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INNOVATION AND COMPANY PERFORMANCE RELATIONSHIP: AN INVESTIGATION WITH PANEL DATA ANALYSIS IN BIST STONE AND SOIL-BASED SECTOR

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Abstract

The aim of this study is to determine the relationship between the expenditures the firms make for innovation and their financial performance. For this purpose, two models have been established for firm performance of the firms in the sector of BIST Stone and Soil Based on the 2007Q1-2015Q2 period. In the models, the effects of the R & D investments on the same year were investigated, also the effects on the next one, two and three years were analyzed.As a methodology, one of the models in which the panel data analysis method is used is based on the profitability of the sales and the second on the growth in sales. As a result, R & D investments have been found to be meaningless in the profitability of sales; concerning the growth in sales the first two years were found meaningless and following two years were considered positive in this study where the R & D expenditures made by the companies for innovation expenses are used. When the unit effects of the firms were examined, it was determined that four of the ten firms were positive in both models and four of them were negatively affected in both models.As a result, some of the firms have used R & D investments efficiently and others have used them inefficiently.

Keywords: R&D, Firm Performance, Panel Data Analysis

1. INTRODUCTION

Today's economy, known as the new economy, has a dynamic and ever-changing structure. At the heart of this economy is information. This area brings information on wealth, high paying jobs, more exports and higher living standards. This process, known as knowledge economy or knowledge, is constantly changing technologically (Rashkin, 2007, p.1). Science, technology and innovation has become a key factor contributing to economic growth both in developed and developing economies (OECD, 2005, p. 8). Countries that can be part of this new economy can increase their profitability and maintain their international competitiveness (Rashkin, 2007, p.1).

In today's competitive market, where competition is intense, businesses need to be open to innovations, create new products and develop existing ones so that they can continue their operations. Expenditures made for these innovations are shown as research and development expenses in the accounting records. In short, these expenditures, which are called R & D

expenditures, are transformed into assets that cause businesses to maintain their market presence or increase their market share. It is therefore possible to look at R & D expenditure as an investment. Businesses which do not give the necessary importance to these investments, particularly of those that operate in highly competitive industries, in the future may lose their market shares and encounter loss in profitability as the worst scenario (Kiracı and Arsoy, 2014, p. 34).

It is necessary to constantly improve and renew the knowledge and expertise areas in order to bring out new and qualified goods and services, to improve the production process, to meet the needs of the international market customers, to reduce costs while increasing production quality and to meet the changing environmental needs.At this time when international competition is on the rise, even today's powerful businesses are forced to manufacture in technology and innovation to meet changing customer needs and requirements. In this situation businesses need to focus on R & D activities on an ongoing basis and to increase their expenditures for these activities. (Sarısoy, 2012, p. 99).In addition to increasing R & D spendings, it is also a necessity to well manage and use them effectively. R & D management is a combination of innovation management task and technological management task (Akhilesh, 2014, p. 6).

2. LITERATURE REVİEW

There have been many studies on the effect of R & D investments on firm performance. Morbey (1988) found a strong and positive relationship between R & D and sales in the following years and found a weak relationship between R & D and profitability. He also stated that R & D investments must overcome certain thresholds in order to affect sales.Parcharidis and Varsakelis (2007) reached the conclusion that R & D investments had a negative effect on firm performance in the same year but positively affected after 2 years.

Similarly, Ehie and Olibe (2010), Nord (2011), Hsu, Chen, Chen and Wang (2013), Rosli and Sidek (2013), Gharbi, Sahut, and Teulon (2014), Öztürk (2008), Team (2013) and Başgöze and Sayın (2013) who were investigating the effects of R & D studies, also found positive effects. In contrast, Pantagakis, Terzakis and Arvanitis (2012), Özcan, Ağırman and Yılmaz (2014) and F. U. Jianhong concluded that R & D investments have a negative relationship with firm performance.Khayum, Cashel-Cordo and Rhim stated that the results were not meaningful.

As a result of the studies using the profitability ratios as the company performance, it was found that the works of Lin, Ge and Goh (2011), García-Manjón and Romero-Merino (2012), Kocamış and Güngör (2014), Unal and Seçilmiş (2014), Ayaydın and Karaaslan Turkan (2015) have found positive effects. On the contrary, Kiraci and Arsoy (2014) found a negative relationship between R & D investment and operating profit ratio and equity profitability ratio, and determined that there was no significant relationship between asset profitability, gross profit ratio and net profit ratio.

Del Montea and Papagni (2003), Demirel and Mazzucato (2012), Falk (2012), García-Manjón and Romero-Merino (2012), Lee, Han and Yoo (2013) and Öztürk and Zeren (2015), using growth in sales as firm`s performance, found that R & D investments positively affected the firm's growth performance.However, Arslantürk (2010) argues that the relationship between R & D investments and firm growth is not significant.

Czarnitzki and Kraft (2006) investigated whether the effect of R & D investments on the performance of firms in West Germany and East Germany is different.The performance of the company using the credit note given by the European Economic Research Center (ZEW) to the

firm's performance is that R & D investments are positive for firms in West Germany and negative for companies in East Germany. Given that West Germany is more developed than East Germany, R & D investments can be achieved as a result of firms operating in more developed regions using them more effectively than firms operating in other locations.

Wang (2011) found a non-linear relationship between R & D and firm performance. He also argued that R & D is the minimum level at which an optimum level is in effect and that it is effective in order to maximize its operating performance.

3. DATA AND METHODOLOGY

The panel data equation is generally expressed by the following equation (1) (Akıncı, Akıncı, and Yılmaz, 2014, p 87).

$$Y_{it}=\beta_1 + \beta_2 X_{2it} + \beta_3 X_{3it} + \varepsilon_{it} \quad (1)$$

According to Equation (1), all of the independent variables, horizontal cross-sectional units are affected at the same time (Akıncı, Akıncı, and Yılmaz, 2013, p. 68).

The fixed effect model expressed by equation (2) predicts that the starting point will have a different fixed value for all horizontal section units (Akıncı, Aktürk, and Yılmaz, 2012, p. 5,6).

$$Y_{it}=\beta_{1i} + \beta_{2i} X_{2it} + \beta_{3i} X_{3it} + \varepsilon_{it}\ , \quad \beta_{1j} \neq \beta_{1i} \quad (2)$$

If there is a relationship between these error terms and the explanatory variables, the use of the constant effect model will give more consistent results. Because in such a case the predictors of this model will be unbiased. In the same way, when the number of sections is small and the time dimension is large, it is more accurate to use the fixed effect model (Erkal, Akıncı and Yılmaz, 2015, p. 335).

According to the random effects model, which defines the starting point as a random variable, the starting points are the sum of the β_1 fixed value and the zero averaged μ_i random variable and are expressed with the help of equation (3) (Akıncı, Aktürk, and Yılmaz, p.6).

$$Y_{it}=\beta_{1i} + \beta_{2i} X_{2it} + \beta_{3i} X_{3it} + \varepsilon_{it}\ , \quad \beta_{1j} \neq \beta_{1i} + \mu_i \quad (3)$$

It is suggested that random variations in horizontal cross-sectional units, such as error terms, are random in the random effects model. In this model, changes occurring in units or changes in both unit and time are included as a component of the model error term.

The financial statements used in the preparation of the data set in this study were taken from the Stock Exchange Istanbul between 2007-2009 and from the Public Enlightening Platform between 2009-2015. Company values were obtained from the Finnet 2000 program. The necessary ratios were then calculated from the financial statements brought together. These variables are calculated; dependent, independent and control variables.To determine these variables, the relevant literature was examined and it was decided to use R & D investments for the innovation to be used as an independent variable.Subsequently, dependent variables were stated by determining the ratios that could represent the firm's performance from the studies relevant to firm performance, and finally, appropriate control variables were determined from studies investigating the effect of R & D investments on firm performance using panel data analysis.

It has been determined that 28 firms were active in the stone and soil-based sector, a sub-sector of the manufacturing sector, and only 10 of them had regularly invested R & D in the relevant period. Therefore, the data belonging to these 10 companies were used in the study.

A deep literature review was conducted to determine the variables to be used in the study. Variables deemed suitable for use as a result of the national and international literature review were determined. The variables used in the study and the studies using these variables are presented in Table 1.

Table 1: Variables and Studies Where Variables Are Used

Variables	Works Where Variables Are Used
R_D / Sales	(Ehie andOlibe, 2010); (Lin, Ge andGoh 2011); (Zhu andHuang 2012); (Choi andWilliams 2013); (García-Manjóna andRomero-Merino, 2012); (Choi andWilliams, 2014); (Falk, 2012).
Profitability of Sales	(Elsayed andPaton, 2005); (Tanrıöven andAksoy,2010); (Karamustafa, Varıcı andEr, 2009); (Varıcı andEr, 2013); (Anastasia and Tsaklanganos, 2012)
Growth in Sales	(García-Manjóna and Romero-Merino, 2012); (Choi and Williams, 2014); (Del Montea and Papagni, 2003); (Lee, 2010); (Falk, 2012); (Forbes, 2002).
Logarithm of Sales	(Coombs and Gılley, 2005); (Demirel and Mazzucato, 2012); (Rao, Yu, and Cao, 2013); (He, Lıu, Lu, and Cao, 2015); (Aytekin and İbiş, 2014); (Nord, 2011); (Lazaridis and Tryfonidis, 2006).
Debts / Assets	(Aytekin andİbiş, 2014); (He, Lıu, Lu, and Cao, 2015); (Zhu and Huang, 2012; (Aytekin andİbiş, 2014); (Rao, Yu, and Cao, 2013).

Dependent, independent and control variables and their abbreviations and explanations are given in Table 2. It is logarithmic as variables can be understood from the name of the Logos of Assets and Sales. All other variables are proportional. The proportions of the ratios are given in the explanation of the variables in the table.

Table 2: Variables, their Abbreviations and Explanations

	Name of Variable	Abbreviation of Variable	Explanation of Variable
Independent Variable			
1	R_D/Sales	R_D	R & D investments are divided into sales revenue.
Dependent Variables			
1	Profitability of Sales	GRW_SL	Net profit divided by sales revenue.
2	Growth in Sales	PROF_SL	With the help of $(t-t_{-1})/t_{-1}*100$ formula it is calculated by extracting the sales of the previous year from the sales of the present year and then dividing it by the sales of the previous year.
Control Variables			
1	Logarithm of Sales	LOG_SL	The logarithm of sales revenue is taken.
2	Debts / Assets	DBT_ASS	Total debts are divided by total assets.

The models to be used in the study are as follows:

Model developed for Profitability of Sales:

$$PROF\_SL = a_i + \beta_1 R\_D_{i,t} + \beta_2 LOG\_SL_{i,t} + \beta_3 DBT\_ASS_{i,t} + \varepsilon_{i,t} \quad (1)$$

Model for Sales Growth :

$$GRW\_SL = a_i + \beta_1 R\_D_{i,t} + \beta_2 LOG\_SL_{i,t} + \beta_3 DBT\_ASS_{i,t} + \varepsilon_{i,t} \quad (2)$$

In both models, the independent variable is R_D (R & D investments / net sales). The control variables are LOG_SL (Sales Logorithm) and DBT_ASS (Debits / Assets). The dependent variable consists of the variables PROF_SL (Profitability of Sales/ Net Profit / Net Sales) and GRW_SL (Growth in Sales) in models (1) and (2), respectively.

4. ANALYSIS AND FINDINGS

In this section, firstly descriptive statistics of variables are given, then correlation coefficients between variables are calculated. Then, before the unit root tests were performed, a horizontal section analysis was performed to decide whether to use the first generation unit root tests or the second generation unit root tests and finally the stability of the series was tested before starting the subheadings of the models. Subsequently, the effects on the models were tested in the sub-headings, varying variance and autocorrelation were tested and models were estimated. Descriptive statistics for the variables in this section appear in Table 3.

Table 3: Descriptive Statistics for Variables

Variables	Average	Medium	Max.	Min.	Standard deviation	Jarque-Bera	Possibility	No. of Observations
R_D	0,0058	0,0045	0,0438	7,8E-06	0,0052	984,73	0,0000	340
PROF_SL	0,0806	0,0769	0,7784	-0,4681	0,1307	428,89	0,0000	340
GRW_SL	0,0603	0,0037	4,8031	-0,6100	0,3686	98693	0,0000	340
LOG_SL	18,062	17,897	20,162	15,607	1,0815	12,325	0,0023	340
DBT_ASS	0,3787	0,3367	0,7508	0,0628	0,1586	17,603	0,0001	340

When Table 3 is examined, the average ratio of R & D investments of 10 firms to sales is 0.58%. This situation shows that our firms allocate very little budget for R & D investments. This is much higher in the leading countries at the point of R & D investments in the world. For example, in 2013 he ratio of R & D to sales in Intel was 20.1%, 13.1% in Microsoft, 6.5% in Samsung and 6% in Volkswagen (Hernández, 2014, 36).As understood from the standard deviations of the variables, the bigger fluctuation is in the Logarithm of the sales, and the lowest fluctuation is the R & D / Sales ratio. But it is noteworthy that, in general, variables do not fluctuate around a high variance. Moreover, according to the Jarque-Bera statistic, which is the normality test, not all of the variables are normally distributed.

Correlation coefficients of all the variables to be used in the analyzes for the manufacturing sector are presented in Table 4. Statistically, the correlation coefficient takes a value between 1 and -1. When the sign of the correlation coefficient between the variables indicates the direction of the relationship, it expresses that the coefficient as absolute value is a strong relationship, whereas if it is close to zero, it is a weak relation (Şentürk and Aşan, 2007, p.151).

Table 4: Correlation Coefficients Related to Variables

	R_D	**PROF_SL**	**GRW_SL**	**LOG_SL**	**DBT_ASS**
R_D	1				
PROF_SL	-0,220	1			
GRW_SL	-0,091	0,100	1		
LOG_SL	-0,266	0,254	0,058	1	
DBT_ASS	0,256	-0,377	0,067	-0,221	1

Correlation coefficients of the variables in the Stone and Soil Based Sector are presented in Table 4. In this sector all variables except DBT_ASS seem to be in negative relation with R & D. At the same time, it is noteworthy that all variables are weak in relation to R & D. It can be stated that the relationship between the variables is low and will not cause a multiple linear connection error.

Horizontal section dependency can cause significant problems when testing the null hypothesis that the series are not stationary in unit root tests (Bai and Ng, 2010, p. 1088).For this reason, before testing the stability of the series, it is necessary to test for the presence of horizontal section dependency in the variables.Horizontal section dependency in variables:

CD_{LM1} (Breusch-Pagan 1980), CD_{LM2} (Pesaran 2004) and CD_{LM-Adj} (Pesaran-Ullah-Yamagato 2008) and the results are placed in Table 5.

Table 5. Results of Horizontal Cross Section Addiction Tests

Variables	CD_{LM1}		CD_{LM2}		CD_{LM-Adj}	
	Stable	**Stable and Trendy**	**Stable**	**Stable and Trendy**	**Stable**	**Stable and Trendy**
R_D	7578,14[a] (0,000)	7793,17[a] (0,000)	121,407[a] (0,000)	125,582[a] (0,000)	52,474[a] (0,000)	19,880[a] (0,000)
PROF_SL	2174,29[a] (0,000)	2280,22[a] (0,000)	16,473[a] (0,000)	18,530[a] (0,000)	15,620[a] (0,000)	15,730[a] (0,000)
GRW_SL	1799,12[a] (0,000)	1861,63[a] (0,000)	9,187[a] (0,000)	10,401[a] (0,000)	29,963[a] (0,000)	29,185[a] (0,000)
LOG_SL	12939,66[a] (0,000)	13214,35[a] (0,000)	225,519[a] (0,000)	230,853[a] (0,000)	150,709[a] (0,000)	63,242[a] (0,000)
DBT_ASS	8186,98[a] (0,000)	8748,63[a] (0,000)	133,229[a] (0,000)	144,136[a] (0,000)	103,892[a] (0,000)	59,134[a] (0,000)

Note-1: The significance levels 1%, 5% and 10% are expressed as a, b and c respectively.

Note-2: The optimal number of delays is taken as 1.

The results of the horizontal section dependency tests shown in Table 5 show that the horizontal section dependency of both the stable and the stable and trendy models at the 1% significance level is found in all variables according to the CD_{LM1}, CD_{LM2} and CD_{LM-Adj} tests. Therefore, the stability of the variables will be tested with second generation unit root tests.

The results obtained for the level values of the variables using the second generation unit root tests using CADF-CIPS and PANIC (BOING) tests are shown in Table 6. According to this CADF-CIPS and PANIC (BOING) second-generation unit root tests used to test the stability of the series, all variables are assumed to be stationary, both stable and stable and trendy, at 1% significance level. For this reason, the models to be installed in this sector will be estimated with the OLS (Ordinary Least Squares).

Table 6. Results of Second Generation Unit Root Tests

Variables	CADF-CIPS		PANIC (BOING)			
	Stable	Stable and Trendy	Stable		Stable and Trendy	
			Choi	MW	Choi	MW
R_D	-4,08*	-3,990*	8,7987* (0,0000)	75,6478* (0,0000)	8,0961* (0,0000)	71,2041* (0,0000)
PROF_SL	-4,258*	-4,383*	9,4868* (0,0000)	80,0000* (0,0000)	9,0448* (0,0000)	77,2041* (0,0000)
GRW_SL	-3,630*	-3,963*	6,4662* (0,0000)	60,8957* (0,0000)	6,2032* (0,0000)	59,2324* (0,0000)
LOG_SL	-4,519*	-4,727*	8,1106* (0,0000)	71,2956* (0,0000)	6,0916* (0,0000)	58,5264* (0,0000)
DBT_ASS	-3,899*	-3,970*	7,6847* (0,0000)	68,6021* (0,0000)	6,1797* (0,0000)	59,0839* (0,0000)
CADF Critical Values	%1: -2,23 %5: -2,11 %10: -2,03	%1: -2,73 %5: -2,61 %10: -2,54	**Note:**At the 1%, 5% and 10% significance levels, the stability of the series is denoted by *, ** and ***, the maximum common factor in the PANIC test is 2.			

Note: The Schwarz information criterion is used to determine the optimal delay lengths and the maximum delay length is taken as 4. The critical values of the CADF-CIPS statistical data were derived from the critical values in Table II (b) and Table II (c) of Pesaran (2007). The CADF-CIPS statistic is the average of the CADF statistics.

The results of the F, LM and Hausman tests used to determine whether the model predicted by the OLS are stationary or random are shown in Table 7.

Table 7: Results of F, LM and Hausman Tests belonging to the models

	Model (1) - Profitability of Sales		Model (2) - Growth in Sales	
Tests	**Statistics**	**Possibility**	**Statistics**	**Possibility**
$\mathbf{F_{Unit}}$	3,2299*	0,0009	5,1387*	0,0000
$\mathbf{F_{Time}}$	2,5354*	0,0000	3,1663*	0,0000
$\mathbf{F_{Unit\text{-}Time}}$	3,2894*	0,0000	3,4160*	0,0000
$\mathbf{LM_{Unit}}$	2,1075**	0,0175	-0,6581	0,7447
$\mathbf{LM_{Time}}$	6,3614*	0,0000	5,2580*	0,0000
$\mathbf{LM_{Unit\text{-}Time}}$	5,9885*	0,0000	3,2526*	0,0005
Hausman	24,3974*	0,0000	40,6631*	0,0000

Note: The significance levels 1%, 5% and 10% are expressed in *, **, and ***, respectively.

In model (1), fixed unit and time effects at 1% significance level and random time effects at 5% significance level, and random unit effects at 5% significance level were reached. According to the Hausman test, which is used to test the significance of random effects, random effects are not significant.Therefore, Model (1) will be estimated by a bidirectional fixed effect regression model. Likewise, in Model (2), constant unit and time effects and random time effects were found to be significant at 1% significance level, but random unit effects were not significant. The

Hausman test also shows that a fixed effect model should be used in the same way. For this reason, the bidirectional constant in model (2) will be estimated as effective.

Normal panel regression estimates are based on the assumption that there is no autocorrelation and variable variance problem.But these assumptions need to be tested for deviations. Greene (2012) LMh test was used to determine whether the variance in the model was (1) or not and the presence of autocorrelation was investigated using LMp and Baltagi-Lee (1995) LMp and Born-Breitung (2011) LMp tests.

Table 8: Modified Variance and Autocorrelation Test Results for the Models

	Model (1) – Profitability of Sales		**Model (2) – Growth in Sales**	
Tests	**Statistics**	**Possibility**	**Statistics**	**Possibility**
LMh	66,6401*	0,0000	454,0481*	0,0000
LMp	28,2497*	0,0000	0,4114	0,5212
LMp*	34,4975*	0,0000	1,4245	0,2326

Note: The significance levels 1%, 5% and 10% are expressed in *, **, and ***, respectively.

The H_0 hypothesis, which suggests that the variances of the units are equal according to the LMh test, was rejected and the existence of variance in the models was accepted at the 1% significance level.As a result of LMp and LMp * tests for autocorrelation, autocorrelation in Model (1) was determined at 1% significance level. In model (2), it is understood that there is no autocorrelation.

Deviations from the variance and autocorrelation assumptions cause the variance-covariance matrix of error terms to lose the unit matrix property. For this reason (1) model should be estimated under the variable variance and autocorrelation existence, and Model (2) should be estimated only under the variable variance existence. Therefore, Model (1) is a bidirectional fixed effect model White Period estimator and Model (2) is a bidirectional fixed effect White Cross-section resistant estimator. Corrected bidirectional stable model estimates and one-, two- and three-year delayed values are given in Table 9.

Table 9: Bidirectional Fixed Effective Regression Results for Models

	Model (1) – Profitability of Sales				Model (2) – Growth in Sales			
Variables	**Coefficient**	**Standard Error**	**t-Statistics**	**Possibility**	**Coefficient**	**Standard Error**	**t-Statistics**	**Possibility**
R_D	2,5885	6,6924	0,3867	0,6992	1,9655	6,5073	0,3020	0,7628
LOG_SL	0,0529	0,0849	0,6234	0,5334	0,6547*	0,2024	3,2334	0,0014
DBT_ASS	-0,4170**	0,1697	-2,4568	0,0146	-0,1248	0,2341	-0,5331	0,5944
C	-0,7333	1,5743	-0,4658	0,6417	-11,730*	3,6683	-3,1977	0,0015
	R^2= 0,4429 F= 5,1948* F(Possibility)= 0,0000				R^2= 0,3410 F= 3,3818* F(Possibility)= 0,0000			
One Year Delayed Results								
R_D(-1)	-0,9861	2,7890	-0,3535	0,7240	5,1888	4,1968	1,2363	0,2174
LOG_SL	0,0415	0,1182	0,3515	0,7254	0,7556*	0,1729	4,3685	0,0000
DBT_ASS	-0,486***	0,2844	-1,7092	0,0886	-0,2844	0,3297	-0,8627	0,3891
C	-0,4871	2,1187	-0,2299	0,8183	-13,524*	3,1447	-4,3007	0,0000
	R^2= 0,4084 F= 4,3456* F(Possibility)= 0,0000				R^2= 0,3447 F= 3,3107* F(Possibility)= 0,0000			
Two Years Delayed Results								
R_D(-2)	0,6182	2,1352	0,2895	0,7725	6,1026**	2,4655	2,4751	0,0141
LOG_SL	0,1759*	0,0619	2,8391	0,0049	0,7245*	0,1582	4,5776	0,0000
DBT_ASS	-0,640***	0,3580	-1,7879	0,0751	-0,665***	0,4010	-1,6601	0,0983
C	-2,8681**	1,1803	-2,4299	0,0159	-12,848*	2,7456	-4,6794	0,0000
	R^2= 0,4290 F= 4,5092* F(Possibility)= 0,0000				R^2= 0,5319 F= 6,8179* F(Possibility)= 0,0000			
Three Years Delayed Results								
R_D(-3)	0,6863	1,5632	0,4390	0,6611	3,9008***	2,0352	1,9166	0,0568
LOG_SL	0,1711*	0,0656	2,6075	0,0099	0,5746*	0,1049	5,4749	0,0000
DBT_ASS	-0,1314	0,2037	-0,6454	0,5194	-0,2642	0,2715	-0,9734	0,3316
C	-2,9745**	1,2070	-2,4643	0,0146	-10,308*	1,8724	-5,5053	0,0000
	R^2= 0,4456 F= 4,5305* F(Possibility)= 0,0000				R^2= 0,5793 F= 7,7638* F(Possibility)= 0,0000			

Note: The significance levels 1%, 5% and 10% are expressed in *, **, and ***, respectively.

In Model (1), the effects of R & D investments on sales profits of companies in the stone and soil-based industry were found to be negative after one year, positive in the same year and other years, but the results were not significant. It is understood from the F statistic that models belonging to both the same year and past years are significant at 1% significance level. The R2 statistics indicate that the models have a power rating of 40-45%.

In Model (2), it is determined that R & D investments are positively related to Growth in Sales. However, the same year and year after effects were not significant.A 1% increase in R & D expenditure after two years was found to result in an increase of 6.10% at 5% significance level and 3.90% at 10% significance level after 3 years,Models' power of explanation was found to be between 30-35% for the first two years and 50-60% for the next two years, and the models were found to be significant at the 1% significance level.

Finally, the units belonging to the firms are taken from the impact models and presented in Table 10.

Table 10: Unit Effects of the Firms Taken from the Models

Model (1) – Profitability of Sales			**Model (2) – Growth in Sales**		
Row	**Firms**	**Coefficient**	**Row**	**Firms**	**Coefficient**
1	Anadolu Cam	-0,0490	**1**	Anadolu Cam	-0,9454
2	Aslan Çimento	0,0278	**2**	Aslan Çimento	0,3830
3	Bolu Çimento	0,0565	**3**	Bolu Çimento	0,2736
4	Bursa Çimento	-0,0638	**4**	Bursa Çimento	-0,3630
5	Denizli Cam	0,0624	**5**	Denizli Cam	1,3647
6	Ege Seramik	-0,0012	**6**	Ege Seramik	0,2147
7	Kütahya Porselen	-0,0604	**7**	Kütahya Porselen	0,1566
8	Nuh Çimento	-0,0202	**8**	Nuh Çimento	-0,8294
9	Trakya Cam	-0,0606	**9**	Trakya Cam	-1,1358
10	Uşak Seramik	0,1085	**10**	Uşak Seramik	0,8811

The effect of R & D investments on sales profitability seems to be negative in six firms and positive in four firms. Similarly, growth in sales of R & D investments are positive in six firms and negative in four firms. This generally implies that the results are not significant. In both models, Aslan Çimento, Bolu Çimento, Denizli Cam and Uşak Seramik firms are positively affected by R & D investments and Anadolu Cam, Bursa Çimento, Nuh Çimento and Trakya Cam firms are negatively affected. Ege Seramik and Kütahya Porselen firms were negative in profitability and positively affected in growth.

5. CONCLUSION

In order to measure the effect of R & D investments on firm performance, there are many studies carried out domestically and abroad. The vast majority of these studies have reached the conclusion that R & D investments positively affect the performance of the firm. Works of Bae and Kim (2003), Del Montea and Papagni (2003), Öztürk (2008), Ehie and Olibe (2010), Kotan (2011), Demirel and Mazzucato (2012), García-Manjón andRomero-Merino (2012), Başgöze and Sayın (2013) as well as Gharbi, Sahut and Teulon (2014) can serve as examples of the positive effect of the works.It is expected that R & D investments will have a positive effect on firm performance.The huge R & D investments made by the leading countries and companies in the world and the positive effects of R & D investments are due to their efforts to increase these

investments day by day. However, due to the level of development of the economies in which they operate, and for other reasons, not all firms are able to use R & D investments efficiently. This causes negative results in some studies.Czarnitzki and Kraft (2006), Arslantürk (2010), Wang (2011), Pantagakis, Terzakis and Arvanitis (2012) and Kiracı and Arsoy (2014) are examples of these works. In this study, the effect of R & D investments made by companies on innovation performance of firms was investigated by panel data analysis using data belonging to firms operating in BIST Stone and Soil Based sector. In the period of 2007Q1-2015Q2, 10 companies that made continuous R & D investment have been analyzed.According to the panel regression results, it has been determined that both the same year and the lagged effect of R & D investments on profitability of sales are not meaningful. Regarding the growth in sales, it was found to be positive in two and three years, and not significant in the same year and one year later.It is not possible to mention the positive effect of R & D investments on firm performance when an evaluation is made considering the same year and the lagged effects of the two models used in this study. Because sometimes positive and sometimes negative effects were found, the results were generally not significant. However, as a result of extensive literature review, it is seen that a large part of the studies find a positive relationship between R & D investments and firm performance. In practice, it is noteworthy that the countries that have increased their R & D investments are enriched and the firms that increase their R & D investments have increased their market shares and profitability. For this reason, countries are trying to encourage the private sector to invest in R & D with various incentive programs. Thanks to these incentives, R & D investments made by the private sector as well as the public sector also increased very rapidly. Investments made in the developed countries are used effectively because of the importance of R & D investments. However, developing countries such as Turkey sometimes do not take the necessary care and attention to use R & D effectively because sometimes they take incentives and sometimes view R & D investments as an unnecessary expenditure.

There may be various reasons why R & D investments do not have positive effects of firms in Turkey. One of these can be seen as the fact that the benefits of R & D investments are often not immediately seen. Generally, after a certain period of time, R & D gains positive influence on firm performance in terms of technology and innovation. Without technology and innovation, it is not possible to see the positive impact of R & D investments. Looking at the R & D investments of firms in Turkey, it is seen that many firms have not started to make a regular R & D investment yet, and a great majority of them have started or increased in recent years. Therefore, it is possible to mention that the expected yield from R & D investments has not yet emerged in the majority of firms.

Another reason for the adverse effect of R & D investments on firm performance may be that the investments made are not in sufficient levels.Morbey (1988) and Wang (2011) on this issue point out that R & D investments must pass a certain threshold in order to affect sales. When investments in Turkey are proportionate to sales, it is noteworthy that R & D investments are still at very low levels.

Another reason why R & D investments can not positively influence firm performance is that R & D investments are not most efficiently used. This is because, when R & D is used efficiently, it becomes an investment that increases performance, and when it is not used efficiently, it is an extra cost item that reduces performance. The unit effects of the firm from the models also prove it. When we examine the unit effects of the firm used in the study, it is seen that the four firms are positively affected in both models and the four firms are negatively

affected in both models. Therefore, the impact of R & D investments on the financial performance of the company is understood as positive for firms that use them efficiently and negative for those who can not use them efficiently.

It is observed that there has been a significant increase in R & D investments in Turkey due to the recent incentives. The most important share in this rise belongs to the private sector. It is also important to be productive in order to be able to achieve the real purpose of these investments as well as catch up with this trend. Therefore, it is necessary for the companies to be given awareness of increasing R & D investments as well as effective utilization awareness.

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