairly in direction of favoring bank lending channel but there is also some serious evidence weakening the hypothesis. The nonuniform results stem from three factors: the method utilized, the period investigated and country-specific factors.

2.2. Studies for Emerging Countries

There is also a vast empirical literature investigating the bank lending channel for developing countries. In these studies, VAR, dynamic regression techniques, as well as panel data methods, have been commonly used. By using VAR, Disyatat and Vongsinsirikul (2003) focus on the issue for Thailand and their data covers the 1993-2001 period. Higher interest stemming from the tight monetary policy shocks causes real sector investment to reduce and banks play important role in the propagation of these shocks. In a VAR-based study for two MENA countries (i.e. Morocco and Tunisia) covering 1990-2005, Boughrara (2009) concludes that the results for Tunisia are in line with bank lending model while the those of Morocco are not. Sun et al. (2010) study the monetary transmission mechanism for China for 1996-2006. The empirical results point to the significance of the bank lending mechanism for China for both tight and loose monetary policies.

Arena et al. (2007) employ bank-specific data that are derived from balance sheets of banks in 20 emerging economies and the data cover the period between 1989 and 2001. The asymmetric response of the banks may suggest the existence of a bank lending channel in those countries. Similarly, Olivero et al. (2011) aim to discover the bank lending channel in twenty Asian and Latin American countries. In this study, concentration ratio is used as a proxy to account for one of the bank-specific variables. The fixed effects panel data model reveals that increased competitions in the banking sector tend to weaken the effectiveness of the bank lending channel.

By performing a deterministic general equilibrium model, Zhang and Sun (2006) investigate the link between consumer credits and monetary stance in China. Indirectly, the results are in line with bank lending channel, showing that easier access to property loans plays a major role in recent property boom in China which implies that the deepening in consumer credit market may strengthen the effectiveness of monetary policy.

There are also some empirical studies with a specific focus on Turkey. Employing panel data regression model based on GMM estimation, Çavuşoğlu (2002) examines the link between loan

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growth and the bank-specific factors in Turkey from 1988 to 1999. According to the study, although balance sheet strength and quality of asset portfolio are found to be statistically significant in the regression models, the overall results fail to support active bank lending channel in Turkey. Aktaş and Taş (2007) use fixed effects panel data regression model to analyze the role of the bank's capital adequacy on the bank lending channel mechanism. According to the study, banks with high capital adequacy ratio respond more to changes in monetary policy. Peker and Cambazoğlu (2011) carry out a VAR-based study for Turkey over the 1990-2008 period and the results of the study suggest that bank lending channel is also a valid hypothesis for Turkey. Note however that favorable results in this study partially stem from the choice of policy tool (i.e. M2) of money authority.

Employing a two-step regression procedure, Sengonul and Thorbecke (2005) analyze the period of 1997-2001 for Turkey. They discover that bank liquidity is significant on lending which may interpret as a favor of a bank lending channel. Adopting the similar methodology, Aydın and Igan (2012) extend the analysis by adding retail banking focus and ownership type into the analysis. They use bank-level data covering the period between 2002 and 2008.

The results they reported are not so robust to support effective bank lending channel in the Turkish economy. Brooks (2013) uses a difference-in-difference approach for Turkey. In the study, May-June 2006 financial turbulence where CBRT applied significant monetary contraction is employed as an exogenous shock. Estimation results show that the liquidity is the significant variable in bank lending behavior. The results of the study failed to confirm the presence of effective bank lending mechanism in the Turkish economy. Similar to the conclusion made on developed countries above, the results of the empirical studies on developing countries have varied markedly based on structural factors, data coverage and methodology used.

3. Data, Variables, and Empirical Models

3.1. Data

The study uses a panel dataset containing a yearly aggregated financial balance sheet indicators of Turkish manufacturing firms for the period of 1996-2015. The data are obtained from two sources; the CBRT and World Bank. Aggregated balance sheet indicators are available in Electronic Data Delivery System (EDDS) of CBRT. "Company Account Statistics" is a survey-based data carried out by CBRT to monitor developments in real sectors in the Turkish economy. In "Company Accounts Statistics", CBRT collects balance sheet information at the firm level but to avoid confidentially problem, CBRT only presents the aggregated version of the company statistics. On the basis of the size of the firms, CBRT aggregated data into three main types; small, medium and large. The classification about the size of the firm is based on Bank for the Accounts of Companies Harmonized (BACH) where (i) firms with net sales of less than 10 million Euro are classified as small, (ii) firms with net sales between 10 million and 50 million Euro are classified as medium and (iii) firms with net sales of more than 50 million Euro are large firms. Sector classification is based on NACE.rev2. since the year 2011 and NACE rev. 1.1 before 2011. Finally, the consumer price index data is obtained from the World Bank database.

3.2. Variables

Inspired by previous studies in the empirical literature, the current study carries out multiple panel regressions using alternating dependent and independent variables. On the right-hand side of the regression analysis, two sets of independent variables have been used. Firstly, to account for the policy shifts by the monetary authority, this study uses Monetary Condition Index (MCI, henceforth) and Real Interest Rate (RON, henceforth). To comprise the substitutability of external

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funds in the right side of the panel regression analysis, we utilize the ratio of short-term nonbank loans to total assets (LEVER).

In the literature, it has frequently emphasized the identification problem on the right-hand side of the regression equation. The problem arises from the fact that after a contraction measure undertaken by a monetary authority, the number of bank loans declines but the reduction may stem from both supply and demand side factors (Oliner and Rudebusch, 1996). Therefore, the volume of bank loan on the left side of the regression is not appropriate for the spirit of the bank lending channel hypothesis. There is a possibility that firms may substitute bank loans with other external financing sources such as bond, notes payable and sales payable for bank loans.

The variables, outlined and defined on Table 1 includes: (I) ratio of short-term bank loans over the debt mix (SRBCMIX), (II) the ratio of short-term non-bank debt to debt mix (NBLMIX), (III) logarithm of the short-term bank credit (SRBC), and (IV) logarithm of the debt mix (SRMIX). Note also that the debt mix includes both non-bank debt and bank credits and non-bank debt consists of sales payable, notes payable, issued bills and bonds.

Table 1: List of Variables

Left-Hand Side variables		*Right-Hand Side Variables*	
SRBCMIX	the ratio of short-term bank loans over the debt mix	*RON*	Real Interest Rate
NBLMIX	the ratio of short-term non-bank debt to debt mix	*MCI*	Monetary Condition Index
SRBC	the logarithm of the short-term bank credit	*LEVER*	the ratio of short-term nonbank loans to total assets
SRMIX	the logarithm of the debt mix		

The determination of the variable capturing the monetary stance is a difficult task. In the literature, the overnight interest rate is a frequently used. In particular, some empirical studies (for example, Sengonul and Thorbecke 2005; De-Haan and Sterken 2006; Ülke and Berument 2016) examining the bank lending channel for Turkey have been utilizing overnight interbank money market rate. In this study, annualized, average weighted overnight interbank money market rate (RON) is used as one of the independent variables with an aim of capturing the monetary authority's policy stance.

In bank lending channel literature, the heart of the research problem is the examination of actors' behaviors during contractionary periods. In order to determine the contractionary periods, this study constructs a dummy variable where tight money periods are determined by monetary condition index (MCI) for the Turkish economy.

MCI is an index frequently used as an indicator of the monetary policy stance (Ericsson et al. 1997; Siklar and Dogan 2015). The original form of the MCI is the weighted sum of the relative change in the effective exchange rate and the absolute change in the short-term real interest rate as compared to a base period. MCI is based on the following equation (Us, 2004):

$$MCI_t = w_1 \left[\frac{ER_t}{ER_b} - 1\right] + w_2 \left[\frac{r_t}{r_b}\right] \quad (1)$$

where w_1 is the weight for the changes in exchange rate, w_2 is the weight for the changes in interest rate, ER_t is the value of an exchange rate in current pethe riod, ER_b stands for the value of an exchange rate in base period and the r_t and r_b is the real interest rate in current and base periods

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respectively. In our study, MCI for an analyzed period is calculated by employing real interbank money market interest rate and real effective exchange rate data. In this calculation, the model gives a weight of 3 to real interest rate and 1 to exchange rate. Since CBRT started to use implicit inflation targeting after 2005, this year is taken as the base year in constructing MCI. An increase in the MCI index signals the tightening of monetary policy whereas the declining index indicates the loosening monetary policy (Siklar and Dogan 2015). According to the constructed MCI index years 1998, 1999, 2001, 2003, 2004, 2006-2007 and 2013-2015 are the years of tight periods.

3.3 Empirical Models

This study carries out several regression models with alternating dependent and independent variables. The design of regression models and the choice of variables for each regression model are constructed on the essence of previous studies including Kashyap et al. (1993), Kashyap and Stein (1994), Gertler and Gilchrist (1993), Oliner and Rudebusch (1995, 1996) and Huang (2003).

We have the following four regressions to be estimated. First, three of these four regressions focus on to what extent each firm group changes their debt composition in response to the central bank's policy actions. The fourth regression model is constructed to examine whether there is substitutability of bank loans and non-bank debt.

$$SRBCMIX_{i,t} = f(RON_{t-1}, DUMMY_j XRON_{t-1}) \quad (2)$$

$$NBLMIX_{i,t} = f(RON_{t-1}, DUMMY_j XRON_{t-1}) \quad (3)$$

$$SRMIX_{i,t} = f(RON_{t-1}, DUMMY_j XRON_{t-1}) \quad (4)$$

$$SRBC_{i,t} = f(LEVER_{i,t}, RON_{t-1}, DUMMY_j XRON_{t-1}) \quad (5)$$

A dummy variable stands for the monetary policy tightness. The value of the dummy is 1 when the index refers to the monetary contraction period, and 0 otherwise. Where t denotes the year.

$$DUMMY = \begin{cases} 1 \; if \; t = 1998, 1999, 2001, 2003, 2004, 2006, 2007, 2013 - 2015 \\ 0, otherwise \end{cases}$$

4. Methodology

Panel data techniques have advantages over both cross-section and time series, using all the information available, which are not detectable either pure cross-section or in pure time series (Baltacı and Kao 2000). In order to get the efficiency improvement from panel data estimation, one should deal with the proper estimation methods (Bahattacharya et al. 2016). As a precursor to the regression analysis, the unit root testing is carried out in both time series and panel data methods but the choice about appropriate panel unit root test(s) depends on the results of cross-section dependence test. Therefore, the first task is to test whether individual data in the panel are cross-sectionally independent or not. The results of cross-sectional dependence tests will guide us to select whether the first or the second-generation panel unit tests must be performed. While the first generation unit root tests (Maddala and Wu 1999; Hadri 2000; Choi 2006; Levin et al. 2002) are based on the assumption that the individual series in the panel does not display cross-sectional correlation, the second-generation panel unit root tests (Philips and Sul 2003; Moon and Perron 2004; Carrion-i-Silvestre et al. 2005 and Pesaran 2007) allow, in a variety of forms and degrees, contemporaneous correlations among panel members in the panel (Rault and Afonso, 2011).

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Ignoring slope heterogeneity and pooling all the data by assuming no variation in cross-sections may cause series problems in panel regression analysis. According to Sarris (1973), shocks in the economy, misspecification of the model, nonlinearities across the variables, proxy variables and the aggregation of the data are the main reasons of heterogeneity across individual units. The random coefficient model proposed by Swamy (1970) allows for parameter heterogeneity in panel units. The main proposition of this model is that the regression parameters for each unit are extracted from a distribution with a common mean and a nonzero covariance matrix (Hildreth and Houck 1968; Maddala et al. 1997). The Swamy (1970)'s random coefficient model first considers the following equation (Swamy 1970):

$$y_i = X_i\beta_i + e_i \tag{6}$$

where y_i, X_i, β_i, and e_i are Tx1, TxA, Ax1 and Tx1 matrices for i = 1…., N individuals; t = 1…, T time periods. Also, β_i and e_i are unobserved random vectors. Main assumptions of this model are given by (Hsiao 2003):

- $E(e_i) = 0,\ E(e_i e_j') = \begin{cases} \sigma_{ii} I \ when\ i = j \\ 0 \ when\ i \neq j \end{cases}$
- $E(\beta_i) = \bar{\beta}$
- $E(\beta_i - \bar{\beta})(\beta_j - \bar{\beta})' = \begin{cases} \Delta \ when\ i = j \\ 0 \ when\ i \neq j \end{cases}$
- β_i and e_j are independent, β_i and β_j are independent for $i = j$.

Also, $\beta_i = \bar{\beta} + e_i$ where $\bar{\beta}$ correspond to common mean, and e_i ~ IN (0, ϕ_i) with $\phi_i = X_i \Delta X_i' + \sigma_{ii} I$ (Maddala et al., 1997). Furthermore, these propositions indicate that the estimated regression parameters turn out unbiased and consistent estimators if $\frac{1}{NT} X'X$converges to a nonzero constant matrix. Conventional least-squares estimation of estimator's variance-covariance matrix will be misleading. Thus, GLS estimator $\bar{\beta}$ is estimated by the following equation (Hsiao 2003):

$$\hat{\bar{\beta}}_{GLS} = (\sum_{i=1}^{N} X_i' \phi_i^{-1} X_i)(\sum_{i=1}^{N} X_i' \phi_i^{-1} y_i) = \sum_{i=1}^{N} W_i \hat{\beta}_i \tag{7}$$

where $W_\mathrm{i} = \{\sum_{i=1}^{N} [\Delta + \sigma_i^2 (X_i'X_i)^{-1}]^{-1}\}^{-1} [\Delta + \sigma_i^2 (X_i'X_i)^{-1}]^{-1}$; and $\hat{\beta}_i = (X_i'X_i)^{-1} X_i' y_i$.

The GLS estimator is the matrix weighted average of each cross-sectional unit's coefficients with weights that are inversely proportional to their covariance matrices.

In order to predict individual partial effects of the changes in regressors on regressand, cross-sectional coefficients must be estimated. The best linear unbiased individual predictors of the unit-specific coefficient vectors are weighted matrix averages of the GLS estimator, $\hat{\bar{\beta}}_{GLS}$, and the group specific OLS estimates, $\hat{\beta}_i$, (Greene 2012).

$$\hat{\beta}_i^* = Q_i \hat{\bar{\beta}}_{GLS} + [I - Q_i]\hat{\beta}_i \tag{8}$$

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where, $Q_i = [\left(\frac{1}{s_i^2}\right) X_i' X_i + G^{-1}]^{-1} G^{-1}$; and, $G = \frac{1}{N-1}\sum_{i=1}^{N}(\hat{\beta}_i - N^{-1}\sum_{i=1}^{N}\hat{\beta}_i)(\hat{\beta}_i - N^{-1}\sum_{i=1}^{N}\hat{\beta}_i)'$.

In the random coefficient model, a different variance is assigned with each observation of the dependent variable, parameter constancy must be checked as to whether unit-specific coefficients differ significantly across units. The null hypothesis of this test is:

$$H_0 = \beta_1 = \beta_2 = \cdots = \beta_N$$

The test statistic for this test is given by:

$$T_{PC} = \widehat{(\beta_i} - \hat{\beta}_i^*)'\{\frac{1}{\sigma_i^2}(X_i X_i)\}(\hat{\beta}_i - \hat{\beta}_i^*) \quad (9)$$

T_{PC} has a χ^2 distribution with k(N-1) degrees of freedom. The null hypothesis is rejected if the p value of the parameter constancy test is less than 0.05, and decide parameters are heterogeneous across panel units.

5. Empirical Results

Before running the regression models, we performed cross-sectional dependence and unit root tests. Results for the cross-sectional dependence test implies that there is a cross-sectional dependency among the panel units, and this forces us to utilize second-generation unit root tests. The unit root test results showed that the employed variables are stationary in their levels. Cross-sectional dependency and unit root test results are not displayed here but available upon request.

The study runs regressions with different specifications and the results of these regression models will be presented in the following tables. In terms of model specification, the study first examines the parameter constancy where parameter constancy determines whether the constant terms and slope coefficients are homogenous or heterogeneous in these models. The null of homogeneity in each of four regression analysis has been rejected which implies that the reactions towards monetary stance by each type of firms display significant differentiation. Hence, we interpret the unit-specific results. In terms of specification, a dummy variable is used as a proxy for the contractionary periods. The dummy takes the value of (1) in monetary tightening whereas the (0) in loose periods. Thus, the coefficient of RON (-1) represents the effect of monetary stance in loosening periods whereas the sum of the coefficient of RON (-1) and DUMMY*RON (-1) stands for the impact of monetary stance in tight periods.

In the first regression, SRBCMIX that is the ratio of short-term bank credits to the sum of bank credits, issued bonds, sales receivables and sales payables is the dependent variable whereas RON (-1) and DUMMYXRON (-1) are independent variables. Regression results of the Model-1 can be found in Table 2.

Columns 1, 2, 3 and 4 show the regression results for the whole panel, small firms, medium firms and large firms, respectively. The estimated coefficient value of RON (-1) is negative and significant at less than 1 percent level for the whole panel and for medium and large firms. For the small firms, the sign of the coefficient is also negative, but the statistical significance value is not in the acceptable range. In other words, medium and large size firms are firm sensitive to the interest rate changes and these firms can accommodate their liability side according to the changes in monetary policy. The estimated coefficients for DUMMY*RON (-1) serve us to differentiate between tight and loose policy periods. The estimated coefficient for the panel as well as each firm type is negative and statistically significant. Moreover, the coefficient value for each firm type is significantly larger than that of RON (-1) indicating that the effect of interest rate changes is

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stronger in contractions. However, contrary to prior expectations, the fall of the share of bank credits is more in tune with for large firms relative to medium firms during the contraction times. This result may arise due to large firms' ability to switch their funding sources during the contractions. At first glance, empirical findings of the Model-1 are in line with bank lending channel theory. In other words, the contractionary policies induce firms to change their balance sheet.

Table 2: Results for Model-1

Dependent Var: SRBCMIX	*Panel*	*Small Firms*	*Medium Firms*	*Large Firms*
Variables	Coeff.	Coeff.	Coeff.	Coeff.
C	0.49* (0.00)	0.51* (0.00)	0.52* (0.00)	0.43* (0.00)
RON (-1)	-0.11* (0.00)	-0.11 (0.14)	-0.13** (0.01)	-0.10* (0.00)
DUMMY*RON (-1)	-0.35* (0.00)	-0.32* (0.00)	-0.29* (0.00)	-0.43* (0.00)
Slope Homogeneity				
Test of Parameter Constancy (Chi2)		109.73 (0.00)		

Note: Numbers in parentheses represent probability values. * and ** represent 1% and 5% significance respectively.

In the second regression, the dependent variable is NBLMIX (ratio of short-term non-bank debt to debt mix) and the lag of overnight interest rate (RON(-1)) and interaction dummy are the explanatory variables. The results of this model-Model-2 are displayed in Table 3.

Table 3: Results for Model-2

Dependent Var: NBLMIX	*Panel*	*Small Firms*	*Medium Firms*	*Large Firms*
Variables	Coeff.	Coeff.	Coeff.	Coeff.
C	0.50* (0.00)	0.48* (0.00)	0.47* (0.00)	0.56* (0.00)
RON (-1)	0.11* (0.00)	0.11 (0.14)	0.13** (0.01)	0.10*** (0.08)
DUMMY*RON (-1)	0.35* (0.00)	0.32* (0.00)	0.29* (0.00)	0.43* (0.00)
Slope Homogeneity				
Test of Parameter Constancy (Chi2)		109.73 (0.00)		

Note: Numbers in parentheses represent probability values. *, ** and *** represent 1%, 5% and 10% significance respectively.

The coefficient of interest rate for the whole panel, medium and large firms (column 1, 3 and 4, respectively) found to be a positive and significant while for small firms (column 2) not significant. During the contractionary periods, however, the share of non-bank debt in debt mix tend to increase significantly for all firm types. As can be seen, we estimate that the interaction dummy has positive and significant for each firm type. Moreover, the estimated value of interaction dummy for large firms is significantly larger than both small and medium-size firms suggesting that the adaptation and maneuvering capacity during the contractionary period is more apparent for large size firms than small and medium-sized firms in Turkey.

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The results of Model-3 is displayed in Table-4 where the logarithm of the debt mix (SRMIX) is the dependent variable. As explained above, bank lending channel is operational if the bank and non-bank debt instruments are not perfect substitutes, indicating that (some) firms are not able to substitute bank loans with other external debt instruments during tight monetary periods. In Model-3, each coefficient of interest rate (RON) is to be found significant and a negative association between interest rate and debt mix is established for each type. That is, when the interest rate is higher, firms (small, medium and large) tend to reduce their debt mix. The small firms seem to be slightly more sensitive to the interest rate changes. In addition to this, the coefficients for the interaction dummy display some discrepancy. While the coefficient of interaction dummy is negative and significant for medium and large type firms, we found a negative but insignificant relationship between interaction dummy and debt mix for small firms. Again, we found that large firms have much better maneuvering capabilities during the contractionary periods.

Table 4: Results for Model-3

Dependent Var: SRMIX	*Panel*	*Small Firms*	*Medium Firms*	*Large Firms*
Variables	Coeff.	Coeff.	Coeff.	Coeff.
C	12.10* (0.00)	10.44* (0.00)	11.99* (0.00)	13.88* (0.00)
RON (-1)	-0.29*** (0.05)	-0.32** (0.03)	-0.30** (0.04)	-0.25*** (0.09)
DUMMY*RON (-1)	-1.82* (0.00)	-1.57 (0.15)	-1.89** (0.02)	-2.04* (0.00)
Slope Homogeneity Test of Parameter Constancy (Chi2)		6658.48 (0.00)		

Note: Numbers in parentheses represent probability values. *, ** and *** represent 1%, 5% and 10% significance respectively.

Empirical results of Model-4 are presented in Table 5. Model-4 enriched the analysis by adding LEVER (the ratio of short-term nonbank loans to total assets) as an independent variable and using SRBC (short-term bank credit) as our dependent variable. In Model-4, in addition to interest rate and interaction dummy, we add LEVER to examine whether bank loans and other external sources are substitutable or not for each firm type. As discussed in the literature, a negative and significant coefficient for LEVER can be interpreted as an evidence showing that non-bank debt instruments are the substitute of bank loans.

The regression results show a substantial discrepancy among the coefficients and respective statistical significance levels for LEVER. In particular, except for large firms, the sign of the coefficient of LEVER for small and medium firms is negative. Moreover, the estimates for medium and large firms are not significant at conventional levels. A negative and significant coefficient of LEVER for small firms suggest that bank loans and non-bank debt instruments are close substitutes for small firms but not for medium and large firms.

In sum, empirical findings of the models, (Model 1 to 4) suggest that monetary contractions lead to a decline in the share of bank loans in debt mix also lead to increase in the share of non-bank external funds in total debt mix. However, the volume of total external financing tends to decline to imply that the volume of other external financing instruments does not fully offset the drop in the bank loans. Moreover, since the tightening and loosening monetary policies have a

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different set of results (due to the statistical significance of interaction dummy in the regression analysis), the heterogeneous behavior of firms during these two distinct periods gives further evidence favoring bank lending channel. By using a novel technique not employed in previous studies, the empirical results this study found are in line with those Kashyap et al. (1993), Huang (2003), Valverde and Paso (2009) and Özlü and Yalçın (2012). On the other hand, our results have contradicted with those of Gertler and Gilchrist (1993) and Oliner and Rudebusch (1995). Moreover, unlike the results of Huang (2003) and Özlü and Yalçın (2012), this study found that the bank lending channel works for not only small and medium firms but also large firms, which is in line with the Kashyap et al. 1993 and Yalçın et al. 2004). Our overall results suggest that the behavior of Turkish manufacturing firms for a period of 1996-2005 is in most part in line with bank lending channel mechanism.

Table 5. Results for Model-4

Dependent Var: SRBC	*Panel*	*Small Firms*	*Medium Firms*	*Large Firms*
Variables	Coeff.	Coeff.	Coeff.	Coeff.
C	11.76* (0.00)	10.90* (0.00)	11.72* (0.00)	12.67* (0.00)
RON (-1)	-0.68* (0.00)	-0.87** (0.01)	-0.64 (0.13)	-0.51** (0.03)
DUMMY*RON (-1)	-2.75* (0.00)	-2.72* (0.00)	-2.57** (0.02)	-2.88* (0.00)
LEVER	-2.48 (0.44)	-7.56* (0.00)	-2.46 (0.10)	2.55 (0.10)
Slope Homogeneity				
Test of Parameter Constancy (Chi2)		5642.32 (0.00)		

Note: *Numbers in parentheses represent probability values.* *, ** *and* *** *represent 1%, 5% and 10% significance respectively.*

6. Conclusion

This study examines the validity of the bank lending channel in Turkey covering the period between 1996 and 2015 by using the data derived from Turkish manufacturing firms' balance sheets. Since the analysis concentrates on the cross-sectional differences both across firms and time, the study uses the Random Coefficient Model in empirical analysis. This methodology enables to obtain the heterogeneous response of each firm group to interest rate changes during both loosening and tightening periods.

The study runs four regression models with alternating dependent and independent variables. Our results indicate that manufacturing firms modify the composition of external financing following monetary policy changes. The increase in the real overnight interest rate stemming from monetary contraction leads the proportion of bank loans in the financing mix to decline whereas the share of non-bank debt sources to increase. In other words, firms rearrange their external financing across bank credits and other debt instruments. Moreover, the results show that monetary contraction causes the volume of external financing to decline. Since the proposition of bank lending channel indicate that firms cannot perfectly substitute non-bank debt sources with bank credits, our empirical findings are consistent with bank lending channel.

Effect of the monetary contraction is also noticeable in tight money periods. The variation in external financing composition is more significant in these periods. Hence, the study finds the asymmetric effects of the monetary policy changes which in turn provides additional evidence on

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the bank lending channel. Another important finding of the current study is that the bank lending channel works for both small and large firms. The shift of external financing composition across bank credits and non-bank debt sources display remarkable change and both small and large firms tend to adopt their external borrowing behavior in response to developments in the financial environment.

There are some policy implications. Empirical results are in favor of bank lending channel in the Turkish economy. Hence, the monetary authority can use the bank loans as an intermediate instrument in policy setting; and can accelerate this channel to prevent the breakout of financial instability in overheating periods of the Turkish economy. Also, asymmetric effects of monetary policy changes support the proposition of bank lending channel, which in turn indicates the efficiency of policy implementations through bank loans across time.

Empirical findings of the study indicate that both small and large firms experience a reduction in debt financing during monetary contraction contrary to the empirical results of the studies conducted for developed countries. Firms of all sizes suffer from a decrease in bank loans in the manufacturing industry. More precisely, the bank lending channel operates both through relatively small and large firms in a Turkish setting. That is, large firms are also financially constrained in contractionary periods. Hence, large firms cannot mitigate the destructive effects of the crisis on real activity since they are also restricted to get more bank financing. Therefore, large firms also should be supported in crisis times by facilitating their credit opportunities to fix the devastating consequences of the crisis on real economic activity.

The last implication derived from our empirical findings is that bank lending channel operates in the Turkish setting due to the lack of financial deepening in capital markets. Financial deepening arises with the introduction of new debt instruments into the system and enables firms to reach these instruments. Since small, medium and large manufacturing firms are not able to issue bills and bonds in capital markets, they all rely on bank loans to meet their financing needs. Although trade credits are substitutes for bank credits, they cannot fully compensate the bank loan reductions. Hence, deepening in capital markets and the increasing financialization shortly downplay the role of bank lending channel in the Turkish economy.

This analysis can be extended if the firm-level financial statement data are acquired, and the number of observations is enlarged. Hence, many other firm-specific variables can be included in the analysis with an interaction dummy which measures the asymmetric effects of firm-specific characteristics on firm's financing behavior.

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