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RESEARCH ARTICLE

The Lending Behavior of Investment and Development Banks in Turkiye: Evidence from Quantile Regression Approach

Türkiye'de Yatırım ve Kalkınma Bankalarının Kredi Verme Davranışı: Nicel Regresyon Yaklaşımından Kanıtlar

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ABSTRACT

The major aim of this paper is to analyze the extent to which the lending behavior of 14 investment and development banks in Turkiye is responsive to different quantiles of selected three core variables (i.e., (i) non-performing loans/total cash loans ratio (%), (ii) net profit/equity ratio (%), and (iii) liabilities/equity ratio (%)) for the period between 2005/January and 2020/December. The estimation of a change in the degree of lending behavior, proxied by total loans/total assets ratio (%), is stimulated through an endogenous model where different quantile regression models are performed to examine the miscellaneous relationship among the selected variables and to correct potential diagnostic problems stemming from the endogeneous regressors in the panel data analysis. The empirical results imply that there are two fundamental outputs produced in regression analyses: On the one hand, the lending behavior is affected only by the non-performing loans/total cash loans ratio with a negative coefficient sign and the liabilities/equity ratio with a positive coefficient sign, mostly at the lowest quantiles. On the other hand, the highest quantiles showed that the coefficients of these variables are insignificant. In addition, the net profit/equity ratio is only significant with a negative coefficient sign in limited quantiles. This means that there is a mild heterogeneity of statistically significant variables across different quantiles where the lowest quartile of lending behavior of investment and development banks is not confronted with the higher level of financial activities.

Keywords: Investment and development banks, Lending behavior, Financial markets, Turkish economy, Quantile regression approach
JEL Classification: E00, F31, G21, G24

ÖZ

Bu çalışmanın temel amacı, Türkiye'deki 14 yatırım ve kalkınma bankasının kredi verme davranışının, seçilen üç temel değişkenin farklı niceliklerine ne ölçüde yanıt verdiğini analiz etmektir ((i)

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sorunlu krediler/toplam nakdi krediler oranı, (ii) net kar/özkaynak oranı (%) ve (iii) yükümlülükler/özkaynak oranı (%) (2005/Ocak ve 2020/Aralık dönemi için %)). Toplam krediler/toplam aktifler oranı (%) ile temsil edilen kredi verme davranışı derecesindeki bir değişikliğin tahmini, seçilen değişkenler arasındaki çeşitli ilişkiyi incelemek için ve panel veri analizinde endojen regresörlerden kaynaklanan potansiyel tanısal sorunları düzeltmek için farklı kantil regresyon modellerinin oluşturulduğu içsel bir model aracılığıyla uyarılır. Ampirik sonuçlar, regresyon analizlerinde üretilen iki temel çıktı olduğuna işaret eder: Bir yandan, kredi verme davranışı, çoğunlukla en düşük oranlarda, yalnızca negatif katsayı işaretli sorunlu krediler/toplam nakdi krediler oranından ve pozitif katsayı işaretli yükümlülükler/özkaynak oranından etkilenir. Öte yandan, en yüksek kantiller bu değişkenlerin katsayılarının önemsiz olduğunu göstermiştir. Ek olarak, net kar/özkaynak oranı sadece sınırlı niceliklerde negatif bir katsayı işareti ile anlamlıdır. Bir başka deyişle, istatistiksel olarak anlamlı değişkenlerin hafif bir heterojenliği söz konusudur.

Anahtar kelimeler: Yatırım ve kalkınma bankaları, Kredi verme davranışı, Finansal piyasalar, Turkiye ekonomisi, Nicel regresyon yaklaşım
JEL Sınıflaması: E00, F31, G21, G24

1. Introduction

The modern financial system consists of several features, instruments, and actions such as the economic units with funding surplus, the economic units that require funds, the financial institutions that function as an intermediary between these two parties of financial instruments (e.g., bonds and stocks), and the regulatory and supervisory bodies that are necessary for smooth functioning of the system. Among the leading institutions in the financial sector, the investment and development banks could be listed as one of the highly significant types of multilateral development institutions in the banking industry for the last two decades. In this sense, the investigation of investment and development banks in terms of their historical dynamics and the development of complex structures is positioned at the core of existing literature since they grant "tailor-made" loans for industrial development and thus boost capital markets.

However, besides the investment and development banks, the banking sector to a large extent can be classified by several of their functions such as central banks, commercial banks, participation banks, and agricultural banks. The banks are also classified into three different types in terms of their role of function as follows: (i) commercial banks (namely, deposit banks), (ii) participation banks (namely, interest-free banking), and (iii) investment and development banks.

Since the markets for stocks and bonds in developing economies have been far away from being well-developed, the financial instruments were not being held to enable those with a fund surplus to flow their long-term savings for investments that require long-term financing in industrial and trade relations. In principle, deposit banks prefer to provide short-term loans (Uzunoglu, 2020: 18). Therefore, investment and development banks are assumed as one of the key financial institutions among the others to yield short-term loans and produce financial solutions for the customers who have lacked funding needs.

The motivation of this study is that the investment and development banks have a key role in sustainable development of the financial sector and capital

markets in terms of their characteristics and activities though they have a limited share of total assets over the whole financial and banking system.

In that vein, the contribution of this study to the relevant literature can be explained as follows: Given the fact that literature in this business line is scarce, this study comprehensively covers the very basic features of the banking industry with recent data to analyze the lending behavior of investment and development banks in Turkiye employing the quantile regression approach.

The rest of the paper is organized as follows: Part 2 provides a general framework about investment and development banks in Turkiye, Part 3 covers the literature review, Part 4 explains the data and empirical methodology, and Part 5 summarizes empirical findings. The last section concludes the paper with some policy recommendations.

2. Investment and Development Banks in the World and Turkiye: A Comparative Outlook

Prior to summarizing the empirical findings for the lending behavior of investment and development banks in the Turkish economy, a quick glance at the current economic and financial conditions in the world may provide some basic information for this particular banking group in which some specific types of macroeconomic conditions can affect the lending behavior of those banks in a direct way, especially in the long-run. For instance, the COVID-19 pandemic has affected real and financial sectors adversely in terms of demand and supply conditions. A bulk of studies point to the following argument that the post-COVID era will stimulate different economic conditions than before in terms of financial relations, banking activities, social interactions, and working strategies. However, most importantly, the post-COVID era will possibly lead economic and financial units to integrate more digitally transformed capital into their production mechanisms. Therefore, most of the institutions and firms will probably go out of play in the global value chain if they do not follow the recent business transformations in the era of digitalization. This is thus especially important in the

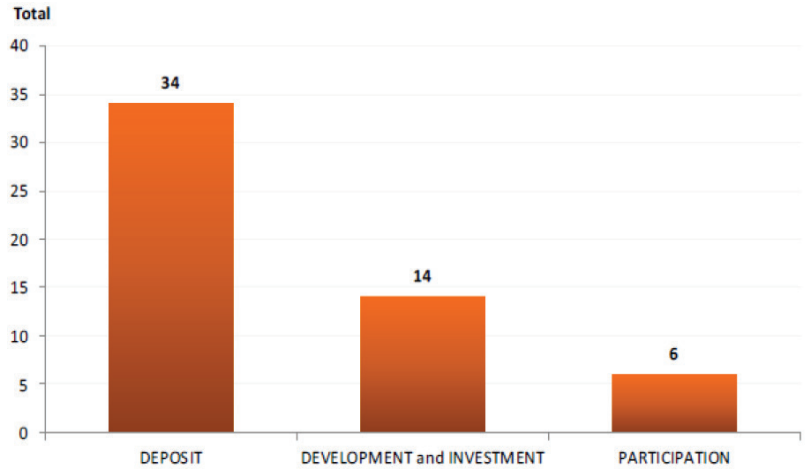
banking industry where digitalization has a special importance for the global transfer of funds and other financial needs. While the increasing scale of the digitalization process in financial transactions and management has recently paved a long way, the development and investment banking activities have had a special role in terms of financial transformation through integrating most of the digital instruments into working conditions.

As a matter of fact, some leading development banks, by their relative importance in a global scale, can be listed as follows: *World Bank Group* (IBRD), *International Finance Corporation* (IFC), *European Investment Bank* (EIB), *Islamic Development Bank* (IDB), *Asian Development Bank* (ADB), *Council of Europe Development Banks* (CEB), *Japan Bank for International Cooperation* (JBIC), *Kreditanstalt für Wiederaufbau* (KfW), *Agence Française de Development* (AfD), and *African Development Bank* (AfDB). They can also be classified into three sub-categories as follows: International Development Banks, Regional Development Banks, and National Development Banks.

Moreover, leading investment banks with their relative importance on a global scale can be ranged as follows: *JP Morgan Chase*, *Goldman Sachs*, *BofA Securities*, *Morgan Stanley*, *Citigroup*, *UBS*, *Credit Suisse*, *Deutsche Bank*, *HSBC,* and *Barclays Investment Bank*.

Figure 1 indicates the number of banks regarding their functions in financial activities. Compared with conventional banks (e.g., commercial banks), the number of investment and development banks is much less as of the year 2021.

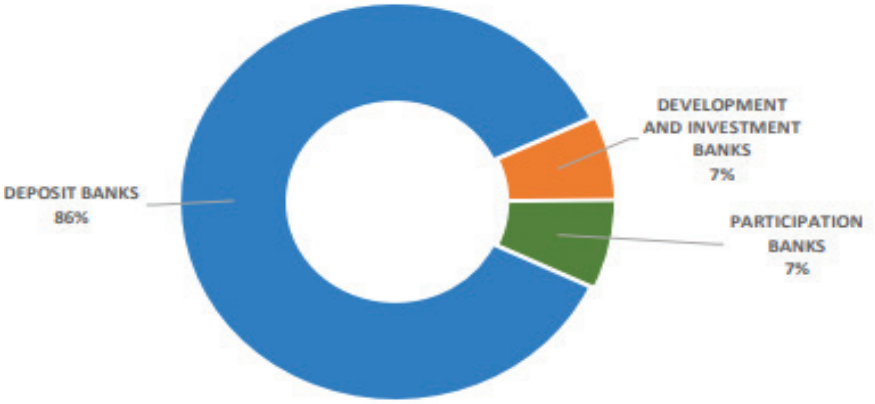
Figure 1. Number of Banks in Turkiye



Source: BRSA, Department of Data and System Management.

Figure 2 also suggests that the total assets of development and investment banks are comparatively lower than commercial banks (deposit banks), which is in line with the number of banks to a certain degree.

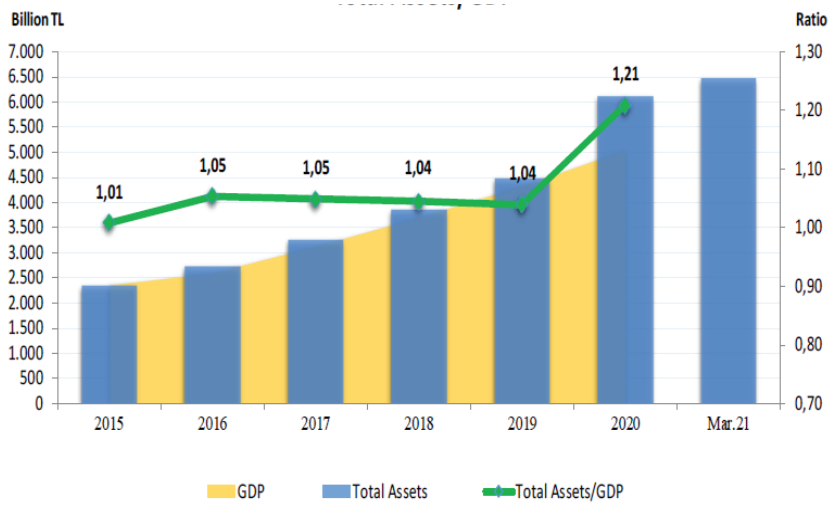
Figure 2. Distribution of Assets by Function Group in Turkiye



Source: BRSA, Department of Data and System Management

Moreover, Figure 3 indicates that the ratio of total assets over Gross Domestic Product (GDP) has risen over time, which is attributable to an increase in total loans (credit expansion) provided by the banking industry in Turkiye.

Figure 3. Total Assets over GDP in Turkiye



Source: BRSA, Department of Data and System Management

Table 1 also lists the total number of investment and development banks in Turkiye as of the year 2021 where they are the most heavily regulated and supervised institutions. They are also relatively more prone to government intervention than the other types of banks since the common belief towards the role of the government in finance is based on the argument that it ensures efficient functioning of the market and efficient allocation of financial services through the implementation of bank regulations (Yay, 2015: 413). Concerning the regulation and supervision of investment and development banks, these financial institutions are monitored under the control of the Banking Regulation and Supervision Agency (BRSA) in Turkiye. In addition, the other organization for supervision and regulation is the Capital Market Board in the case of controlling capital market activities. The investment and development banks are members of the Turkish Banking Association (according to Article 79 of the Banking Law of Turkiye). Banking Law No. 5411 is prepared as the major legal text to regulate investment and development banks, as well as the other bank types (e.g., commercial banks and participation banks) in Turkiye.

Table 1: Investment and Development Banks in Turkiye (2021)

AKTİF YATIRIM BANKASI A.Ş.
BANK OF AMERICA YATIRIM BANK A.Ş.
BANKPOZİTİF KREDİ VE KALKINMA BANKASI A.Ş.
DİLER YATIRIM BANKASI A.Ş.
GOLDEN GLOBAL YATIRIM BANKASI A.Ş.
GSD YATIRIM BANKASI A.Ş.
İLLER BANKASI A.Ş.
İSTANBUL TAKAS VE SAKLAMA BANKASI A.Ş.
NUROL YATIRIM BANKASI A.Ş.
PASHA YATIRIM BANKASI A.Ş.
STANDARD CHARTERED YATIRIM BANKASI TÜRK A.Ş.
TÜRKİYE İHRACAT KREDİ BANKASI A.Ş.
TÜRKİYE KALKINMA VE YATIRIM BANKASI A.Ş.
TÜRKİYE SINAİ KALKINMA BANKASI A.Ş.

Source: BRSA

Under the control of those agencies, boards, regulations, and legal impediments, some critical functions of investment and development banks can be listed as follows: On the one hand, the investment banks provide three core financial services to the customers. Corporate finance is listed at the top as the most important financial service of investment banks. Related to corporate finance, investment banks analyze the sector, the market share of the firm, and the demand target of firms for funds that claim to issue stocks (i.e. shares) or bonds. If the structure of the firms' financial statement is enough to provide the financial needs, the investment bank decides that the issued stocks and bonds can be sold and thus take over the issuance business. This intermediation process in public offers (i.e., intermediation in the primary market) covers the intermediation activities which have been carried out during the initial public offering of capital market instruments (Konuralp, 2005: 44). Besides, the second and the third kinds of financial services provided by the investment banks include mergers and acquisitions, consultancy and restructuring services, and security transactions. On the other hand, the development banks provide the following core financial services: (i) funding industrial and commercial activities with medium and long-term loans, (ii) technical support for entrepreneurs, (iii) transfer of internal funds and credits to domestic corporate firms, (iv) consultancy services, and (v) APEX banking (i.e., wholesale banking).

In addition to the functions of investment and development banks, the asset and liability structure of those banks can also be mentioned to analyze the change in their financial statements over time. Most importantly, it can be noted that investment and development banks cover the operations of all activities irrespective of whether they are active in investment banking or development banking. The liabilities part of their balance sheet shows that there are no deposits. In particular, the lack of deposits depends on the structural difference between those banks and conventional banks in which the former is regulated by banking law (Law No. 5411). Therefore, investment and development banks are not allowed to accept deposits. They obtain their funding sources from international investment and development institutions/banks, commercial banks, syndicated loans, debt instruments, subordinated resources, and public funds. On the other hand, as in almost all banking types, capital (equity) is the major channel that composes the liability part of these banks. The maturity of loans granted by investment and development banks is relatively longer than those given by commercial banks, and likewise the maturity of the fund source (liability structure) is also longer.

The historical development phases of these banking types should be covered within the framework of global finance which can be examined in four different stages: (i) the period starting from 1800 to World War I (WWI), (ii) the period starting from WWI to the Bretton Woods System, (iii) the Bretton Woods period, and (iv) the period starting from the Bretton Woods period to the present (Terzi, 2017: 5). It can be seen that development banks with a significant size and impact factor began to be established after the Second World War (WWII). The logic behind the establishment of this process is straightforward: A development banking model was needed for the economy to return to normal and for the development of industrial institutions following the great destruction of WWII.

After WWII, the development banks in the modern sense were set up with the support and initiative of the World Bank Group. The International Bank for Reconstruction and Development (IBRD) was a pioneer in this field. It was established in 1944 under the control of the World Bank Group, the International

Monetary Fund (IMF), and the legal sanction of the Bretton Woods Agreement. The IBRD loans provided financial support for infrastructure investments (e.g., hospital, school, and energy efficiency) in developing countries and long-term funds to government programs for the stimulation of economic development. In the case of Turkiye, the IBRD also provided financial services through local investment and development banks.

In addition, following WWII, the development of banking increased in terms of its volume and the level of financial transactions across different countries. The development banks that could be considered as leading financial institutions on a country basis can be summarized as follows: Japan (1947), Korea (1954), Malaysia (1973), Indonesia (1960), and the China Development Bank (1994). While these banks were established in the East/Far East, the most important development in this field in Europe was the establishment of the KfW (German Development Bank) (1948) and EIB (European Investment Bank) (1958). The AfD (French Development Agency) was also one of the most important banks that should be specially mentioned in the field of investment and development banking in Europe. It has supported and accelerated financing projects for the transition to a more sustainable world in most of the developing and developed economies. The AfD is still considered one of the leading development institutions in the world and operates in the Turkish economy by providing loans to local investment and development banks.

In the Republican era (Turkiye), aside from Isbank and the Central Bank, the banking system has been developed as specialized banks that supported certain economic activities of the state such as housing, tradesmen, and craftsmen. The banking activities were especially developed in the shade of economic policies implemented in Turkiye (Kepenek, 2016: 239). The first development bank called Sanayi and Maadin Bank started to operate in 1925. The second move in development banking was the establishment of Belediyeler Bankası (i.e., Municipalities Bank) initiated in 1933. In the post-1950s period, the privately-owned investment and development banks (i.e., the Industrial Development Bank of Turkiye (TSKB) (1950) and the Sınai Yatırım ve Kredi Bankası (SYB) (1963))

were established in parallel to the ongoing changes in the economic model which were structured upon the acceleration of a private sector mechanism. The SYB was transferred to TSKB in 2002. However, the TSKB, which was the prime privately-owned investment and development bank in Turkiye (along with the shareholding of the World Bank, the Central Bank of Turkiye, and commercial banks), is still active in providing financial services. In parallel with the increasing importance of the public economy (i.e., planned economy) in Turkiye after the 1970s, public banks were established in the field of investment and development banking such as the Turkiye Development and Investment Bank (TKYB) (1976) and Eximbank-Turkiye Export Credit Bank (1987) to accelerate (finance) export. The establishment of Takasbank (IMKB-Takas ve Saklama A.Ş.) in 1992 was especially important in terms of capital market development and received the title of "Istanbul Settlement and Custody Bank" in 2013.

3. Literature Review

From the standpoint of the microeconomics of banking, Freixas and Rochet (2008: 13) define a bank as an institution whose current operations consist of granting loans and receiving deposits from the public. In this definition, 'granting loans' is applicable to the investment banks but 'receiving deposits' is not applicable to development banks. This also refers to a fundamental difference between conventional banking and investment & development banking. Thorne and du Toit (2009) analyze a macro-framework of successful development banks and argue that development banking is still a risky line of business. Therefore, this kind of banking mechanism should be managed properly and it should follow an objective framework to accomplish the goals in the financial sector. However, this also needs to consider the following dimensions: (i) environment, (ii) regulation and supervision, (iii) governance and management, (iv) financial stability, and (v) performance assessment.

Although the state-owned development banks have a key role to provide a stimulus for investment and sustainable growth, the relevant literature has not met the common ground on whether the ongoing plans are enough to reach these

macroeconomic goals. In a critical study about the role of development banking in the Turkish industrial sector, Ozturk et al. (2010) argue that investment loans do not contribute to reducing regional (development) imbalances, and that the institutions which provide funding to total capital investments, considered as the "raison d'etre" for development banking, are predominantly commercial banks.

Radic et al. (2012) analyze the cost and profit efficiency of a sample of investment banks in G7 countries and suggest that the size is one of the core elements of cost and profit efficiency, nonetheless, this does not imply that more concentrated markets are more efficient. Furthermore, Radic et al. (2012) find out that in case environmental factors are not accounted for, this can considerably bias the efficiency scores for investment banks. The study also contends that profit efficiency estimates are underestimated in the case that bank risk-taking level is neglected in the measuring process.

Parasız (2014: 81) defines the functions/tasks of the investment and development banks as follows: These banks provide long-term funds for industry, direct local financial sources to industry, lay the ground for the development of capital markets, provide project-based-technical assistance for entrepreneurs, carry out pre-analyses for feasible investment opportunities and fields, pioneer new investment areas, and direct financial sources of international financial institutions to industry.

Some of the studies about the financial analysis of investment and development banks in Turkiye can be listed as follows: Koç et al. (2016) examine the performances of investment and development banks over the 2002-2012 period using ROA (Return on Assets) and ROE (Return on Equity) and find that there is a long-term performance continuity in the group of foreign banks. Besides, the state banks perform well only according to ROA, while their privately-owned counterparts perform well only according to ROE in the long run. Moreover, Karahanoglu (2017) analyze the ROA of investment and development banks for the period between 2005/June and 2016/October and find out that both macro and micro factors directly affect the profitability.

Regarding the main differences between investment and development banks, Kaya (2017: 107) argues that investment banks are heavily operated in developed countries where capital markets are more developed, while development banks are heavily operated in underdeveloped or developing countries where the investment banks are mostly considered as private banks and the development banks are regarded as state-owned companies.

Wang (2017: 113) also analyzes the case of whether new development banks in the world pose a threat or opportunity to existing development banks. The empirical findings imply that they (existing and new ones) may improve cooperation in many fields in contrast to moving as rivals.

There is an important link between development banking and sustainable banking: Mendez and Houghton (2020) put forward the following argument by analyzing the role of multinational development banks (MDB) in the development of sustainable banking (i.e., banking that supports green finance): MDBs - from the 1970s to the present - as the leading initiatives in sustainable banking became the first port of call for international governmental organizations and non-governmental organizations to establish a sustainable financial framework for development. MDBs are also seen as the most likely political actor to pioneer sustainable banking.

The following papers also investigate the impact of the COVID-19 pandemic on the financial sector (with comments referring to investment banking): Wójcik and Ioannou (2020: 394) study the impact of the pandemic on financial markets and financial institutions and argue that besides facing the challenge of non-performing debt, the COVID-19 pandemic is likely to accelerate the digitization of banking, which may influence retail banking (including also investment banking) more than the wholesale part of the financial sector. Thus far, at least, the investment banks have lost much less of their market value than more of the retail-oriented banks.

In another study, Skidelsky (2020: 349) studies economic recovery in the era of the pandemic. He concludes that on the verge of economic recession caused

by the COVID-19 pandemic, the economies no longer have an economic policy that focuses only on bringing down inflation; that solves the problem of unemployment only with the help of emergency measures and solves the problem of income distribution only with the help of free-market mechanisms. Regarding investment banking within the framework of a stabilization policy, he also maintains that public investment does not necessitate public ownership which could be done by public investment banks (quasi-state institutions) or funds or state-holding companies (Skidelsky, 2020: 347).

4. Data and Empirical Approach

4.1. Data

This study examines a balanced panel set (i.e., monthly data from 2005/January to 2020/December) for investment and development banks functioning in Turkiye. The total loans over the total assets obtained from the Banking Regulatory and Supervisory Agency (BRSA) database is utilized to figure out the weight of change in loans over the assets. The major aim of using this indicator is to derive balanced panel data for the sample investment and development banks in Turkiye, and thereby, obtain statistically reliable estimation outputs.

The non-performing loans over total cash loans is measured as a ratio to explain its effect on loans/assets by considering two sides of the given data. First, the non-performing loans are used as an indicator to consider the borrower who is in default, and thus the loans could not be scheduled as payments for a specified period. In the empirical analysis, the non-performing loans are divided by the total cash loans to analyze the impact of borrowers' behaviors who are on the spot in terms of financial aspects and the changing dynamics of the loans/assets ratio.

Second, the empirical analysis is also considered as two additional variables (i.e., net profit/equity and total liabilities/equity) to account for the effects of a change in net profits on the loans/assets ratio. The major reason to allow for estimating the effects of net profit/equity is to reveal that the banks' behavior towards lending

becomes an important fact for the future when their net profits have a positive trend over their total assets and equity, respectively. Therefore, they can differ the optimal allocation of credits and then may indirectly change the behaviors of other banks in different banking classifications. Besides, the total liabilities over the equity is measured as a ratio to explain how the features of the loans/assets ratio can be altered when banks' short-term financial obligations, that are due within one year or a normal operating cycle, are being decisive in lending behaviors.

The *lnLOANS*, *lnNPL*, *lnPREQUITY*, and *lnLIABILITY* represent the aforementioned variables in abbreviations for the total loans/total assets ratio (%), non-performing loans/total cash loans ratio (%), net profit/equity ratio (%), and liabilities/equity ratio. All in all, Table 2 summarizes the data sources and the corresponding information about the listed variables.

Table 2: Data Sources and Measurement

Variable	Abbreviation	Measurement	Source
Total Loans/ Total Assets	lnLOANS	Ratio (%)	Banking Regulatory and Supervisory Agency
Non-Performing Loans/ Total Cash Loans	lnNPL	Ratio (%)	Banking Regulatory and Supervisory Agency
Net Profit/ Equity	lnPREQUITY	Ratio (%)	Banking Regulatory and Supervisory Agency
Liabilities/ Equity	lnLIABILITY	Ratio (%)	Banking Regulatory and Supervisory Agency

4.2. Empirical Approach

The common way of estimating the conventional regression technique (e.g., the least-squares method) considers the conditional mean of dependent variables for given independent variables. In addition, it deals with the explanation of the conditional distribution. Therefore, the tails of conditional distribution lead to employing different methods such as quantile regression (Koenker and Bassett, 1978), expectile regression (Newey and Powell, 1987), and M-quantiles (Brecking and Chambers, 1988). These are the methods that can use different variables referred to as generalized quantile regressions, which are widely accepted as a

significant procedure in different disciplines. Besides, the parameters can be estimated at different quantiles regarding the effects of explanatory variables on a dependent variable through the minimization of potential bias arising from current outliers.

Unlike the estimation results produced by employing the conventional least-squares method, the estimators of quantile regression are conjectured as more efficient than the rest of the others when the error terms are not white noise. Moreover, the less efficiency in the estimates of conventional regression analysis may produce unbiased results where it results in an average effect of explanatory variables on the dependent variable. Thus, this study employs the quantile regression methods to estimate the linear models. In this sense, there are two theoretical advantages for using quantile regression methods. First, the empirical findings of quantile regression analyses are supposed to be robust to outliers (Buchinsky, 1994). Second, the quantile regression analysis deals with the entire conditional distribution of the dependent variable (Coad and Rao, 2011). In line with these two advantages in the theoretical framework, the following assumptions can be made for the analytical background. On the one hand, the error terms are not identically distributed for the entire conditional distribution. On the other hand, the slope parameters are varied through different quantiles of the conditional distribution. In that vein, Eqs. (1) and (2) represent the baseline quantile regression:

$$y_{it} = x_{it}\beta_{\theta} + u_{\theta it} \tag{1}$$

and

$$Quant_{\tau}(y_{it}/x_{it}) = x_{it}\beta_{\tau} \tag{2}$$

where *y* is the dependent variable, *x* is a vector of the regressors, β is the vector of estimated parameters, and *u* is the error term. describes the τ^{th} conditional quantile of *y* given *x*. Regarding the use of this method, the empirical specification of this study is based on the implementation of the generalized quantile regression approach produced by Powell (2017). The major advantage of this approach is due to the reason that it introduces the additional covariates to measure the

changes in the estimated coefficient on the treatment variable. The conditional distribution for the natural logarithmic form of the dependent variable can be identified for τ^{th} quantile ($0 < \tau < 1$) of a given set of independent variables, X_{it}, in the following Eqs. (3)-(5):

$$Q_\tau\left\{\frac{lnNPL_{it}}{X_{it}}\right\} = \alpha_\tau + \beta_\tau X_{it} + \alpha_\tau \nu_{it} \tag{3}$$

$$Q_\tau\left\{\frac{lnPREQUITY_{it}}{X_{it}}\right\} = \alpha_\tau + \beta_\tau X_{it} + \alpha_\tau \nu_{it} \tag{4}$$

$$Q_\tau\left\{\frac{lnLIABILITY_{it}}{X_{it}}\right\} = \alpha_\tau + \beta_\tau X_{it} + \alpha_\tau \nu_{it} \tag{5}$$

where $lnNPL_{it}$, $lnPREQUITY_{it}$, and $lnLIABILITY_{it}$ denote the natural logarithmic form of non-performing loans/total cash loans, net profit/equity, and liabilities/equity ratios, respectively, of investment and development bank *i* for time *t* and X_{it} is the vector of explanatory variables. u_{it} specifies the unobserved factors. Similar to the technique of ordinary-least squares, the parameters are estimated by minimizing the absolute value of the residuals. Eqs. (6)-(8) depict the objective functions for all independent variables:

$$Q_\tau(\beta_\tau) = \min_\beta \sum_{i=1}^{n} [|lnNPL_{it} - \beta_\tau X_{it}|] \tag{6}$$

$$Q_\tau(\beta_\tau) = \min_\beta \sum_{i=1}^{n} [|lnPREQUITY_{it} - \beta_\tau X_{it}|] \tag{7}$$

$$Q_\tau(\beta_\tau) = \min_\beta \sum_{i=1}^{n} [|lnLIABILITY_{it} - \beta_\tau X_{it}|] \tag{8}$$

Following the minimization approach towards the absolute value of residuals, the empirical methodologies will employ three different quantile regressions. The first approach is based on the shrinkage method to estimate the vector of fixed effects (Koenker, 2004). The second approach depends on producing a new method in terms of using a two-step process to measure panel quantile regression

models with fixed effects (Canay, 2011). The last approach yields alternative fixed-effects quantile estimators by including individual fixed effects (Powell, 2016).

This study is based on the estimation of a quantile regression model for panel data with nonadditive fixed effects, which derives nonseparable error terms (Baker et al., 2016). In consideration of the data framework, Eq. (9) describes the panel quantile regression model to account for the changes in the loans/assets ratio in investment and development banks over the 2005/January-2020/December period (based on monthly data):

$$lnLOANS_{it} = \beta_0 + \beta_1 lnNPL_{it} + \beta_2 lnPREQUITY_{it} + \beta_3 lnLIABILITY_{it} + u_{it} \quad (9)$$

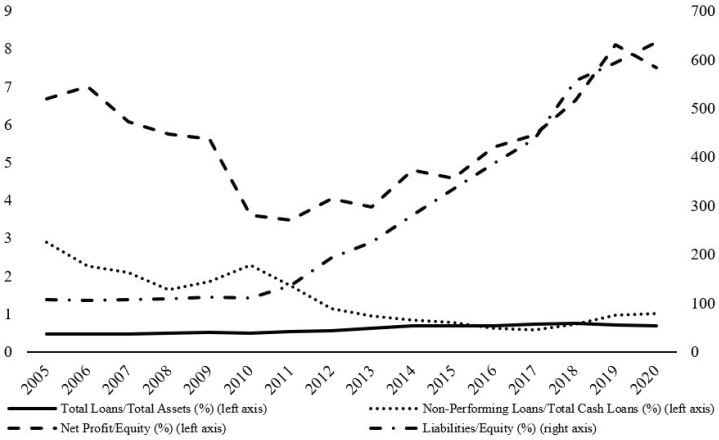
where $lnLOANS_{it}$ is the total loans/total assets ratio, $lnNPL_{it}$ is the non-performing loans/total cash loans ratio, $lnPREQUITY_{it}$ is the net profit/equity ratio, and $lnLIABILITY_{it}$ is the liabilities/equity ratio. All variables are measured in natural logarithmic forms.

Table 3 represents the descriptive statistics of all variables. Furthermore, Figure 4 presents the nexus between the dependent variable and the explanatory variables from 2005/January to 2020/December. The next section summarizes the empirical findings based on employing three different quantile regression approaches.

Table 3: Descriptive Statistics

	Min.	Max.	Mean	Median	J-B	Skewness	Kurtosis
lnLOANS	0.455	0.761	0.599	0.589	21.27	0.027	1.370
lnNPL	0.519	3.185	1.398	1.062	17.08	0.614	2.211
lnPREQUITY	0.562	14.75	5.556	5.215	9.411	0.492	2.545
lnLIABILITY	88.69	725.2	277.3	205.2	23.78	0.776	2.252

Figure 4. Trends in Data Structure (Yearly Average)



Source: Banking Regulatory and Supervisory Agency (BRSA) Database

5. Empirical Findings

The major purpose of the empirical investigation is to estimate Eq. (9) via the quantile regression approach. In that vein, two major estimation results are reported by way of employing two different nonparametric regression models (i.e., simultaneous quantile regression (SQREG) and bootstrapped quantile regression (BSQREG)). On the one hand, SQREG produces the same coefficients as standard quantile regression for each quantile by producing estimates of standard errors through the bootstrapping technique for between-quantile blocks. On the other hand, BSQREG is congruent with SQREG with one quantile in consideration of the fact that the data are conditionally heteroskedastic. However, the aforementioned two methods implement bootstrapped estimates of the entire variance-covariance matrix of the estimators. Besides, each estimate produces standard errors by way of resampling the data in random sequences. Table 4 presents the empirical findings for simultaneous quantile regression with bootstrapped standard errors (Koenker, 2005). As expected, non-performing loans over total cash loans negatively affect the total loans over total assets of investment and development banks in Turkiye at all quantiles of the conditional distribution, in which the empirical findings directly lead us to argue that there is a negative spillover effect of the non-performing loans/total cash loans ratio on total loans/total assets ratio.

Furthermore, the empirical findings indicate that the other explanatory variables (i.e., net profit/equity ratio and liabilities/equity ratio) have mixed impacts on the dependent variable. While the coefficient of net profit over the equity is only statistically significant at the lowest (i.e., quantile 0.1) and highest (i.e., quantile 0.9) quantiles, liabilities over equity are statistically significant at all quantiles. In that vein, the liabilities/equity ratio has a significant positive effect on the ratio of loans/assets due to the following reasons: As far as the development and investment banking industry is concerned, liabilities are generally composed of long-term funds. This long-term nature of foreign funds (loans) is advantageous with the help of long-term fund resources. Besides, development banks have the advantage to grant long-term investment loans (project loans) to local companies that need long-term loans to fund projects. An increase in liabilities (foreign resources) brings about a considerable amount in project loans granted to local companies. In addition, an increase in funding provided by international financial institutions with a low rate of interest helps investment and development banks to grant project loans with low-interest rates to local companies. Long-term loans are in general provided by international finance institutions and then distributed to local investment and development banks with pre-defined conditions in 'loan agreements' (covenants). Upon these mutually agreed conditions, local investment and development are made to direct foreign funds to local companies. Representing alternative methods of saving, local investment and development banks are not free about the utilization of foreign funds. Finally, liabilities contain mostly funds/loans that are provided by international financial institutions with specified themes like renewable energy, green energy, and employment for women. When the foreign loans are distributed to these types of 'themes', it becomes relatively easier for local investment and development banks to grant these loans to fund local projects.

Moreover, the loans/assets ratio is significantly affected by the non-performing loans/cash loans ratio. Non-performing loans over the cash loans negatively affect the ratio of loans/assets for the following reasons: When NPL increases, special provisions are used for these loans (issued by local investment and development banks), then profitability goes down. This results in a decline in equity and a decline in the capital adequacy ratio. In turn, this affects the credit risk adversely. In the final analysis, loan disbursement by local investment and development banks goes down significantly. Since the increase in NPL is considered a negative

Table 4: Simultaneous Quantile Regression with Bootstrapped Standard Errors: SQREG Results

	Dependent variable: lnLOANS								
	τ=10th	τ=20th	τ=30th	τ=40th	τ=50th	τ=60th	τ=70th	τ=80th	τ=90th
lnNPL	-0.167*** (0.013)	-0.148*** (0.012)	-0.142*** (0.012)	-0.144*** (0.014)	-0.148*** (0.012)	-0.157*** (0.009)	-0.158*** (0.012)	-0.169*** (0.014)	-0.184*** (0.014)
lnPREQUITY	-0.009*** (0.003)	-0.005 (0.004)	-0.005 (0.004)	-0.004 (0.004)	-0.001 (0.006)	-0.005 (0.005)	-0.003 (0.005)	0.001 (0.003)	0.006* (0.003)
lnLIABILITY	0.143*** (0.009)	0.152*** (0.012)	0.156*** (0.009)	0.155*** (0.010)	0.147*** (0.010)	0.141*** (0.009)	0.139*** (0.008)	0.129*** (0.009)	0.114*** (0.010)
Constant	-1.302*** (0.052)	-1.339*** (0.064)	-1.353*** (0.057)	-1.331*** (0.061)	-1.289*** (0.060)	-1.235*** (0.045)	-1.222*** (0.049)	-1.160*** (0.053)	-1.063*** (0.056)
Pseudo-R^2	0.7597	0.7866	0.8033	0.8127	0.8189	0.8071	0.7853	0.7670	0.7523
No. of obs.	192	192	192	192	192	192	192	192	192

Note: Bootstrapped standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10. The bootstrap replications are selected as 50.

Table 5: Bootstrapped Quantile Regression: BSQREG Results

	Dependent variable: lnLOANS								
	τ=10th	τ=20th	τ=30th	τ=40th	τ=50th	τ=60th	τ=70th	τ=80th	τ=90th
lnNPL	-0.167*** (0.014)	-0.148*** (0.009)	-0.142*** (0.014)	-0.144*** (0.012)	-0.148*** (0.011)	-0.157*** (0.013)	-0.158*** (0.014)	-0.169*** (0.016)	-0.184*** (0.016)
lnPREQUITY	-0.009*** (0.003)	-0.005 (0.004)	-0.005 (0.003)	-0.004 (0.004)	-0.001 (0.005)	-0.005 (0.005)	-0.003 (0.005)	0.001 (0.004)	0.006* (0.003)
lnLIABILITY	0.143*** (0.010)	0.152*** (0.008)	0.156*** (0.011)	0.155*** (0.009)	0.147*** (0.011)	0.141*** (0.009)	0.139*** (0.010)	0.129*** (0.011)	0.114*** (0.012)
Constant	-1.302*** (0.054)	-1.339*** (0.047)	-1.353*** (0.062)	-1.331*** (0.057)	-1.289*** (0.061)	-1.235*** (0.051)	-1.222*** (0.056)	-1.160*** (0.064)	-1.063*** (0.065)
Pseudo-R^2	0.7597	0.7866	0.8033	0.8127	0.8189	0.8071	0.7853	0.7670	0.7523
Raw sum. dev.	4.629	8.768	12.14	14.45	15.51	14.03	11.20	8.104	4.503
No. of obs.	192	192	192	192	192	192	192	192	192

Note: Bootstrapped standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10. The bootstrap replications are selected as 50.

financial indicator by foreign credit institutions, it is difficult for investment and development banks to find resources along with a decrease in loan disbursement opportunities. All in all, the estimation results indicate a mild heterogeneity for statistically significant explanatory variable spillovers across the quantiles.

Meanwhile, Table 5 presents the estimation results for bootstrapped quantile regression. The crucial difference between this method and the SQREG method is that the coefficients remain unchanged, but the standard errors vary with the estimates. The empirical findings show that the hypothesized propositions are still statistically significant across the given samples through the implementation of the BSQREG method.

To assess the statistical variation of coefficients giving regard to the conditional distribution of dependent variable (i.e., *lnLOANS*), the quantile regression coefficients and confidence intervals for each regressor along with the constant term can be analyzed through Figure 5. The horizontal lines measure the OLS point estimates and confidence interval, respectively. The plots depict the spillovers for each indicator in which the positively estimated coefficients mean that lower quantiles have relatively higher effects on the total loans/total assets ratio. Meanwhile, Figure 6 depicts the hanging rootogram to compare the empirical and theoretical distributions (Tukey, 1965, 1972; Wainer, 1974; Friendly, 2000).

Figure 5. Quantile Regression Coefficients and Confidence Intervals

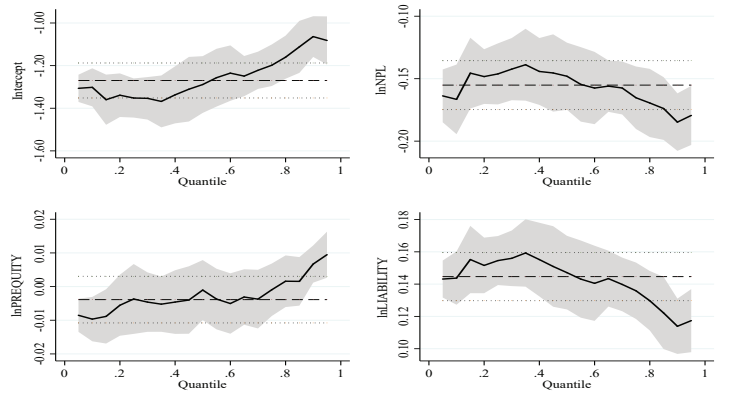
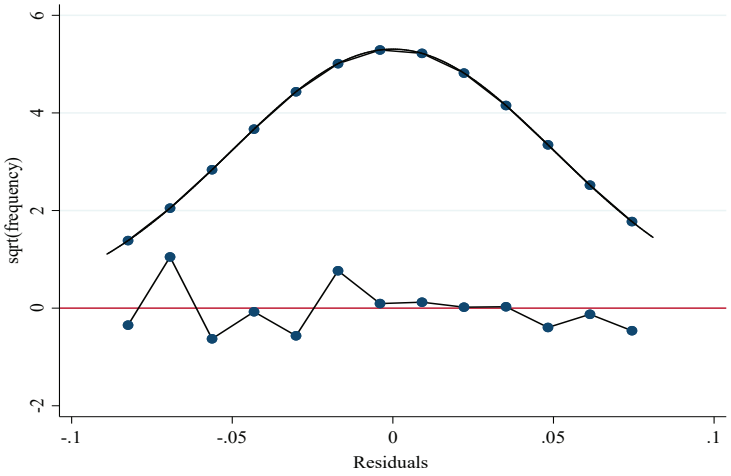


Figure 6. Hanging Rootogram



As a next issue, the Wald tests of simple and composite linear hypotheses for the parameters of fitted models are fulfilled, which are obtained by the simultaneous quantile regression with bootstrapped standard errors, to examine whether the coefficients on explanatory variables are confronted with the same values. Table 6 indicates the Wald statistic and its corresponding *p*-value. The test statistics show that the coefficients differ for each quantile where the null hypothesis of coefficient equality is rejected at a 1% significant level.

Table 6: Wald Test of Coefficient Equality

Test Result	p-value
F (2, 188) = 1688.71	Prob > F = 0.0000

The empirical outcomes reveal that the statistical variation of coefficients is significant for the conditional distribution of the total loans over the total assets ratio. However, there is also a need to control the intra-cluster correlation for the data sampled from independent and identically distributed (i.i.d) clusters employing the Parente-Santos Silva testing approach (Parente and Silva, 2016).

In that vein, the quantile regression with robust and clustered standard errors method (QREG2) is used to test the intra-cluster correlation. The empirical

findings based on intra-cluster correlation show that the results are not statistically significant and thus the quantile estimator is assumed as consistent and efficient. Table 7 represents the estimations of the QREG2 method coupled with the results of the intra-cluster correlation test.

The estimation results of quantile regression with robust and clustered standard errors in Table 7 show that the previous findings are statistically reliable for the effects of the non-performing loans/total cash loans ratio and the liabilities/equity ratio on total loans/total equity ratio. Furthermore, the results are robust concerning the intra-cluster correlation.

However, the simultaneity of the decision process for each data directs the testing procedure to investigate the endogeneity problem of all models. Therefore, the generalized quantile regression (QREGPD) for the panel data method (Powell, 2014, 2016; Baker et al., 2016) is considered to solve this given issue. The results of the QREGPD are summarized in Table 8. To solve the endogeneity problem the lagged values of the explanatory variables are included in the regressions as instruments. The empirical findings of each quantile (except for quantile 0.7, quantile 0.8, and quantile 0.9) imply that the initial results are coherent with the results obtained by the QREGPD approach in which the robustness checks validate the relations among the selected variables.

Concluding Remarks

Financial institutions can be considered as the core element of the financial sector and thereby the banking industry as a whole. The investment and development banks, as one of the specific types in the banking industry, play a significant role in granting long-term loans for investment projects. They are also considered banks that support project financing.

In principle, there are two important differences between conventional banks and investment & development banks. On the one hand, the investment and development banks grant 'tailor-made' loans, that is, the loans are specific to the

Table 7: Quantile Regression with Robust and Clustered Standard Errors: QREG2 Results

	Dependent variable: lnLOANS								
	τ=10th	τ=20th	τ=30th	τ=40th	τ=50th	τ=60th	τ=70th	τ=80th	τ=90th
lnNPL	-0.167*** (0.015)	-0.148*** (0.014)	-0.142*** (0.012)	-0.144*** (0.012)	-0.148*** (0.012)	-0.157*** (0.013)	-0.157*** (0.014)	-0.169*** (0.014)	-0.185*** (0.014)
lnPREQUITY	-0.009* (0.005)	-0.005 (0.004)	-0.005 (0.004)	-0.004 (0.003)	-0.001 (0.004)	-0.005 (0.004)	-0.003 (0.005)	0.002 (0.004)	0.006* (0.003)
lnLIABILITY	0.143*** (0.011)	0.152*** (0.012)	0.156*** (0.009)	0.155*** (0.010)	0.147*** (0.010)	0.140*** (0.010)	0.139*** (0.011)	0.129*** (0.009)	0.114*** (0.009)
Constant	-1.302*** (0.058)	-1.339*** (0.067)	-1.353*** (0.054)	-1.337*** (0.059)	-1.289*** (0.059)	-1.235*** (0.059)	-1.222*** (0.062)	-1.160*** (0.055)	-1.064*** (0.052)
Pseudo-R^2	0.957	0.958	0.957	0.958	0.958	0.958	0.958	0.957	0.954
Obj. function	0.0057	0.0097	0.0124	0.0141	0.0146	0.0141	0.012	0.0098	0.0058
Intra-cluster correlation	0.853 (0.356)	2.321 (0.128)	1.566 (0.211)	1.164 (0.281)	1.923 (0.166)	1.882 (0.170)	2.000 (0.157)	2.832 (0.092)	5.049 (0.025)
No. of obs.	192	192	192	192	192	192	192	192	192

Note: Robust and clustered standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10. The objective function and intra-cluster correlation test results are also integrated into the table.

Table 8: Generalized Quantile Regression: QREGPD Results

	Dependent variable: lnLOANS								
	τ=10th	τ=20th	τ=30th	τ=40th	τ=50th	τ=60th	τ=70th	τ=80th	τ=90th
lnNPL	-0.168*** (0.021)	-0.154*** (0.015)	-0.137*** (0.015)	-0.153*** (0.017)	-0.155*** (0.020)	-0.117*** (0.017)	-0.085 (2.882)	1.127 (2.778)	-0.023 (1.369)
lnPREQUITY	-0.004 (0.011)	-0.000 (0.009)	-0.014* (0.008)	-0.012 (0.009)	0.019 (0.012)	-0.004 (0.014)	8.494 (7.891)	-9.632* (5.505)	1.875 (1.192)
lnLIABILITY	0.142*** (0.013)	0.154*** (0.009)	0.171*** (0.009)	0.163*** (0.010)	0.157*** (0.015)	0.150*** (0.015)	-6.656 (6.603)	0.984 (1.797)	0.014 (1.032)
Constant	-1.300* (0.769)	-1.356*** (0.486)	-1.465*** (0.545)	-1.406*** (0.526)	-1.372*** (0.508)	-1.294*** (0.460)	25.86 (43.14)	14.42 (17.43)	-1.127 (35.49)
No. of obs.	192	192	192	192	192	192	192	192	192

Note: The standard errors are in parentheses *** p<0.01, ** p<0.05, * p<0.10. Instruments are the first and second lagged values of variables: lnLOANS(-1), lnLOANS(-2), lnNPL(-1), lnNPL(-2), lnPREQUITY(-1), lnPREQUITY(-2), lnLIABILITY(-1), lnLIABILITY(-2).

long-term projects unlike the loans provided by conventional banks which grant standard loans with predetermined maturity and characteristics. On the other hand, as opposed to conventional banks, the investment and development banks accept no deposits. Their major sources of funds (liability structure) are composed of loans provided by international finance corporations, international development banks, and foreign banks, as well as debt instruments (for example, a debt instrument issued in the form of promissory notes by investment and development bank to raise the level of funds).

Moreover, these specialized banks are considered an important component of sustainable development since they provide financial support for large-scale industrial projects that need corporate loans with long maturity. At the same time, their role involves the enhancement of capital markets via their expertise in advising services, helping corporate firms go public, mergers & acquisitions, and other advisory services. These banking groups raise international funds obtained from abroad and direct them to local/domestic firms for their financial needs via less costly and long-term funding opportunities.

The Development Investment Bank of Turkiye (TKYB), which started banking activities in 1976 and was restructured and renamed in 2018, is the leading public bank in this line of business with services in capital markets and development banking. In addition, the Industrial Development Bank of Turkiye (TSKB) is a private investment and development bank in this banking branch and has been operated since the pre-1950s in enhancing capital markets as well as providing loans for industrial development. There are 14 investment and development banks in Turkiye as of the year 2021. Apart from the TKYB, Takasbank, Eximbank, and Ilbank (i.e., Iller Bankası) are the other state-run banks with specialized functions. Takasbank provides services mainly for central settlement and custody of securities. Eximbank is the key bank for boosting export by enabling export companies to make use of export-loans with favorable cost and maturity structures. And finally, 'Ilbank' finances local administrations, namely municipalities. Apart from these banks with comparatively greater assets, other investment and development banks also play a significant role in this business line in which they

grant loans for commercial and corporate companies, take part in syndicated loans, and increase the total amount of funds (loans) via their relatively small portion (additional funding furnished by these small banks are the key determinant of the total funding for the firms).

This study examines a balanced panel set (i.e., monthly data from 2005/January to 2020/December) to investigate the lending behavior of investment and development banks functioning in Turkiye. To examine the lending behavior of those selected banks, the paper used the quantile regression approach. To assess the lending behavior, the total loans/total assets ratio is used as a proxy variable. The potential effects on this ratio are tested by three fundamental indicators: (i) the non-performing loans/total cash loans ratio, (ii) the net profit/equity ratio, and (iii) the liabilities/equity ratio. The empirical findings implied that the lending behavior is affected only by the non-performing loans/total cash loans ratio with a negative coefficient sign and the liabilities/equity ratio with a positive coefficient sign, mostly at the lowest quantiles. However, the highest quantiles showed that the coefficients of these two variables are insignificant. In addition, the net profit/equity ratio is only significant with a negative coefficient sign in limited quantiles.

In that vein, some of the recommendations can be listed in line with those empirical results as follows: The role of this line of business in overall banking should be increased for corporate companies to reach funds with more favorable conditions concerning maturity, cost, and collateral structures. That is, competition in this field of the banking sector can further enhance industrial development and develop capital markets. A state-run regional development bank of Turkish origin can be set up to boost industrial development activities of the region and enhance capital markets. In addition to conventional investment and development banks in Turkiye, an interest-free investment and development bank is needed since there is no bank in this particular line of business. Although existing investment and development banks provide some services in this field, a specialized bank in an interest-free field shall improve financing facilities.

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