

Building a Financial Constraint Index for Türkiye

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December 2023 Çalışma Tebliği No: 23/06



 $\ensuremath{\mathbb{C}}$ Central Bank of the Republic of Türkiye 2023

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Abstract

The aim of this paper is to construct an index of financial constraints for firms in Türkiye. Traditional indices such as the KZ index, the WW index and the HP index have been constructed for advanced economies such as the United States or European countries. In this study, we take advantage of the Investment Tendency Survey sent to firms by the Central Bank of the Republic of Türkiye to extract a real indicator of financial constraints based on managers' own evaluations of their firms. The survey question on the factors that stimulate investment decisions is evaluated as a true indicator of financial constraints, and then this response is predicted with various balance sheet indicators. In this way, we construct an index of financial constraints that is specific to firms operating in the Turkish economy. We find that financial constraints can be determined with seven fundamental variables: age of the firm, size, change in size, profitability, leverage, tangibles (tangible assets to total assets) and export share. We prove the validity of the index by showing that financially constrained firms identified by this index have real difficulties in accessing bank credit in the form of lower volumes, higher interest rates and shorter loan maturities. We then show that financial constraints have a dampening effect on the firm's net worth and investment both through its own effect and through the long-term borrowing channel. Moreover, the transmission of a macro-financial shock is persistently affected by the financial constraint status. Finally, the validity of the index applies to a larger sample of companies.

Keywords: Index of Financial Constraints, KZ Index, Investment tendency, Turkish firms, Turkish economy

JEL Codes: E44, E60, G30

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Non-Technical Summary

Financial constraints refer to restrictions on firms' access to external finance, which limit their potential for investment, production and employment. Because of their significant impact on the economy as a whole, the identification of financial constraints is of the utmost importance.

Despite its importance, financial constraint is not something that can be measured. Both academics and practitioners have made considerable efforts to measure financial constraints. These indicators help to quantify financial constraints in an index form. However, these measures are mainly designed for advanced economies, such as the United States or European countries, where financial constraints are very different from those in emerging markets.

This paper aims to construct a financial constraints index for an emerging economy, Türkiye. To this end, we use the Investment Tendency Survey of the Central Bank of the Republic of Türkiye, which is conducted among manufacturing firms, to extract a true indicator of financial constraints based on firms' self-reports. The survey question on the factors that stimulate investment decisions is evaluated as a true indicator of financial constraints, and then this response is predicted with various balance sheet indicators. In this way, we are able to construct an index of financial constraints that is specific to firms operating in the Turkish economy. We find that financial constraints can be determined by seven basic variables, namely age of firm, size, change in size, profitability, leverage, tangibles (tangible assets to total assets) and export share.

Our paper contributes to and advances the literature on construction of financial constraint indices by showing that firms identified by our index are indeed unable to borrow from creditors as much as others. Moreover, thanks to our granular firm-level and debt-level data, we show that financially constrained firms, as identified by our index, are able to access bank debt at higher interest rates and shorter maturities.

We show that financial constraints are particularly effective on long-term borrowings. Financially constrained firms have less access to both domestic and foreign currency denominated long-term debt than other firms. In addition, financial constraints persist. They are effective at least for 2-3 periods. We also show how an aggregate shock, such as a tightening of credit conditions (an increase in the average spread), is transmitted to borrowing conditions via the financial constraint status. We find that when there is an increase in the average spread, Turkish lira borrowing for constrained firms declines more compared to the unconstrained one. Thus, financial constraints do indeed play a role in the propagation mechanisms of the credit channel. We then test how financial constraints affect real variables such as investment and net worth. We show that financially constrained firms have lower investment and net worth through the long-term borrowing channel. Finally, the sample of firms has been expanded to encompass all corporate taxpayers in the manufacturing sector in Türkiye. We show that our index works for the entire set of firms, proving its practicality for policy makers and researchers.

Understanding financial constraints and usage of indices like ours provide policymakers with valuable information to understand the extent of financial constraints faced by firms. This knowledge helps to formulate targeted policies, assess the effectiveness of monetary policy, promote financial inclusion and monitor systemic risks, ultimately contributing to more efficient and inclusive financial systems.

1. Introduction

Financial constraints refer to restrictions on firms' access to external finance, which limit their potential for investment, production and employment. Because of their significant impact on the economy, the identification of financial constraints is of the utmost importance. Both the theoretical and empirical macroeconomic literature pay close attention to financial constraints, given their inevitable role in shaping business cycles and the transmission of various policies.

In the absence of financial frictions, the financing and capital structure of firms are irrelevant (Modigliani and Miller, 1958; 1963). In such a frictionless economy, financial resources are free to flow to the most productive or profitable projects and financial constraints are not an issue. However, financial constraints and their macroeconomic implications do matter (Brunnermeier et al., 2012). Liquidity and collateral considerations, as well as the distribution of funds to firms, become very important, as shown by the recent episodes since the Lehman crisis.¹

Despite its importance, financial constraint is not measurable. Both academics and practitioners have made considerable efforts to measure financial constraints and their general equilibrium implications. As a result of these efforts, several indicators of financial constraints were produced, such as the Kaplan-Zingales (KZ) index (Kaplan and Zingales, 1997; Baker et al., 2003), the Whited-Wu (WW) index (Whited and Wu, 2006) and the Hadlock-Pierce (HP) index (Hadlock and Pierce, 2010); and the more recent indices produced by Mulier et al. (2016) and Schauer et al. (2019). These indicators help to quantify financial constraints in an index form. However, these measures are mainly constructed for advanced economies, such as the United States (US) or European countries, where financial constraints are very different from those in emerging markets.

Therefore, this paper aims to construct a financial constraints index for an emerging economy, namely Türkiye, where firms face a challenging environment in terms of financial constraints. To this end, we use the Investment Tendency Survey (ITS) of the Central Bank of the Republic of Türkiye (CBRT), which is conducted among firms to extract a true indicator of financial constraints based on firms' statements. The survey question on factors that stimulate investment decisions is evaluated as the true indicator of financial constraints, and then this response is predicted with various balance sheet indicators. In this way, we are able to construct an index of financial constraints that is specific to firms operating in the Turkish economy.

To the best of our knowledge, our paper is the first attempt to construct an index for an emerging economy, and also for the Turkish economy. Unlike advanced economies, the Turkish economy has some unique characteristics, which makes it worthwhile to analyze firms in terms of their financial constraints. To be more specific, Türkiye has experienced a remarkable credit deepening since the early

¹ Campello et al. (2010) present survey evidence that 86% of US CFOs say they have been financially constrained during the 2008 credit crisis due to a shortage of funds.

2000s, which was largely initiated by a comprehensive structural reform agenda introduced after the 2001 financial crisis. The importance of credit markets to economic activity and investment dynamics has increased significantly (Buyukbasaran et al., 2022; Akcigit et al., 2021). Even though firms' access to bank credit has become a crucial element for business investment, equity financing is still limited and accounts for a small share of business financing in Türkiye.

We find that financial constraints can be determined by seven basic variables, namely age of firm, size, change in size, profitability, leverage, tangibles (tangible assets to total assets) and export share. As expected, age, size, change in size and profitability are negatively correlated with the status of being financially constrained. Unlike similar studies, the growth rate matters as well as size for Turkish firms. Export share is negatively correlated with financial constraints, indicating that an increase in the amount of exports reduces the probability of being financial constrained. This could be attributed to the fact that the productivity and profitability of exporting firms exceed those of non-exporting firms, thereby raising their access to financial markets. The variable of export share is found to be significant which differs from similar studies in the literature. This can be attributed to the small open economy nature of Türkiye.

We find that having higher leverage lowers the likelihood of being financially constrained. This is just the opposite of findings of similar studies. We conjecture that this is linked to a firm's ability to borrow or access credit. Companies with existing bank debt can readily have access to financial funds. This interpretation is especially valid for economies like Türkiye that have recently undergone financial deepening. Previous studies in the literature mainly suggest that higher leverage leads to financial constraints. Our research adds new insights, showing that this may not always be the case, particularly in emerging economies like Türkiye. We discover a positive relationship between tangibles and the status of being financially constrained. This implies that a decrease in liquid assets could potentially be associated with being financially constrained. Faulkender et. al. (2019) state that firms may increase their cash holdings due to precautionary needs in times of high risk and escalating uncertainty. Investing in tangible assets could be perceived as a shift towards a more illiquid position. This might matter for a small open economy like Türkiye. In brief, for these two variables; leverage and tangibles we find different results from the literature.

Our paper contributes to the literature by showing that these firms are indeed unable to borrow as much as others from creditors. Moreover, thanks to our granular firm-level and debt-level data, we show that financially constrained firms, as identified by our index, can only be granted bank credit at higher interest rates and shorter maturities. In our view, this is a significant contribution to the literature as it confirms that these constrained firms are indeed experiencing difficulties in borrowing.

We show that financial constraints are particularly effective for long-term borrowings. Financially constrained firms have less access to both domestic and foreign exchange (FX) long-term debt than other firms. For domestic debt, the constraints are stronger and longer lasting. A firm that labelled as

"financially constrained" in the current year still borrows a smaller amount of Turkish Lira (TL) debt three years later. This shows the persistence of financial constraints. In addition, financially constrained firms borrow at significantly shorter maturities and also pay significantly higher interest rates on longterm debt. We also show how an aggregate shock, such as a tightening of credit conditions (an increase in the average spread), is transmitted to borrowing conditions via the financial constraint status. We find that when there is an increase in the average spread which could be due to a monetary policy surprise, a macroprudential measure or a global funding shock, Turkish lira (TL) borrowing for constrained firms continues to decline. Thus, financial constraints do indeed play a role in the propagation mechanisms of the credit channel.

We then test how financial constraints affect investment decisions and net worth of firms by analyzing both its sole effect and interaction with long-term TL borrowing. Our findings demonstrate that financial constraints have a negative impact on the ability of firms to access long-term credit, resulting in a decline in their investments and net worth. This can be interpreted as evidence of the real effects of financial constraints.

Finally, we extend our sample of firms participating in the ITS to include all corporate taxpayers in Türkiye in the manufacturing sector. Using the index formula obtained for the firms that participated in the survey, we construct financial constraint indices for the entire population of firms. We then perform similar tests for firms' borrowing ability and real variables. We show that the reliability of our index is validated for all firms, which proves that it can be a useful tool for policy makers and also researchers.

To sum up, our results contribute to the literature by, first, constructing an index for an emerging economy, namely the Turkish economy. Second, using our granular data, we show that financially constrained firms labelled with our index borrow at higher interest rates and shorter maturities. We interpret this as a validation of such indices constructed in the literature. Third, we show that our index is not only able to represent ITS respondent firms, but also the entire sample of manufacturing firms in the Turkish economy.

The majority of the economic activity in emerging markets such as Türkiye is carried out by small and medium-sized enterprises (SMEs). These firms require bank loans and are particularly vulnerable to financial disruptions. Credit market imperfections have significant real-side effects in these economies, affecting business investment, employment, sales, growth, and ultimately the overall welfare. The attempt to construct such an index should provide valuable insights to identify potential risks and vulnerabilities of the real sector. It allows for benchmarking and industry analysis. By comparing financial indicators across different entities or industries, it becomes possible to identify best practices, trends, and areas for improvement. Financial constraint indices would be useful in evaluating the overall financial soundness of a firm or a sector. Also, these indices might be very useful for external stakeholders such as investors, lenders or regulators.

The outline of the paper is as follows: Section 2 presents the literature review. Section 3 introduces the data. In Section 4, we show the calculation of the index and present our main empirical findings. Section 5 summarizes the findings and concluding remarks.

2. Literature Review

Brunnermeier et al. (2012) provide a detailed survey showing why and how financial frictions are important for general equilibrium, and how they can be quite destructive. Financial frictions are the main transmission mechanism of certain macroeconomic shocks through the credit channel. The empirical macroeconomic and financial literature shows that the credit channel operates through two sub-channels: a bank lending channel and a balance sheet channel. When financial frictions are mainly on the side of financial intermediaries, they are interpreted as a bank lending channel; whereas if they are on the side of firms, it is interpreted as a balance sheet channel.

As the earlier studies in the literature show, financial frictions and the balance sheet channel cause shocks to have persistent effects (Bernanke and Gertler, 1989; Carlstrom and Fuerst, 1997). In these models, a deterioration in the net worth of the entrepreneurs exacerbates financial frictions and limits their borrowing from lenders, which eventually leads to a decline in investment. Lower investment and lower net worth in the following periods have significant macroeconomic effects, which are summarized under the term "credit channel".

A large empirical literature studies the effect of financial constraints on business cycles and investment dynamics. Without building an index, the literature emphasizes various variables such as size (Gertler and Gilchrist, 1994; Crouzet and Mehrotra, 2020; Dinlersoz et al., 2018), cash flows (Fazzari et al., 1988; Oliner and Rudebusch, 1992; Almeida et al. 2004; Arslan et al., 2006; Bates et al., 2009), dividend payments (Fazzari et al.; 1988, Farre-Mensa and Ljungqvist, 2016), bank debt and maturity-weighted floating-rate debt (Ippolito et al., 2018; Gurkaynak et al., 2022), age (Cloyne et al., 2018; Haltiwanger et al., 2013; Fort et al., 2013; Dinlersoz et al., 2018), leverage (Ottonello and Winberry, 2020), liquidity (Jeenas, 2018) and business affiliation (George et al., 2011; Saidani et al., 2017).

Another strand of the literature combines the information in these variables and builds indices to detect financial constraints. Habib et al. (2021) provide a detailed literature survey on this. Kaplan and Zingales (1997) aim to answer one of the fundamental questions in corporate finance literature, i.e. the effect of financial constraints on investment-cash flow sensitivities. They use the qualitative information in annual reports combined with the quantitative information in tables. Their regressions attribute positive values for Tobin's Q and leverage, and negative values to operating cash flow, cash balances, and dividends to detect financial constraints for a large sample of firms. Baker et al. (2001) create a synthetic KZ Index of financial constraints for a large sample of firms. Baker et al. (2003) revise the KZ index by removing Q from the equation, claiming that the information content of the index would stay the same. Cleary (1999) develops a new index similar to KZ using variables of current ratio, fixed charge

coverage ratio, financial slack, net income deflated by sales, growth of sales and leverage. Whited and Wu (2006) estimate an investment Euler equation by employing cash flows, dividend, leverage, size, industry sales growth and firm's sales growth to create the WW Index. Hadlock and Pierce (2010) collect qualitative information and build a Size-Age (SA) index using variables of size and age. Mulier et al. (2016) build an Age-Size-Cash Flow-Leverage (ASCL) index of financial constraints using a sample of unquoted firms based on their size, age, cash flows and leverage. Cherchye et al. (2020) follow a non-parametric approach by recovering financial constraints from the optimizing behavior of profit-maximizing firms to identify financial constraints for the euro area. They validate their index by manager's reports from survey data and firms' access to external finance.

All of these indices include some subjectivity in their design, which stems from the categorization of firms into groups. We add to the recent literature by employing firms' self-assessments to measure financial constraints instead of imposing prior selection restrictions on balance sheet information. The closest study to ours is Schauer et al. (2019), which uses a similar survey to derive a new measure of financial constraints for European firms. Similar to this study, we run logit estimators to produce the index combining the information from the survey responses and annual balance sheet fillings. We extend Schauer et al. (2019) by showing the credit access of constrained firms, thus validating the use of this type of index and proving its practicality. Our dataset allows us to ask whether these firms, labelled as "financially constrained", actually face difficulties in accessing credit with regards to various criteria such as quantity, interest rate, maturity or currency type. Using Credit Registry data, we provide a detailed picture of credit access and financial constraints. We show that financial constraints are particularly important for long-term debt, for both TL and FX debt. Moreover, we show that financially constrained firms face higher interest rates. In this respect, our study is one of the few studies in the literature on financial constraint indices such as Cherchye et al. (2020).

Arslan et al. (2006) specifically examine the investment-cash flow sensitivity of Turkish firms to financial constraints. To identify financially constrained firms, they follow the findings of the existing literature and group firms by size, age, dividend payout and industry. Similar to their study, we find that the investment of constrained firms is more sensitive to cash flows. Unlike them, we identify firms' financial status by constructing an index derived from managers' own statements. Our structure allows for non-linearity, which is both statistically and economically meaningful. Furthermore, we demonstrate the usefulness of our index with respect to several criteria that are mentioned above.

3. Data

To construct a financial constraint index, we first produce a financial constraint indicator (FinCon) based on managers' own statements. Our main data source is the CBRT's ITS. The survey aims to monitor current investment tendencies and near-term investment plans of manufacturing firms on a biannual basis. The survey is compiled from the responses to the investment questions in the Business Tendency Survey (BTS). The survey is conducted twice a year (in the spring and autumn). However, we construct FinCon using the question on factors stimulating investment, which is only available in the autumn survey.² Therefore, our sample period covers 2008-2021 with an annual frequency. The annual coverage of ITS is close to 2,000 firms.

Our empirical design assumes that the survey-based indicator of financial constraints, FinCon, is an accurate indicator. First, we ask which balance sheet indicators are successful in explaining FinCon. Then, we conduct a battery of tests on firms' access to credit and their real variables like investment and net worth. The corporate balance sheets provided by the CBRT are merged with the ITS data and the granular corporate-bank credit datasets. All balance sheet items are deflated by the consumer price index (CPI) where applicable. A detailed description of data sources and variable definitions is provided in the Appendix.

3.1. The Design of FinCon

The autumn ITS survey asks about the factors that would lead to an increase in investments in period t (current year) or in period t+1 (next year) (Table 1). This question lists demand, financial conditions, technical factors and other factors as "stimulating investment decisions". If the firm does not select financial conditions as a factor that would increase investments for this year (t) and the next year (t+1)in the current survey and does not select the same response for this year (t) in the next survey, then the firm is considered to be "financially constrained". Following this identification, we extract information from two consecutive surveys. This is consistent with the findings from annual firm-level investment data that the time-to-build effect for equipment is one year, whereas it lasts up to two or three years for structures (Del Boca et. al., 2008). Similarly, Meier (2017) shows that order backlogs to monthly shipments for non-defense capital goods fluctuate between three and nine months and tend to be largest at the end of recessionary periods. Schauer et al. (2019) construct a financial constraint indicator using manager self-assessments based on investment surveys but unlike our identification, they focus on only the current year investments. Returning to our definition, the economic conditions for the current year are almost complete in the autumn, so firms' assessments for year t can be considered consistent with realizations. In addition, we take into account current expectations for t+1 and realizations for the next year.

Our sample consists of unbalanced data for the period 2008-2021. The yearly number of unique firms ranges from 1,500 to 2,500, and there are 18,282 observations (number of yearly unique firms x number of years) in total. Although the number of financially constrained firms varies from one year to another year, it constitutes approximately 20% of the sample on average. Consistent with Hu and Schiantarelli

² Survey questionnaire and more methodological information can be found at

https://www.tcmb.gov.tr/wps/wcm/connect/EN/TCMB+EN/Main+Menu/Statistics/Tendency+Surveys/Investment+Tendency+Statistics/.

(1998), Cleary (1999) and Schauer et. al. (2019), firms' financial status changes within their life-cycle. Even though no firm was found to be financially constrained in all years, 7% of firms were found to be financially constrained in at least half of the periods they responded to the survey on average. The ratio of the number of financially constrained firms to the total number of firms varies depending on the cyclical fluctuations, but remains between 13% and 26%. Similar to Schauer et. al. (2019), the ratio of financially constrained firms remains high in times of economic downturns. More specifically, the ratio remained high in the 2009-2010 period after the global financial crisis, and then declined until 2014 and remained flat in the 2014-2016 period. The ratio hit its trough in 2017 on the back of the credit guarantee fund (CGF)³ subsidies provided to firms, but then increased rapidly in 2020 due to the outbreak of the Covid-19 pandemic.

Table 1. BTS Question Regarding Factor Stimulating Investment

Question - What main factors are stimulating your investment? (Several choices possible)			
or this year (t)	For the next year (t+1)		
	•		
	•		

Source: BTS.

Table 2 presents summary statistics for the full sample as well as for the constrained and unconstrained firms identified in the survey. In the analysis, we aimed to examine all relevant and economically significant variables related to financial constraints in the literature. As Table 2 shows, our sample consists mainly of medium and large-sized enterprises. Compared to financially unconstrained firms, financially constrained firms have a lower ratio of plant and equipment to capital.

³ The CGF is a fund established by the government to provide credit to firms (both to SMEs and non-SMEs), which otherwise cannot obtain bank loans due to insufficient collateral.

	Financiall	y Unconstrained	Financially		Entire Sample	
		~	Con	istrained		~
	Mean	Standard	Mean	Standard	Mean	Standard
A ===	26.02	12.80	27.40	Deviation	27.01	12.06
Age	20.95	15.80	27.40	14./1	27.01	13.90
Number of Employees	5.75	0.95	5.81	0.95	5./4	0.95
Size	13.01	1.24	13.21	1.23	13.05	1.24
Financial Debt	0.12	0.14	0.09	0.13	0.11	0.14
Profitability	0.06	0.09	0.07	0.10	0.06	0.09
Cash Flow	0.07	0.10	0.08	0.11	0.07	0.10
Investment/Capital	0.10	0.39	0.05	0.31	0.09	0.38
PE/Capital	0.05	0.23	0.02	0.18	0.04	0.23
Leverage	0.57	0.24	0.52	0.25	0.56	0.24
Current Ratio	2.18	1.82	2.59	2.38	2.25	1.94
Liquidity Ratio	0.46	0.73	0.58	0.90	0.48	0.77
Export Share	0.27	0.28	0.27	0.27	0.27	0.28
Sales Growth	0.11	0.26	0.09	0.23	0.11	0.26
EBIT/Assets	0.10	0.10	0.11	0.10	0.10	0.10
EBIT/Sales	0.10	0.11	0.11	0.11	0.10	0.11
Short-Term Debt	0.78	0.21	0.79	0.21	0.78	0.21
Tangibles/Assets	0.24	0.15	0.24	0.14	0.24	0.15
Working Capital/Assets	0.25	0.23	0.28	0.24	0.25	0.23
Equity/Assets	0.43	0.24	0.48	0.25	0.44	0.24
Trade Credit/Assets	0.17	0.13	0.17	0.13	0.17	0.13
Return on Assets	0.10	0.08	0.10	0.09	0.10	0.09
Dividends/Assets	0.00	0.25	-0.01	0.27	0.00	0.25
Financing Expenses	0.05	0.06	0.05	0.06	0.05	0.06
Short-Term TL	0.05	0.08	0.04	0.08	0.05	0.08
Debt/Assets						
Medium-Term TL	0.01	0.03	0.01	0.03	0.01	0.03
Debt/Assets						
Long-Term TL	0.03	0.05	0.02	0.04	0.03	0.05
Debt/Assets						
Short-Term FX	0.05	0.09	0.04	0.09	0.05	0.09
Debt/Assets						
Medium-Term FX	0.02	0.04	0.02	0.04	0.02	0.04
Debt/Assets						
Long-Term FX	0.05	0.09	0.04	0.09	0.05	0.09
Debt/Assets						
Total TL Debt/Assets	0.10	0.13	0.08	0.12	0.10	0.13
Total FX Debt/Assets	0.13	0.16	0.11	0.16	0.12	0.16
Total Credit/Assets	0.23	0.20	0.20	0.20	0.23	0.20
Number of Observations	15,124		3,158		18,282	

Table 2. Summary Statistics According to Financial Constraints

Note: We performed parametric and non-parametric statistical tests to analyze the significance of differences between means of variables given in Table 1 for financially constrained firms (FinCon=1) and financially unconstrained firms (FinCon=0). The test results show that the means of variables for financially constrained and unconstrained firms are statistically significant for almost all of the variables except PE/Assets, EBIT/Assets and return on assets.

4. Empirical Analysis

4.1. Investment-Cash Flow Sensitivities

Following the literature initiated by Fazzari et al. (1988), we start our analysis with investment-cash flow sensitivities to demonstrate that our survey-based indicator does indeed capture financial constraints. Accordingly, we estimate the model in Equation 1:

$$Investment_{i,t+1} = \beta_1 CashFlow_{i,t} + \beta_2 FinCon_{i,t} + \beta_3 CashFlow_{i,t} x FinCon_{i,t} + \sum_k \beta_k Firm Controls_{k,i,t-1} + \delta_i + \vartheta_t + \epsilon_{i,t}.$$
(1)

where $Investment_{i,t}$ and $CashFlow_{i,t}$ denote the investment and cash flow of firm *i* at time *t*, $FinCon_{i,t}$ denotes the financial conditions index of firm *i* at time *t*, $CashFlow_{i,t} \times FinCon_{i,t}$ shows the interaction of financial conditions index with cash flow, $Firm Controls_{k,i,t-1}$ denotes the variables given at Table 2, and finally, δ_i and ϑ_t denote the firm and time fixed effects, respectively. The interaction term between $FinCon_{i,t}$ and $CashFlow_{i,t}$ examines whether the coefficient of cash flow differs significantly according to the financial constraints. As presented in Table 3, there is a positive and statistically significant relationship between investments and cash flow for financially unconstrained firms. The negative and statistically significant coefficient of the interaction term indicates that the investment-cash flow sensitivities are lower for the financially constrained firms. The results do not differ remarkably according to different definitions of the dependent variable. The finding of lower investment and cash flow sensitivities of constrained firms is in accordance with the results of Kaplan and Zingales (1997), Kadapakkam et al. (1998), Cleary et al. (2007) and Schauer et al. (2019).

	(1)	(2)	(3)
Variables	(Investment/Capital) _{t+1}	(Investment/Assets) _{t+1}	(Investment/Capital)t+1
CashFlow	0.91***	0.12***	0.73***
	(0.07)	(0.01)	(0.07)
FinCon	0.03**	0.00*	0.02
	(0.01)	(0.00)	(0.01)
CashFlow*FinCon	-0.20**	-0.03**	-0.19*
	(0.10)	(0.02)	(0.10)
Number of Employees	-0.07***	-0.01***	-0.09***
	(0.02)	(0.00)	(0.02)
Leverage	-0.03	-0.01**	-0.06
	(0.04)	(0.01)	(0.04)
Export Share	0.04	-0.00	-0.01
	(0.04)	(0.01)	(0.04)
Sales Growth	0.01	0.01**	0.03*
	(0.02)	(0.00)	(0.02)
Industry Sales Growth	-0.03	0.00	0.00
	(0.05)	(0.01)	(0.07)
Number of Observations	11,828	11,806	11,828
R-squared	0.29	0.31	0.32
Firm Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	No	Yes	Yes

Table 3. Estimation Results on Investment and Cash Flow Sensitivities

Note: This table estimates cash flow sensitivities of investment. The dependent variable, investment, is defined as the ratio of the change in firm's investment over capital for t+1 in the first and third column and investment over total assets in the second column. *, **, *** denote statistical significance at 10, 5 and 1 percent, respectively. Values in parentheses are standard errors.

4.2. Building a Financial Constraint Index

In this section, we estimate an indicator variable for financial constraints using survey data and firmlevel variables, following Schauer et al. (2019). We apply a general-to-specific approach to identify the optimal set of explanatory variables from the large set of variables presented in Table 2. We assess the statistical and economic significance of the equations to determine the final equation. Our aim is to obtain the most specific model with the greatest explanatory power. Equation (2) represents the final predicted model. Table 4's model shows comparable outcomes for panel and pooled logit regressions.⁴

⁴ To assess the financial constraint index's estimation performance Schauer et al. (2019) tests parameter stability at varying time periods and for different sub-samples. Our sample is relatively short due to data constraints, and financial depth in Türkiye has increased since the mid-2000s.

Equation (2) will be estimated to create a Financial Constraint Index (FC Index) for every firm and year pair in the sample. The estimation results of Equation 2 are presented at Table 4.

 $FC \ Index_{i,t} = -0.87 * Age_{i,t-1} - 0.26 * Size_{i,t-1} - 0.49 * SizeChange_{i,t-1} - 1.32 * Profitability_{i,t-1} - 0.82 * Leverage_{i,t-1} + 1.15 * \frac{Tangibles}{Assets} - 0.62 * ExportShare_{i,t-1} (2)$

Table 4	Determinants	of Financial	Constraints	Obtained from	Firm's Finan	cial Tables
I aDIC ¬	. Dutter minants	UI I'IIIAIICIAI		Obtained from	1 II III 5 I' III AII	

	Panel Logit	Pool Logit
Variables	FinCon	FinCon
Age	-0.87***	-0.06
	(0.24)	(0.04)
Size	-0.26*	0.21***
	(0.14)	(0.02)
Change in Size	-0.49**	-0.49***
	(0.21)	(0.16)
Profitability	-1.32**	-0.20
	(0.63)	(0.36)
Leverage	-0.82**	-1.21***
	(0.34)	(0.13)
Tangibles/Assets	1.15**	-0.07
	(0.47)	(0.18)
Export Share	-0.62*	0.03
	(0.36)	(0.09)
Constant		-3.59***
		(0.30)
Number of Observations	5,727	12,098
Firm Fixed Effects	Yes	No

Note: This table estimates logit regressions for the dummy variable FinCon produced from survey data. The first column runs a panel logit with fixed effects, whereas the second column runs pooled logit estimations.*, **, **** denote statistical significance at 10, 5 and 1 percent, respectively. Values in parentheses are standard errors. Right-hand side variables are lagged by one period.

The set of variables identified as noteworthy by our analysis does not present any unexpected findings and is largely consistent with previous research. Unlike the existing studies, our study documents the significance of growth through change in size, leverage, tangible assets and export share.

Prior research suggests that financial constraints tend to affect smaller firms more frequently due to increased information asymmetry and agency problems (Schauer et al., 2019). In our case, both the magnitude and the rate of change in size matter for financial constraints. The rate of growth of total assets is a crucial factor, and change in firm size has a negative correlation with the financial constraint indicator. The results of the study are in line with previous research suggesting that well-established, older firms tend to have a good reputation and long-standing relationships with creditors, which makes it easier for them to obtain external finance (Berger and Udell, 1995). Furthermore, according to Cloyne et al. (2018), a firm's age can serve as a reliable indicator for its financial constraints. In addition, an increase in profitability can play an important role in reducing the likelihood of financial limitations. An increase in market share indicates higher net worth, which ultimately helps to reduce financial restrictions. We also find export share is negatively correlated with financial constraints indicating that increase in the amount of exports reduces the probability of being financial constraints. This may be due to the fact that exporting firms' productivity and profitability are higher than the non-exporting

firms which in turn may increase access to financial markets. We attribute these results to the small open economy nature of Türkiye.

The leverage issue is particularly interesting, especially for Türkiye. Most studies that construct a financial constraint index find that firms face greater financial constraints as their leverage increases. However, this is not quite accurate for Türkiye. Leverage has a significant negative correlation, which is consistent across all specifications. We posit that companies with existing bank debt can more easily obtain credit from banks. Finally, our results indicate a positive relationship between tangible assets and financial conditions. If the increase in tangible assets leads to a decrease in the firm's liquid assets in the short term, this may cause an increase in financial constraints. The signs of these two variables differ from the literature and are robust to alternative specifications.

Panel (a) of Figure 1 presents the distribution of the index. To identify financially constrained and unconstrained firms, we follow Kaplan and Zingales (1997) and categorize the top one-third of the distribution as "financially constrained" and the bottom one-third as "financially unconstrained". We build the FC Index dummy for the financially constrained group as equal to 1. Panel (b) of Figure 1 displays the number of firms for each year by adding together the FC Index dummies and original FinCon variable dummies. It is evident that financial conditions were restricted in the period subsequent to the 2008 global financial crisis, particularly in the years when macroprudential policies, such as reserve requirement ratios were effectively employed by the CBRT during the 2010-2013 period. In the year 2019, macrofinancial conditions were tight resulting from tight monetary policy in the first half. Neither FinCon nor FinCon Index reflects that. Instead, both indicators revealed a tightening in the last period which corresponds to the Covid-19 pandemic. Firms' perception of being financially constrained for investment expenditures indicates that, despite supportive credit policies, limitations other than the interest rate, e.g. selective behavior of banks or shortening of loan maturities, could have been influential.

The subsequent sections utilize the dummy variable, FC Index dummy, to undertake various analyses on credit utilization and related general outcomes. Although we adopt this indicator variable in our regression model based on previous research, we must emphasize that the findings remain robust when we substitute it with the continuous version of the index.



Figure 1. Financial Constraint Index (FC Index)

Note: Panel (a) presents histogram of the FC Index constructed with Equation (2). Panel (b) shows number of firms for each year by summing over dummies of FC Index and original FinCon variable from survey data.

Table 5 presents summary statistics for the variables that explain the financial constraint status of two groups: financially constrained (FC Index Dummy=1) and financially unconstrained (FC Index Dummy=0). The differences between the groups are statistically significant. On average, size, age, profitability, leverage and export share of unconstrained firms are higher than their constrained counterparts. Financially unconstrained firms experience a profitability rate of 6%, while constrained firms experience around 5% on average. The size for the unconstrained and constrained firms is 14.03% and 12.35% percent, respectively. Likewise, the growth rate for size is 8% for both unconstrained and constrained firms. Unconstrained firms have an average age of 38.36 years, while their constrained and constrained firms, respectively. The tangibles over assets ratio is lower for unconstrained firms with a value of 19%, whereas it is 28% for constrained firms. Finally, export share is 36% and considerably higher for unconstrained firms compared to 18% for constrained firms. The discrepancies in certain variables between restricted companies and unrestricted companies differ significantly from what is presented in Table 2 (for instance, age). Our index has effectively distinguished and categorized firms based on their financial constraints.

1 abit 0	· Summary S	cationes for in	uca vallabl	
	FC Inc	dex Dummy=0	FC I	ndex Dum=1
Variables	Mean	Standard Deviation	Mean	Standard Deviation
Size	14.03	1.08	12.35	1.00
Age	38.36	11.29	17.96	8.23
Change in Size	0.08	0.22	0.08	0.21
Profitability	0.06	0.09	0.05	0.09
Leverage	0.61	0.23	0.52	0.24
Tangibles/Assets	0.19	0.12	0.28	0.15
Export Share	0.36	0.28	0.18	0.23
Number of Observations	4,738		4,737	

Table 5. Summary Statistics for Index Variables

4.3. The Effects of Financial Constraints on Firms' Credit Use

The literature on financial constraints usually derives the validity of the index from investment-cash flow sensitivities or inferences from the responses of macroeconomic variables, such as investment, to aggregate macro shocks. To contribute to this literature, we use granular data on financial debt and test whether our financial constraint index measures constraints by examining future borrowing capacity across maturities and currencies. In line with the definition used in the Credit Bureau of Türkiye data, short-term debt denotes financial debt with a maturity of less than one year. Long-term debt, on the other hand, refers to financial debt with a maturity of more than five years. Medium-term debt has a maturity of between one and five years.

Figure 2 provides a visual inspection of the average financial leverage across years for financially constrained and unconstrained firms for both TL and FX debt. TL-denominated leverage levels of constrained and unconstrained firms are close to each other, whereas regarding the FX-denominated leverage levels, a consistent gap is observed for both types of firms. Below, we test whether this difference is due to some firm-specific differences or whether financial constraints do indeed play a role.





Note: Panel (a) presents mean TL Debt/Assets ratio for financially constrained (FC Index=1) and unconstrained (FC Index=0) firms. Panel (b) do the same for FX Debt/Assets.

Table 6 and Table 7 display regression findings for TL-denominated and FX-denominated long-term bank credit over total assets, with a separate analysis conducted for assets from t+1 to t+4 (one year ahead to four years ahead), respectively. On the right-hand side, there are indicator variables for the financial constraint index and other control variables at the firm level, such as sales growth, EBIT/assets, working capital/assets, return on assets, and industry sales growth, along with firm fixed effects, as shown in Equation (3).

Bank Credit Ratio_{*i*,*t*+*x*} = β_1 FinCon Index Dummy_{*i*,*t*} + $\sum_k \beta_k$ Firm Controls_{*k*,*i*,*t*} + δ_i + $\epsilon_{i,t}$ (3)

Variables	(Long TL/Assets) $_{t+1}$	(Long TL/Assets) _{t+2}	(Long TL/Assets) t+3	(Long TL/Assets) t+4
FC Index Dummy	-1.83***	-1.75***	-1.89***	0.45
	(0.38)	(0.44)	(0.59)	(0.83)
Sales Growth	0.28	-0.05	-0.11	-0.31
	(0.25)	(0.28)	(0.32)	(0.37)
EBIT/ Assets	0.78	3.33***	0.55	-0.84
	(1.14)	(1.20)	(1.31)	(1.54)
Working Capital/Assets	-0.15	-1.14**	-0.86	-0.99
	(0.46)	(0.50)	(0.58)	(0.70)
Return on Assets	-2.60*	-3.09**	-1.02	0.39
	(1.36)	(1.46)	(1.62)	(1.94)
Industry Sales Growth	-2.50***	1.68**	0.85	-2.65***
	(0.62)	(0.68)	(0.77)	(0.85)
Constant	3.98***	3.82***	4.05***	3.13***
	(0.24)	(0.27)	(0.35)	(0.47)
Number of Observations	6,827	5,700	4,612	3,621
R-squared	0.66	0.70	0.72	0.72
Firm Fixed Effect	Yes	Yes	Yes	Yes

Table 6. Financial Constraints and Long-term TL Debt / Assets

Note: This table estimates panel regressions in which left-hand side variables are defined as long-term TL debt at various maturities over total assets. *,**,*** denote statistical significance at 10, 5 and 1 percent, respectively. Values in parentheses are standard errors.

The results indicate that financial limitations have a notable impact on long-term borrowing, affecting both TL and FX debt. The repercussions of these constraints are prolonged, particularly for TL debt. If a firm is financially constrained at time t, obtaining TL loans in the next three years becomes arduous. This emphasizes that financial constraints persist for an extended time and do not vanish readily.

Variables	(Long FX/Assets) _{t+1}	(Long FX/Assets) _{t+2}	(Long FX/Assets) _{t+3}	(Long FX/Assets) _{t+4}
FC Index Dummy	-1.32**	0.38	-0.79	0.52
	(0.64)	(0.74)	(0.95)	(1.36)
Sales Growth	1.29***	1.13**	1.00*	1.32**
	(0.43)	(0.47)	(0.52)	(0.58)
EBIT/ Assets	0.14	-2.35	-0.98	-0.46
	(1.94)	(2.02)	(2.13)	(2.44)
Working Capital/Assets	-0.55	0.08	0.27	0.48
	(0.77)	(0.84)	(0.95)	(1.11)
Return on Assets	-6.08***	-4.15*	-4.56*	-4.64
	(2.31)	(2.46)	(2.64)	(3.08)
Industry Sales Growth	-1.64	-2.60**	-8.22***	-2.94**
	(1.06)	(1.14)	(1.25)	(1.34)
Constant	7.22***	6.64***	7.76***	6.55***
	(0.40)	(0.46)	(0.57)	(0.77)
Number of Observations	6,795	5,670	4,582	3,606
R-squared	0.71	0.75	0.79	0.81
Firm Fixed Effect	Yes	Yes	Yes	Yes

Table 7. Financial Constraints and Long-term FX Debt / Assets

Note: This table estimates panel regressions in which left-hand side variables are defined as long-term FX debt at various maturities over total assets. *,**,*** denote statistical significance at 10, 5 and 1 percent, respectively. Values in parentheses are standard errors.

4.4. The Effects of Financial Constraints on Interest Rate and Maturity

In this section, we extend our analysis on the effects of financial constraint on firm's credit conditions again using our Credit Registry data. Accordingly, we calculate firm-level interest rate and maturity weighted with credit amounts.

To this end, we examine how interest rates respond to financial restrictions. Along with the rising inflation in the Turkish economy, TL commercial loan interest rates also increased in 2017 and remained elevated in the following two years (Figure 2). In 2020, commercial loan interest rates declined due to the monetary and fiscal measures introduced to support economic activity during the Covid-19 pandemic. We observe that interest rates have a unimodal distribution throughout the sample period, indicating that the interest rate to which firms are exposed is concentrated at a certain level. An exception is the year 2021, when the distribution is bimodal. This shows that firms' borrowing costs were not concentrated at any one rate, and that financing uncertainties had increased. In the aftermath of the pandemic, the global inflation rate increased due to supply- and demand-driven factors. Policies to slow down domestic demand in order to reduce inflation also led to a slowdown in commercial lending. In 2020-2021, as an alternative to banks evaluating loan applications, institutions such as the Small and Medium Enterprises Development Organization of Türkiye (KOSGEB) and the CGF, which

provide credit support to enterprises, also evaluated loan applications. As a result, the diversity of subsidies and policies led to a divergence in interest rates across firms. This diversity allows us to analyze the relationship between financial constraints and interest rates. Compared with firms exposed to low interest rates, firms exposed to high interest rates are younger and smaller, have lower profitability, liquidity, export share, working capital to assets ratio and sales growth, and also have a higher ratio of short-term debt to total debt.



Figure 2. Distribution of Interest Rates (IR)

Firms with financial constraints have more difficulty in accessing credit, and they may have to use loans with higher interest rates or lower maturity. In this context, the effect of loan interest and loan maturities, which are observable and measurable factors in the perception of financial constraints of companies, was examined within the framework of the regression model.

Table 6. Effect of Financial Constraint Status on Debt Maturity and interest Rate				
Variables	Maturity t+1	Interest Rate t+1		
FC Index	-15.01**	5.89***		
	(1.22)	(0.58)		
Net Sales/Assets	0.19	1.53***		
	(1.11)	(0.53)		
EBIT/Assets	35.34***	-2.68		
	(6.50)	(2.84)		
Return on Assets	-12.76*	-4.16		
	(7.72)	(3.31)		
ISG	29.48***	21.66***		
	(2.81)	(1.25)		
Working Capital/Assets	15.02***	-5.59***		
	(2.96)	(1.31)		
Leverage	22.37***	-4.26**		
	(3.72)	(1.77)		
Number of Observations	5,157	2,788		
R-squared	0.48	0.52		
Firm Fixed Effect	Yes	Yes		

Table 8. Effect of Financial Constraint Status on Debt Maturity and Interest Rate

Note: This table estimates panel regressions in which left-hand side variables are defined as weighted debt maturity and weighted interest rates. *, **, *** denote statistical significance at 10, 5 and 1 percent, respectively. Values in parentheses are standard errors.

A negative correlation between credit maturity and financial conditions is observed in the regression model where maturity is the independent variable. That is, an easing in financial constraints leads to longer loan maturities. We see that controlling for other firm-level variables, easing financial constraints leads to an extension in the debt maturity by nearly 15 months. Regarding the relationship between financial constraints and credit interest rates, estimation results show that financially constrained firms borrow with significantly higher interest rates, i.e. around 589 basis points higher than other firms (Table 8).

Analyses provided in the current and previous sections show that financially constrained firms which are identified by our methodology are indeed constrained in terms of quantity, interest rate and maturity. These findings approve the use of financial constraint indices and their validity. To explain the level difference in Figure 2, inherited constraints when we control for all other firm-level variables, firm and time fixed effects play a significant role.

4.5. Aggregate Implications of Financial Constraints

In this section, we check aggregate macroeconomic implications of financial constraints, specifically for investment. Lamont et al. (2001) introduce financial constraints as frictions that detain firms from funding their desired investment levels. Hence, any study of financial constraints refers to the relation between investment and financial constraints. We calculate cumulative change in the capital stock from time t to t+x normalized with total assets as of time t. We find a significant response of cumulative investment to financial constraints lasting for three years (Table 9). The results show the stimulating effect of long-term borrowing on investment. However, the interaction of long-term borrowing with FinCon implies that despite long-term borrowing, increases in financial constraints may cause a reduction in investments. Another implication derived from the results is the persistent and long-lasting effects of financial constraints on macroeconomic variables. This specification is robust to using investment to total capital as a left-hand side variable.

Variables	(Capital _{t+1} -	(Capital _{t+2} - Capital_)/Assets	(Capital _{t+3} - Capital)/Assets	(Capital _{t+4} -
Long-term TL Debt / Assets	0.98***	0.63	-0.27	1.07
c	(0.33)	(0.41)	(0.51)	(0.70)
FC Index Dummy	-0.06	-0.18**	-0.46***	-0.05
	(0.06)	(0.07)	(0.10)	(0.15)
FC Index Dummy * Long-term TL Debt / Assets	-1.26***	-0.98*	0.29	-1.26
	(0.44)	(0.54)	(0.66)	(0.88)
Sales Growth	-0.08**	-0.16***	-0.14**	0.02
	(0.04)	(0.05)	(0.05)	(0.07)
EBIT/Assets	0.52***	0.51**	0.85***	0.65**
	(0.19)	(0.20)	(0.22)	(0.28)
Working Capital/Assets	0.18**	0.16*	0.28***	0.03
	(0.08)	(0.08)	(0.10)	(0.13)
Return on Assets	0.10	0.17	0.13	-0.05
	(0.22)	(0.24)	(0.28)	(0.36)
Industry Sales Growth	-0.07	-0.26**	0.60***	0.52***
	(0.10)	(0.11)	(0.13)	(0.16)
Constant	-0.03	0.07	0.11*	-0.00
	(0.04)	(0.05)	(0.06)	(0.09)
Number of Observations	6,553	5,489	4,460	3,539
R-squared	0.17	0.19	0.25	0.34
Firm Fixed Effect	Yes	Yes	Yes	Yes

Table 9. Financial Constraints and Investment

Note. This table estimates panel regressions in which left hand side variables are defined as the change in capital from time t to t+x which implies investment over initial capital *,**,*** denote statistical significance at 10, 5 and 1 percent, respectively. Values in parentheses are standard errors.

We repeat this analysis with change in the net worth over initial period total assets and find similar results (Table 10). A rise in long-term borrowing contributes to the increase in the net worth of the firm and this effect lasts at least four years. An increase in financial constraints has a dampening effect on the firm's net worth both through its own effect and through the long-term borrowing channel. This approves the net worth channel of Bernanke et al. (1999).

Variables	$((Assets_{t+1}-Debt_{t+1})-(Assets_t-Debt_t))/Assets_t$	$((Assets_{t+2}-Debt_{t+2})-(Assets_t-Debt_t))/Assets_t$	$((Assets_{t+3}-Debt_{t+3})-(Assets_t-Debt_t))/Assets_t$	$((Assets_{t+4}-Debt_{t+4})-(Assets_t-Debt_t))/Assets_t$
Long-term TL Debt / Assets	0.34***	0.47***	0.29*	0.54**
	(0.10)	(0.14)	(0.17)	(0.27)
FC Index Dummy	-0.02	-0.04*	-0.07*	-0.03
	(0.02)	(0.03)	(0.03)	(0.06)
FC Index Dummy * Long-term TL Debt / Assets	-0.22*	-0.36*	-0.04	-0.43
	(0.13)	(0.19)	(0.22)	(0.34)
Sales Growth	-0.01	-0.02	-0.02	-0.00
	(0.01)	(0.02)	(0.02)	(0.03)
EBIT/Assets	0.03	-0.18***	-0.23***	-0.40***
	(0.05)	(0.07)	(0.08)	(0.11)
Working Capital/Assets	-0.08***	-0.21***	-0.26***	-0.26***
	(0.02)	(0.03)	(0.03)	(0.05)
Return on Assets	0.23***	0.50***	0.66***	0.61***
	(0.07)	(0.09)	(0.09)	(0.14)
Industry Sales Growth	-0.10***	-0.27***	0.06	0.10*
	(0.03)	(0.04)	(0.05)	(0.06)
Constant	0.04***	0.12***	0.14***	0.18***
	(0.01)	(0.02)	(0.02)	(0.03)
Number of Observations	6,831	5,719	4,621	3,649
R-squared	0.25	0.43	0.62	0.71
Firm Fixed Effect	Yes	Yes	Yes	Yes

Table 10. Financial Constraints and Net Worth

Note. This table estimates panel regressions in which left hand side variables are defined as the net worth change over initial assets from time t to t+x. *,**,*** denote statistical significance at 10, 5 and 1 percent, respectively. Values in parentheses are standard errors.

4.6. Transmission of Aggregate Shocks

Adverse macroeconomic shocks, such as policy rate hikes or macroprudential measures, are transmitted through financial markets, and imperfections, such as adverse selection and moral hazard problems, can lead to distributional effects (Bernanke and Gertler, 1989). This means that heterogenous effects are present on firms, which have different properties. The transmission of macroeconomic shocks is extremely important especially for policy makers. Central banks pay utmost attention to the credit channel and its distributional effects.

In the spirit of this argument, in this section we aim to investigate the role of financial constraints in the transmission to TL borrowing. As a macroeconomic shock, we choose the change in average spread, which is defined as the change in the difference between commercial loan rates and deposit rates. This variable can be perceived as a macroeconomic indicator that reflects the tightness of monetary and financial policies. We do not attempt to calculate a monetary policy shock since the CBRT had employed an integrated policy framework during the period of analysis and used quantitative and macroprudential measures quite frequently in addition to interest rate policy.

Variables	Total TL $Debt_{t+1}/Assets_{t+1}$	Total TL Debt	Total TL Debt	Total TL Debt t+4/Assetst+4
FC Index Dummy	-0.69*	-0.90**	-0.94	1.52*
	(0.39)	(0.45)	(0.60)	(0.83)
FC Index Dummy*Average Spread Change	-0.13**	-0.06	-0.04	-0.20*
	(0.06)	(0.07)	(0.09)	(0.11)
Sales Growth	0.56**	0.09	-0.03	-0.19
	(0.25)	(0.28)	(0.31)	(0.36)
EBIT/Assets	-0.37	1.16	-0.38	-0.08
	(1.14)	(1.21)	(1.31)	(1.54)
Tangibles/Assets	2.18***	-0.29	-1.24	-0.55
	(0.82)	(0.92)	(1.04)	(1.24)
Working Capital/Assets	0.21	-1.03**	-1.45**	-1.75**
	(0.48)	(0.52)	(0.61)	(0.73)
Return on Assets	-2.60*	-3.55**	-0.12	-1.82
	(1.35)	(1.46)	(1.62)	(1.92)
Industry Sales Growth	0.26	1.43	-1.79	-1.30
	(0.92)	(1.04)	(1.23)	(1.35)
Constant	1.48***	2.81***	3.70***	2.53***
	(0.42)	(0.47)	(0.55)	(0.67)
Number of Observations	6,790	5,667	4,586	3,594
R-squared	0.68	0.71	0.73	0.73
Firm Fixed Effect	Yes	Yes	Yes	Yes

 Table 12. Financial Constraints and Transmission of an Increase in Average Spread

Note: This table estimates panel regressions in which left-hand side variables are defined as total TL bank debt over assets by time t+x. *,**,*** denote statistical significance at 10, 5 and 1 percent, respectively. Values in parentheses are standard errors.

The interaction term of the FC index dummy and change in average spread is negative and significant from time t+1 to time t+4. This tells us that when there is a tightening shock through the spread, borrowing by constrained firms declines more. A tightening of macrofinancial conditions limits borrowing by constrained firms for the following period (Table 12).

4.7. Results for the Entire Sample

We have presented the results for the sample of firms which are respondents of the ITS. For those firms, we have provided evidence that our index reflects their borrowing abilities and it is effective on future investment and transmission of macroeconomic shocks.

In the next step, we will explore whether this index is also applicable to other firms who are not respondents of this survey. In this section, with the aim of overcoming selection bias, we repeat the analysis for the whole sample and investigate whether our results are robust for all firms. From Revenue Administration and KKB data, we have access to all firms who are obliged to prepare financial tables and submit them to the Ministry of Finance. We narrow the sample to manufacturing firms. This means that we have around 146,973 firms in total.⁵ For this entire sample, we prefer to trim the continuous FC

⁵ We should note that ITS applies only to manufacturing firms. So, the FX Index is derived using information from those firms. Testing it on the entire sample which covers other sectors as well proves its validity.

Index into five groups and label the top and the bottom 20 percent as financially constrained and unconstrained respectively.⁶ Again, for the constrained group, the FC Index dummy is set equal to 1.

First, we repeat our exercise where we investigate the effect of the FC Index dummy on credit use. Similar to the survey sample, we find significant results to long-term debt especially for TL debt (Table A2 in the Appendix). For the entire sample, financially constrained firms have lower access to TL debt for at least three years and FX debt for two yearsLarge firms have more access to FX debt due to the regulations in Türkiye. Especially after 2018, regulatory authorities imposed various requirements to be able to borrow in FX, such as being an exporter.⁷ Nevertheless, we find a negative and statistically significant coefficient for the first two periods in the entire sample.

Next, we check the behavior of the real variables with our FC Index dummy. Here, we have statistically significant results for the net worth specification. Firms that are identified as financially constrained have lower levels of net worth at least for the next two years (Table A3 in the Appendix). Both through its own effect and through the long-term borrowing channel, an increase in financial constraints has a dampening effect on firm's net worth.

5. Conclusion

Financial constraints and their complicated effects on different firms and different sectors are major concerns for policy makers. To design monetary policy as well as micro and macroprudential policies, practical measures are necessary. In this regard, financial constraint indices are very useful in order to track and record the status of firms. This paper builds an index and proves its validity for an emerging economy, namely Türkiye.

We used the ITS conducted by the CBRT to extract a real indicator of financial constraint based on managers' own statements for Turkish firms. Then, we estimated this real indicator with common balance sheet measures. In the end, we reached an index constituted from seven fundamental variables, i.e. age of the firm, size, change in size, profitability, leverage, tangibles and export share. Unlike other common indices and contributing to Schauer et al. (2019), we demonstrate that borrowing abilities and credit use could be identified with the FC Index. We show that financially constrained firms borrow much less both in TL and FX especially in the long term. They can only borrow at shorter maturities and higher interest rates. Our results imply that being financially constrained is a persistent phenomenon. Investment decisions and transmission of aggregate shocks persistently affect those firms.

⁶ Results are robust if we divide into three groups as in the survey sample.

⁷ On 25 January 2018, Decree No. 32 was amended regarding the use of foreign currency denominated loans, and the regulation was put into effect on 2 May 2018. With the new regulation, firms with FX debts from domestic and foreign financial institutions and foreign partners totaling less than 15 million US dollar were included in the scope of the regulation. In this context, an effective link was established between FX income and loan utilization, firms' FX loan balances were limited to the sum of their FX income in the last three fiscal years, and the FX-indexed loan practice was terminated.

Finally, we show that our FC Index not only works for the firms that contribute to the ITS, but also work for the entire sample of firms reporting to the Revenue Administration.

Understanding financial constraints and use of indices like ours provide policymakers with valuable information to understand the extent of financial constraints faced by firms or individuals. This knowledge helps to formulate targeted policies, assess the effectiveness of monetary policy, promote financial inclusion and monitor systemic risks, ultimately contributing to more efficient and inclusive financial systems. The FC Index would help policymakers to identify credit market imperfections that hinder the efficient allocation of resources. It would be useful to design targeted policies to address specific constraints faced by firms or sectors. For example, if SMEs face higher financial constraints than larger firms, policymakers can develop policies such as credit guarantee schemes or targeted lending programs to support SMEs and promote economic growth. Finally, the level of this index and its distribution across the economy can be used as an early warning indicator to take preventive measures and mitigate potential risks.

There are many issues that we could explore further that would contribute to the understanding of financial constraints and the macroeconomy. First, we can examine the impact of financial constraints on future profits, innovations, production structures, etc. Future studies could include such issues and look for structural concerns of financial constraints. Another issue that we can explore further is the choice of sources of finance for these constrained firms. Their access to bank debt and equity markets, as well as their internal financial resources could all be better documented and linked to trade-off and pegging order theories of debt and other financial literature. Finally, we can better document the characteristics of financially constrained firms using more complicated models. We leave all this as part of our research agenda.

APPENDIX

Variables	Explanation	Source		
FinCon	Dummy variable produced from survey	Granular data of ITS		
	data as explained in the text.			
Cash Flow	Profit before extraordinary items (from	Firm-level financial tables from		
	income statement) over total assets	Revenue Administration		
Size Change	Log difference of total assets	Firm level financial tables from Revenue Administration		
Age	Natural logarithm of firm's age, which is	Firm level financial tables from		
	defined as current year minus	Revenue Administration		
	establishment year			
Financial Debt	Financial debt over total assets	Firm level financial tables from		
		Revenue Administration		
Current Ratio	Current assets over short term debt	Firm level financial tables from		
		Revenue Administration		
FC Index Dummy	Dummy variable for the constrained firms	Granular data of ITS and our own		
	produced from the Financial Constraint	calculations		
	Index as explained in the text.			
Number of Employees	Natural logarithm of number of employees	Firm level financial tables from		
		Revenue Administration		
Leverage	Total debt over total assets	Firm level financial tables from		
		Revenue Administration		
Size	Natural logarithm of total assets	Firm level financial tables from		
		Revenue Administration		
Profitability	Net profits (losses) over total assets	Firm level financial tables from		
		Revenue Administration		
Export Share	Sales abroad over total sales	Firm level financial tables from		
		Revenue Administration		
Sales Growth	Growth of net sales where net sales are	Firm level financial tables from		
	defined as total sales minus sales discounts	Revenue Administration		
EBIT/Assets	Net profit (loss) plus financing expenses	Firm level financial tables from		
	over total assets	Revenue Administration		
Tangibles/Assets	Tangible assets over total assets	Firm level financial tables from Revenue Administration		
Working Capital/Assets	Current assets minus short term debt over	Firm level financial tables from		
	total assets	Revenue Administration		
Return on Assets	Operating income (profit or loss for	Firm level financial tables from		
	period) over total assets	Revenue Administration		

Table A1. Variable Definitions

Industry Sales Growth	Three-digit industry's average sales	Firm level financial tables from	
	growth	Revenue Administration	
Investment	Difference of tangible assets in two	Firm level financial tables from	
	consecutive periods	Revenue Administration	
Capital	Tangible Assets	Firm level financial tables from	
		Revenue Administration	
PE/Assets	Plant and equipment over total assets	Firm level financial tables from	
		Revenue Administration	
PE/Capital	Plant and equipment over total equity	Firm level financial tables from	
		Revenue Administration	
Net Worth	Difference between total assets and total	Firm level financial tables from	
	debt over total assets	Revenue Administration	
Short-Term TL Debt/Assets	Short-term (less than one year) TL banking	Authors' calculations using	
	debt over total assets	Revenue Administration and Credit	
		Registry Data	
Short-Term FX Debt/Assets	Short-term (less than one year) FX	Authors' calculations using	
	banking debt over total assets	Revenue Administration and Credit	
		Registry Data	
Medium-Term TL Debt/Assets	Medium-term (between one year and two	Authors' calculations using	
	years) TL banking debt over total assets	Revenue Administration and Credit	
		Registry Data	
Medium-Term FX Debt/Assets	Medium-term (between one year and two	Authors' calculations using	
	years) FX banking debt over total assets	Revenue Administration and Credit	
		Registry Data	
Long-Term TL Debt/Assets	Long-term (more than two years) TL	Authors' calculations using	
	banking debt over total assets	Revenue Administration and Credit	
		Registry Data	
Long-Term FX Debt/Assets	Long-term (more than two years) FX	Authors' calculations using	
	banking debt over total assets	Revenue Administration and Credit	
		Registry Data	
Total TL Debt/Assets	Total TL banking debt over total assets	Authors' calculations using	
		Revenue Administration and Credit	
		Registry Data	
Average Spread	Spread defined as the difference between	Electronic Data Dissemination	
	mean of interest applied to trade credits	System of the CBRT	
	and deposit rates		

 Table A1. Variable Definitions(continued)

	(Long-Term TL	(Long-Term TL	(Long-Term TL	(Long-Term TL
	Debt/Assets) _{t+1}	Debt/Assets) _{t+2}	Debt/Assets) _{t+3}	Debt/Assets) _{t+4}
FC Index Dummy	-1.56***	-2.11***	-0.88***	0.43
	(0.21)	(0.24)	(0.29)	(0.37)
Number of Observations	167,282	138,624	113,068	90,574
R-squared	0.61	0.63	0.64	0.67
	(Long-Term FX	(Long-Term FX	(Long-Term FX	(Long-Term FX
	Debt/Assets) t+1	Debt/Assets) t+2	Debt/Assets) t+3	Debt/Assets) t+4
FC Index Dummy	-0.123***	-0.109***	-0.038	0.059
	(0.026)	(0.031)	(0.037)	(0.047)
Number of Observations	162,928	134,729	109,737	87,704
R-squared	0.529	0.547	0.569	0.601
Control Variables	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes

Table A2. Financial Constraints and Credit Use for the Entire Sample

VARIABLES	$((Assets_{t+1}-Debt_{t+1})-$	((Assets _{t+2} -Debt _{t+2})-	$((Assets_{t+3}-Debt_{t+3})-$	$((Assets_{t+4}-Debt_{t+4})-$
	(Assets _t -Debt _t))/Assets _t			
	· · · ·	· · · · · ·		
Long-term TL Debt /	0.10***	0.11***	0.14***	0.18***
Assets				
	(0.01)	(0.01)	(0.02)	(0.02)
FC Index Dummy	-0.01*	0.02**	0.07***	0.17***
5	(0.00)	(0.01)	(0.01)	(0.01)
FC Index Dummy * Long-	-0.07***	-0.05***	-0.08***	-0.14***
term TL Debt / Assets				
	(0.01)	(0.02)	(0.02)	(0.03)
Sales Growth	0.00	0.00***	-0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
EBIT/Assets	-0.07***	-0.16***	-0.22***	-0.27***
	(0.01)	(0.01)	(0.01)	(0.01)
Working Capital/Assets	-0.17***	-0.32***	-0.42***	-0.45***
	(0.00)	(0.00)	(0.00)	(0.01)
Return on Assets	0.14***	0.17***	0.20***	0.14***
	(0.01)	(0.01)	(0.01)	(0.02)
Industry Sales Growth	0.00	-0.12***	0.08***	0.17***
-	(0.01)	(0.01)	(0.01)	(0.01)
Constant	0.04***	0.10***	0.06***	0.02**
	(0.00)	(0.00)	(0.01)	(0.01)
Number of Observations	171,759	146,505	122,628	100,524
R-squared	0.38	0.52	0.63	0.70

Table A3. Financial Constraints and Net Worth in the Entire Sample

Note. This table estimates panel regressions for the entire sample in which left hand side variables are defined as the net worth change over initial assets from time t to t+x. *,**,*** denote statistical significance at 10, 5 and 1 percent, respectively. Values in parentheses are standard errors.

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