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THE EFFECT OF FIRM SIZE ON PROFITABILITY: EVIDENCE FROM TURKISH MANUFACTURING SECTOR

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ABSTRACT

Purpose - This study investigates whether size of 112 publicly listed firms in manufacturing sector affects their profitability in Turkey during the period 2005-2013.
Methodology - Dynamic panel data approach (i.e. two-step system GMM estimator) taking into account potential endogeneity of firm-level variables is employed to estimate the effect of alternative firm size indicators on firm profitability.
Findings- Estimation results suggest that after controlling for financial risk, liquidity level, growth opportunities, unsystematic risk, firm age, and the other factors, the indicators of firm size measured by firm's assets, sales and number of employees tend to have a positive influence on the profitability of firm measured by operating return on assets.
Conclusion- There is enough statistical evidence to support a linear relation between firm size measures and profitability of firms in the period analyzed. However, our empirical results do not support the quadratic or cubic association between size measures and profitability.

Keywords: Size-profitability relationship, dynamic panel data, manufacturing industry, Borsa Istanbul, Turkey
JEL Codes: C33, L25, L60

1. INTRODUCTION

According to scholars in industrial economics, business organization and finance, the size is considered to be one of the most essential characteristics of firms in explaining profitability (Majumdar, 1997; Amato and Amato, 2004; Goddard et al., 2005; Serrasqueiro and Nunes, 2008; Lee, 2009; Isik and Tasgin, 2017; among others). However, the question as to whether higher or lower firm size optimizes the firm's profitability continues to be discussed in the theoretical and empirical literature. The link between size and performance has been dealt with in the theoretical literature through various theories of the firm such as institutional, organizational and technological theories. However, these theories offer different implications for the size-performance relationship given the optimal size of the firm (Kumar et al., 2001; Becker-Blease et al., 2010). Likewise, there is also no consensus among researchers about how size is related to profitability in previous empirical studies. For instance, some studies report the relationship between size and profitability to be either positive (e.g. Majumdar, 1997; Serrasqueiro and Nunes, 2008; Stierwald, 2010; Dogan, 2013; Liu at al., 2014; Çelikyurt and Dönmez, 2017; Isik and Tasgin, 2017) or negative (e.g. Goddard et al., 2005; Becker-Blease et al., 2010; Hatem, 2014; Shehata et al., 2017). Others find a quadratic relationship (e.g. Pattitoni et al., 2014, Lee, 2009; Voulgaris and Lemonakis, 2014) or a cubic relationship (e.g. Amato and Amato, 2004) or no relationship (e.g. Gonenc at al., 2007; Nakano and Nguyen, 2013; Niresh and Velnampy, 2014; Sciascia and Mazzola, 2008). In our study, we ask the question as to what is the association between manufacturing firms' size and their financial performance in Turkey. We attempt to answer to this question as the following. In accordance with the economies of scale hypothesis, large firms are likely to enhance their profitability by minimizing their costs stemming from their production process (Amato and Wilder, 1985; Majumdar, 1997; Goddard et al. 2005; Becker-Blease et al., 2010; Stierwald, 2010; Voulgaris and Lemonakis, 2014; among others). Furthermore, large firms exploiting their size may have access to the public debt markets in an easier and cheaper way in order to fulfil their

financing needs. Because of the fact that large firms are known to have a lower probability of bankruptcy, borrowing more at a lower cost thanks to their size is likely to help them benefit from tax shield (Rajan and Zingales, 1995; Delcoure, 2007; Prasetyantoko and Parmono, 2009; Antoniou et al., 2008). In addition, the fact that large-sized firms are more diversified, have higher market power, and employ better technology could contribute positively to firm profitability (Amato and Wilder, 1985; Rajan and Zingales, 1995; Lee, 2009; Voulgaris and Lemonakis, 2014). However, larger and more diversified firms could face scale inefficiencies and be less profitable because of bureaucratic processes, higher agency costs, and other costs associated with managing larger firms (Jensen and Meckling, 1976; Fama and Jensen, 1983; Goddard et al. 2005; Delcoure, 2007; Jónsson, 2007; Ng et al., 2009; Becker-Blease et al., 2010; Pattitoni et al., 2014; Voulgaris and Lemonakis, 2014; among others).

To contribute to the understanding of above-mentioned discussion, we re-investigate size-profitability relation by using various size measures for a comprehensive sample of Turkish-listed manufacturing firms. As well as we know, this study is the first to explore whether size-profitability linkage is nonlinear in terms of different size indicator in the context of Turkish manufacturing industry. Another contribution is that our profitability model is dealt with in a dynamic framework and estimated through system generalized method of moments (system GMM) estimator, taking into account potential endogeneity of firm-level variables. Based on the findings, our study reveals that there exists a statistically significant positive linear relationship between size measures and profitability of firm, regardless of how size is measured. This relationship is, however, not non-linear.

The remainder of the article is structured as follows. Section 2 summarizes the related studies on the nexus between size indicators and profitability. Our data, variables and methodology applied are described in Section 3. Section 4 explains our empirical findings and Section 5 concludes.

2. LITERATURE REVIEW

Using data of 238 quoted firms in the Indonesia Stock Exchange over 1994–2004 period, Prasetyantoko and Parmono (2009) examine whether firm size affect performance, taking into account the pre- and post-crisis periods. The econometric results suggest that after controlling firm characteristics and macroeconomic indicators, there is a significant and positive linkage between total asset variable and return on assets in both total period and post-crisis period. However, in the same study it is reported that there is no linkage between size variable and market value.

In a study on Croatian manufacturing industry between the years 2002 to 2010, Pervan and Višić (2012) analyze the impact of firm's total assets on return on assets performance using fixed effects regression. The results reveal that size of the firm, natural logarithm of firms' total assets, influences return on assets (ROA) positively and significantly.

Size-performance linkage is investigated by Mule et al. (2015) for 53 listed firms registered in Nairobi Securities Exchange during 2010-2014. Employing random effects GLS estimator, the authors find that firm size (i.e., natural log of sales) is found to be positive and significant only in ROE regression, while it is insignificant in ROA and Tobin's Q regressions.

Majumdar (1997) utilizes a sample of 1020 Indian firms registered in the Bombay Stock Exchange and pooled OLS estimations to analyze the influence of age and size on firm performance for the period 1988-1994. Results demonstrate that firms' size and age are significant determinants of performance of firm. More clearly, when compared with smaller firms, bigger firms are less productive but more profitable, while older firms are more productive but less profitable. In the US retailing industries, Amato and Amato (2004) study the association between firm size and profitability, as measured by return on assets for the period of 1977-1987. The findings obtained from their analysis indicate that there exists a cubic relation between firm size and profit rates for the general merchandize, restaurant, and apparel industries. In other words, while linear and cubic coefficients of firm size variable are found to be significant and positive, the quadratic form of this variable is negatively and significantly related to ROA. Employing static and dynamic panel data estimation techniques, Pattitoni et al. (2014) explore the determinants of firm profitability of 30.764 private firms for the 2004-2011 period in the EU-15 area. Based on their regression results, the authors conclude that there exists a threshold effect of firm size measured by natural logarithm of total assets. In other words, although larger firms tend to have higher profitability than small firms, the fact that firms continue to grow in terms of assets causes them to have lower profitability because of the nonlinearity in size-profitability association.

By employing a sample of 200 listed firms in Borsa Istanbul Stock Exchange (BIST) during 2008-2011, Doğan (2013) investigate the relationship between firms size indicators represented by total assets, total sales and number of employees and firm performance represented by return on assets in Turkey. Estimation results imply that each of size measures really influence returns on assets of firms, i.e., size indicators are positively and significantly associated with return on assets. A sample of 15 listed firms operating in manufacturing industry in Sri Lanka over the period 2008-2012 is studied by Niresh and Velnampy (2014) with the aim of assessing the relation of size-profitability. In their study, while total assets and total

sales are employed as firm size measures, net profit and return on assets are used for firm profitability measures. Based on the regression analysis, they report that there is no relation between size indicators and profitability indicators.

Based on a sample of 1.123 small and medium-sized enterprises (SMEs) in Turkey during the period between 2009 and 2013, Aytürk and Yanık (2015) empirically explore the determinants that influence profitability by using dynamic panel data analysis. As a result of the analysis, the authors report that even though the influence of natural log of total sales on gross sales profit divided by total assets is significant and negative, size measure affects the ratio of profit before tax and interest to total assets positively and significantly. Focusing on 34.798 firms of the SME sector in the UK for the period of 2005-2013, Shehata et al. (2017) try to analyze the influence of board diversity on firm financial performance. Their findings from panel fixed effects vector decomposition (FEVD) estimation method indicate that the size of firm, as measured natural log of total assets, is significantly negatively correlated with return on assets. Employing an unbalanced panel data of approximately 7,000 quoted firms in the United States for the 1987-2006 period, Lee (2009) tries to identify factors that influence firm profitability. The author reveals that there is an inverted U-shaped relation between firm size indicator (i.e. total assets) and profitability through panel fixed effects regressions.

Serrasqueiro and Nunes (2008), aiming to determine the size indicators (i.e. log of assets, log of sales, and log of number of employees) affecting performance of 51 small and medium-sized firms in Portugal, use firm level data during 1999-2003.Their results from dynamic panel regression analysis show that each of firm size measures is positively and significantly related to firm performance, measured as operating income divided by total assets for SMS firms. However, in order to compare the results of SMS firms with those of large firms with regards to size measures, they re-run their regression for large firms and their findings regarding firm size indicators reveal that there is no association between size measures and profitability. The factors that influence the profitability of 12.508 firms operating in service and manufacturing industry from major European countries (i.e., the UK, Spain, Italy, Belgium, and France) for the nine years 1993-2001 period are specifically analyzed by Goddard et al. (2005). Estimation results obtained from dynamic panel data model suggest that the impact of firm size variable (total assets) on firms' ROA is negative and significant, meaning that compared to small firms; large firms are better performers with regards to profitability in each of 5 European countries analyzed.

In United Kingdom for the period 2003-2008, Veprauskaitė and Adams (2013) who employ a dynamic panel data estimation technique for a sample of 468 quoted firms operating in industrial sectors report that size indicators like the log of total sales and assets are not correlated with ROA and ROE but are negatively and significantly associated with market value measured by Tobin's Q.

For a sample consisting of over 2.000 listed firms in China between the period 1999-2011, Liu et al. (2014) document a significantly positive correlation between number of employee and firm financial performance indicators represented by the ratio of net income to total sales (assets) and the ratio of operating income to total sales (assets) by employing different estimation methods.

By using a sample of 153 listed real sector firms in Borsa Istanbul for the period 2005-2012, Işık (2017) has examined the linkage between firm size represented by total assets and firm profitability (ROA). Estimation results suggest that in both full firm sample and sub-samples (i.e. young, old, small and big firm sample), firm size is significant in explaining the variation in ROA.

3. DATA AND METHODOLOGY

3.1 Sample

We use a dataset of 112 firms of manufacturing industry[1] listed in BIST (Borsa Istanbul) in order to examine if firm size indicators have a significant influence on firm profitability. The data set is derived from the Finnet database, which contains financial information regarding Turkish firms listed in BIST. In addition, we use personal number from annual activity report. The sample data used for our analysis covers the nine-year period from 2005 to 2013. Firms with negative equity are dropped from the data set. We also exclude firms with less than 6 years of available data. Consequently, an unbalanced panel of 112 Turkish publicly traded manufacturing firms forms the final sample to be used in this study.

3.2. Model specification

The dynamic panel regression equation to be estimated is as follows:

[1] Firms in the manufacturing industry are classified into 8 sectors based on BIST classification to control fully for potential sector differences. Firms belong to the following sub-sectors: food and beverage; textile and leather; chemical-petroleum and plastic products; non-metal mineral products; basic metal; metal products and machinery; and other manufacturing.

$$\mathrm{oROA}_{i,t} = c + \beta \mathrm{oROA}_{i,t-1} + \psi \mathrm{FSI}_{i,t} + \sum_{j=1}^{5} \mathrm{FC}_{i,t}\delta_j + \mathrm{year}_t + \mathrm{industry}_i + \mu_i + \epsilon_{it} \quad (1)$$

In this econometric model, subscripts i and t denote an individual firm and a time period, respectively. oROA_{it} is the profitability of firm i at time t and $\mathrm{oROA}_{i,t-1}$ is lagged firm profitability. While "FSI" is one of our three size variables-LnSize1, LnSize2, and LnSize3, "FC" comprises FinRisk, liqLev, GrOpp, IsRisk, and LnAge (as defined below). Year and industry represent year and industry dummy variables, respectively. μ_i stands for unobserved firm-specific effects, and $\epsilon_{it}$is the classical error term of our profitability model. The dependent variable, firm size indicators and firm characteristics included in the profitability regression equation (1) are presented in Table 1.

As the lagged firm profitability are correlated with firm-specific fixed effects by way of construction, estimating profitability equation by static panel data techniques (e.g. OLS, fixed effects or random effects) produces biased and inconsistent parameter estimates in a dynamic panel data model on account of endogeneity problems (Nickell, 1981; Baltagi, 2014). In order to cope with this kind of endogeneity (simultaneity problem), the profitability equation is estimated using two-step system GMM (generalized method of moments) estimator proposed by Blundell and Bond (1998). The GMM system estimator also controls for the persistence of the dependent variable, potential endogeneity of firm-level variables and unobserved heterogeneity by including firm-fixed effects (Blundell and Bond, 1998). The reliability of the system GMM estimator used in this study hinges considerably on validity of instrumental variables. We conduct Hansen's test to check whether chosen instruments are exogenous. In addition, we also check for the presence of serial correlation. Consistency of estimation depends on that there is no second-order serial correlation AR(2) in the differenced residuals. By construction, negative first-order serial correlation AR(1) is expected in differences and this does not invalidate the estimation. When sample size is small, two-step estimation of standard errors tends to be downward biased. Therefore, our profitability equation is estimated using Windmeijer's (2005) finite sample correction for the reported standard errors (Roodman, 2009).

Table 1: Variables, Notations and Measures

Variable	Notation	Measure
Panel A: Dependent variable		
Profitability	oROA	Operating return over total assets
Panel B: Independent variables		
Firm size	LnSize1	The natural logarithm of the firm's total assets
	LnSize2	The natural logarithm of the firm's total sales
	LnSize3	The natural logarithm of firm's number of employees
Panel C: Control variables		
Lagged profitability	Lagged oROA	One-year lagged profitability
Financial_risk	FinRisk	Total liabilities over total assets
Liquidity_level	liqLev	Current assets over short term liabilities
Growth_opportunities	GrOpp	Capital expenditure over sales
Idiosyncratic_risk	IsRisk	The standard deviation of stock returns in the past 12 months
Ln_age	LnAge	The natural log of the number of years since the firm's incorporation

Table 2 presents descriptive statistics of dependent and independent variables employed for our study over the period 2005 to 2013. The oROA varies between -27.4% and 35.0% with an average of 5.7% and a standard deviation of 8.7%.The average values of total assets, total sales and number of employees of the sample firms are 748.881, 864.875 and 1581.425, respectively. Results of summary statistics reveal that there are large differences between the maximum values and the minimum values of all the variables. Therefore, we transform the variables regarding firm's assets, sales, number of employees and age into their logarithms for regression analyses. In addition, we reduce observations within the first and beyond the 99th percentiles for all the variables to ensure that our findings are not driven by the extreme outliers.

Table 2: Descriptive Statistics

Variable	Mean	Median	SD	Min.	Max.	Obs.
oROA	0.057	0.055	0.087	-0.274	0.350	1002
Lagged oROA	0.058	0.056	0.088	-0.272	0.350	890
Assets	748.881	212.01	1732.175	7.752	17114.14	1009
Sales	864.875	171.1	2927.803	0	47033.22	1009
Employees	1581.425	520	3215.027	1	22552	1009
FinRisk	0.416	0.402	0.217	0.006	1.350	1009

liqLev	2.086	1.699	1.328	0.127	7.060	954
GrOpp	1.206	1.091	0.597	0.100	3.916	951
IsRisk	0.022	0.0008	0.095	0	1.648	995
Age	36.595	37	11.788	5	77	1009

Notes: In this table, the values concerning total assets and sales are denominated in millions of TL (Turkish Lira), the figures on the employees are expressed in the number of the employees.

Table 3 shows the correlation coefficients among the variables reported in this study. The Pearson correlation results reveal that there are significant correlations between profitability measure and firm size indicators[2]. Similarly, the same holds for control variables. The correlation coefficients among our independent and control variables employed in profitability equation are not bigger than the threshold value of 0.80 as recommended by Gujarati (2004)[3]. Based on results of correlation analysis, we can conclude that there exists no serious multicollinearity problem in our model specifications. As reported in Table 3, the correlation coefficient between oROA and lagged oROA is positive and significant at 1% level, confirming that dynamic panel data estimation method should be employed to estimate profitability model in Eq. (1).

Table 3: Correlation Matrix (Pearson)

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
(1) oROA	1									
(2) Lagged oROA	0.62[a]	1								
(3) LnSize1	0.28[a]	0.29[a]	1							
(4) LnSize2	0.35[a]	0.35[a]	0.90[a]	1						
(5) LnSize3	0.19[a]	0.20[a]	0.75[a]	0.78[a]	1					
(6) FinRisk	-0.23[a]	-0.23[a]	0.02	0.12[a]	0.14[a]	1				
(7) liqLev	0.32[a]	0.33[a]	-0.03	-0.06	-0.08[b]	-0.69[a]	1			
(8) GrOpp	-0.18[a]	-0.10[a]	0.04	-0.27[a]	-0.07[b]	-0.23[a]	0.14[a]	1		
(9) IsRisk	0.14[a]	0.03	0.02	0.01	0.02	-0.10[a]	0.05	0.007	1	
(10) LnAge	0.16[a]	0.16[a]	0.29[a]	0.21[a]	0.20[a]	-0.15[a]	0.09[a]	0.18[a]	0.06	1

Note: [a] and [b] suggest that the correlation statistics are significant at 0.01 and 0.05 level.

4. FINDINGS AND DISCUSSIONS

Table 4 reports dynamic panel regression results of 112 Turkish listed firms operating in manufacturing industry based on two-step system GMM estimator controlling for both industry and year effects. Hansen's test confirms that chosen instruments are exogenous. Based on the AR(1) and AR(2) test statistics, we can conclude that the residuals in Eq. (1) are serially uncorrelated. These post-estimation results for autocorrelation and validity of chosen instruments support that our dynamic panel model is a plausible specification for investigating size-profitability association. While profitability variable is measured by oROA, three alternative measures of size are used in our regression models, namely LnSize1, LnSize2 and LnSize3 in each set of regressions. In the first, third, and fifth columns of Table 3, using LnSize1, LnSize2, and LnSize3 we examine whether the size-profitability association is linear. In addition, in the second, fourth and sixth columns of Table 4 we include the squared values of firm size indicators (LnSize1SQ, LnSize2SQ, and LnSize3SQ) in the regression equations to investigate if this relationship is non-linear.

As shown in column 1, 3 and 5 of Table 3, the estimated coefficients for LnSize1, LnSize2, and LnSize3 are positive and significant at conventional levels of significance in three regression models, suggesting that firm size indicators measured by the log of firm's assets, sales and number of employees tend to have a positive influence on profitability represented by the ratio of operating income to total assets. These findings also mean that larger firms are highly likely to have higher profitability than smaller firms. Whereas, as reported in columns 2, 4 and 6, all the estimated linear and quadratic coefficients on firm size indicators are negative but statistically insignificant at any conventional levels of significance. These findings confirm that size-profitability relationship is not nonlinear. Following Amato and Amato (2004), we also investigate whether there is a cubic relation between firm size and profitability. Unreported results from two-step system GMM estimator show that none of coefficients on the firm size indicators (linear, quadratic, and cubic) are statistically significant[4].

[2] The correlation coefficients among the indicators of firm size are positive and significant at 1% level. However, these variables will not be used in the same equation. They will be employed for robustness checking.

[3] According to Gujarati (2004), unless correlation coefficients among independent variables are higher than the value of 0.80, multicollinearity is not a major issue in the multiple regression analysis and all independent and control variables can be employed in the same regression model.

[4] These findings are available upon request.

Consequently, these findings imply that there is enough statistical evidence to support a linear relation between firm size measures and profitability of firms operating in Turkish manufacturing industry in the period analyzed.

Table 4: Dynamic Panel Estimation Results

Independent variable	Dependent variable: oROA					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Constant	-0.159	-0.326	-0.097	-0.089	-0.275	-0.349
	(0.555)	(0.188)	(0.458)	(0.403)	(0.152)	(0.325)
Lagged oROA	0.290***	0.315***	0.292***	0.275***	0.298***	0.287***
	(0.076)	(0.093)	(0.083)	(0.083)	(0.076)	(0.073)
LnSize1	0.044***	0.0927				
	(0.015)	(0.067)				
LnSize1SQ		-0.007				
		(0.005)				
LnSize2			0.023**	0.054		
			(0.010)	(0.035)		
LnSize2SQ				-0.003		
				(0.003)		
LnSize3					0.023*	0.057
					(0.013)	(0.086)
LnSize3SQ						-0.003
						(0.006)
FinRisk	0.096	0.095	0.071	0.093	0.085	0.091
	(0.058)	(0.072)	(0.060)	(0.067)	(0.056)	(0.057)
liqLev	0.016**	0.022**	0.015*	0.022**	0.019**	0.025***
	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
GrOpp	-0.060***	-0.054***	-0.038**	-0.049**	-0.042**	-0.058***
	(0.018)	(0.017)	(0.017)	(0.017)	(0.019)	(0.015)
IsRisk	-0.138	-0.062	-0.059	-0.182	-0.047	-0.204
	(0. 178)	(0.175)	(0.170)	(0. 134)	(0. 187)	(0. 131)
LnAge	-0.022	-0.004	-0.003	0.007	0.009	0.017
	(0.026)	(0.020)	(0.021)	(0.024)	(0.025)	(0.022)
Industry dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies?	Yes	Yes	Yes	Yes	Yes	Yes
F-test	12.72***	17.54***	15.92***	20.32***	19.63***	20.32***
AR(1)	-4.63***	-4.76***	-4.73***	-4.68***	-4.95***	-4.88***
AR(2)	-0.36	-0.02	-0.05	-0.47	-0.02	-0.39
Hansen test	18.42	32.30	20.88	5.93	18.75	19.89
Instruments used	46	51	46	51	46	51
Cross sections included	112	112	112	112	111	111
Observations	767	767	767	767	766	766

Notes: This table presents two-step system GMM estimates of Eq. (1). Robust SEs are in parentheses. Except for sector dummies, year dummies and LnAge, all variables are considered as endogenous in our models. Lagged levels (dated t-2,…, t-5) in the transformed equations, combined with lagged first-differences (dated t-1) in the original equations are employed as instrumental variables based on the GMM procedure. *, ** and *** denotes significant difference at the 0.10, 0.05 and 0.01 levels, respectively.

Our findings suggesting that firm size measures are positively associated with profitability indicator in a linear manner are consistent with the findings of Serrasqueiro and Nunes (2008) for Portugal, Stierwald (2010) for Australia, Mule et al. (2015) for Kenya, Liu et al. (2014) for China, Işık (2017) for Turkey, Majumdar (1997) for India, Prasetyantoko and Parmono (2009) for Indonesia, Pervan and Višić (2012) for Croatia, but contradict the results of Goddard et al. (2005) for European countries, Niresh and Velnampy (2014) for Sri Lanka, Becker-Blease et al. (2010) for the US, and Veprauskaitė and Adams (2013) for the UK. The results regarding the quadratic association are not consistent with those of Pattitoni et al. (2014) and Lee (2009). And finally, our unreported results for cubic association do not support the results of Amato and Amato (2004) as well.

When analysis results are evaluated with regards to the influence of firm specific control variables on profitability, it can be said that lagged (past) profitability has significant impact on current profitability. Besides, while higher liquidity leads to higher profitability, higher growth opportunities cause firms to have lower profitability. The findings seem to suggest that

the other control variables (i.e. financial risk, idiosyncratic risk, and firm age) we have used in our profitability models are, however, found to be statistically insignificant.

5. CONCLUSION

This paper empirically investigates the linkage between firm size indicators and profitability of firms. Our paper contains a total of 112 manufacturing firms quoted on the Istanbul Stock Exchange during the period 2005-2013. In this paper, the size-profitability relationship is dealt with in a dynamic framework and profitability model is estimated employing two-system GMM estimator, taking into account potential endogeneity of firm-level variables. After controlling for financial risk, liquidity level, growth opportunities, idiosyncratic risk (unsystematic risk), firm age and the other factors, we find that there exists a statistically significant positive linear relationship between size and profitability of firm. To further understand whether the size-profitability relation is curvilinear we add the quadratic and cubic form of size variables to the profitability models. The results from these regressions show that this relation is not curvilinear. All these results support the view that as firms get larger, their profitability enhances. To evaluate the robustness of our findings, we estimate the profitability equation for alternative size variables (i.e. total sales, and number of employees (in their logarithmic form)), separately. The results of our empirical analysis indicate that effects of size measures on profitability do not vary, regardless of how firm size is measured. All size indicators continue to be positively related to firm profitability in all models. In other words, our results obtained dynamic panel data models provide econometric evidence that there exists a "size effect" in manufacturing industry in Turkey during the period under consideration.

In brief, the main message of our paper is that scale variable is an important factor affecting the profitability of manufacturing firms listed on the Borsa Istanbul. As emphasized in the introduction section, large-sized firms have significant size advantages compared to small-sized firms. The results achieved in this paper are valid only for the manufacturing sector. They cannot be generalized for the other sectors. In future studies, the influence of the size of the firm on profitability could be empirically analyzed in terms of other sectors as well as financial sector in the Borsa İstanbul.

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