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RESEARCH ARTICLE

THE LEVEL OF INVESTMENT IN RESEARCH AND DEVELOPMENT BY FIRMS WITH FOREIGN TRADING CAPITAL AND ITS IMPACT ON STOCK RETURNS: APPLICATION OF THE BIST SUSTAINABILITY INDEX

Ahmet KARACA
Pamukkale University, Denizli Turkey
ORCID ID: 0000-0001-8556-7337

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ABSTRACT

This study aims to investigate the effect of the R&D intensity of companies included in the sustainability index on stock returns. To this end, R&D intensities were calculated using companies' annual financial statement data for 2010-2020, and an attempt was made to determine the relationship with stock returns using panel data analysis.

This study also examined the R&D intensities of the foreign trade capital companies included in the sustainability index according to their values before and after the index and found that R&D investment increased after the index.

Keywords: R&D Expenditures, Stock Return Rate, Panel Data Analysis

JEL Classification: L20, L25, L29, O30, G17

1. INTRODUCTION

Research and development is a function that includes the activities of pre-planning the future production activities and conditions of the companies. The research and development function should perform important duties and responsibilities in work required to achieve the objectives sought by the company. The 21st century symbolizes a time when technological developments and scientific discoveries are very intense. In order for technological developments and scientific discoveries to benefit humanity, human needs must be transferred to the field of application in an economical way and in a way that can meet more than one need. Inventions can become innovations to the extent that this is achieved (Şimşek & Çelik; 2013: 327).

In the current century, the importance of R&D activities in developed economies is better understood by businesses. Because the most characteristic feature of our time is the rapid change in economic, political, social, technological, and cultural areas. Companies' ability to adapt to this change depends only on the continuity of R&D activities and new inventions, innovations, and developments. The continued existence of companies under difficult competitive conditions depends on R&D investments that will accelerate their continued development and growth.

R&D expenditures include all research expenditures made to produce a new product, service, or more sophisticated technology, as well as expenditures encompassing all stages of converting R&D results into projects of new products, services, assets, production methods, and systems (Öğredik, 2005: 1). R&D spending is not at the desired level, especially in developing countries, because the payback period of this spending for companies is very long.

Following the introductory section, the study contains a literature review on the topic. The "Panel Data Analysis Method" is presented as a research method, and model results and empirical findings are presented after the study's data set and research findings. The study ends with the Conclusions and Suggestions section.

2. IMPORTANCE OF R&D INVESTMENTS

R&D activities eliminate uncertainties in scientific and technological fields, discover new technical information that enables the development of science and technology, and develop new products, substances, and materials, tools, equipment, processes, and systems using new methods. In addition, R&D activities, design, and drawing studies, production of new techniques and prototypes, software activities based on new and original designs, research or development of new production methods, processes and procedures, research of new technologies that reduce the cost of a product, increase its quality, standard or performance (Fidancı, 2017: 72).

It can be said that technological developments within the framework of R&D investments have a positive impact on economic growth, and R&D expenditures contribute to economic activities. These contributions can be categorized as a competitive advantage, attracting foreign capital, enhancing productivity, and

eliminating technological dependence. Countries producing technologically advanced products had a competitive advantage in studies where the relationship between economic development and R&D expenditures was shown to be more successful in terms of production level and quality.

Moreover, it has been observed that R&D expenditures not only play a compensatory role for a new invention but also provide a source for other innovative studies in the field of research (Ülger & Durgun, 2017: 106). R&D activities are also one of the variables often used to describe the technological performance of a country or a company (Güzel, 2009: 31). R&D expenditures are important at every stage of technological activities, e.g., in developing new products and production methods, the effective use of existing or imported technology, and the adaptation or modification of processes (Sylwester, 2001: 72).

It can be seen that R&D activities play an important role in meeting consumer demands and needs, developing and applying new technologies, and improving companies' product quality. For this reason, R&D is a meaningful and indispensable activity for companies. Various departments of companies in the development process, such as production, finance, accounting, and marketing, provide benefits to the company by interacting with the R&D department (Dağlı & Erguen, 2017: 70).

Our country's emphasis on R&D and innovation has grown significantly in recent years. Competitiveness, branding, and Industry 4.0 are critical development building blocks for Turkey. Our age is the information age, and the way to greater competitiveness and progress is to master information. As part of this awareness, tax and other incentive mechanisms for research and development are being developed in our country.

Gross domestic expenditure on R&D as a percentage of gross domestic product (GDP) was 1.03% in 2018, while it increased to 1.06% in 2019.

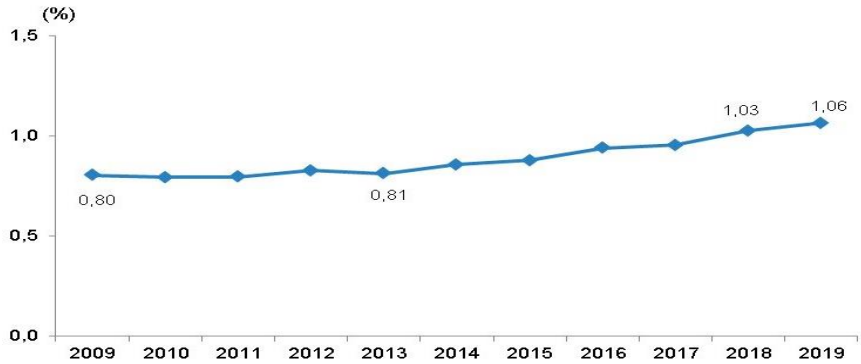

Figure 1. R&D Expenditure as a Share of GDP in Turkey, 2009-2019
Source: TURKSTAT (03/11/2021) https://data.tuik.gov.tr/Bulten/Index?p=Research-and-Development-Activities-Survey-2020-33676

According to the results of TURKSTAT's "Research and Development Activities for 2020," the share of R&D expenditures in gross domestic expenditure (GDP) increased from 1.06 percent in 2019 to 1.09 percent in 2020.

3. LITERATURE REVIEW

Ben-Zion (1978) studied the impact of R&D expenditures on market performance. As a result of the study, a positive and statistically significant relationship was found between R&D expenditures and the market value of companies.

Authors such as Hirschey (1982), Hirschey and Weygandt (1985), Cockburn and Griliches (1988), Hall (1993), Chauvin and Hirschey (1993) have studied the relationship between business R&D expenditures and market performance. As a result of their studies, they found that R&D spending has a positive effect on both market value and Tobin's q ratio (market value/book value ratio).

Lev and Zarowin (1998) examined the relationship between R&D spending, firm value, and risk. As a result of the analysis, a positive relationship was found between R&D spending and company value, while a negative relationship was found between risky and R&D spending. Similarly, Al-Horani et al. (2003) studied the impact of R&D expenditures on firms' market performance. According to the analysis results, there is a positive and statistically significant relationship between R&D spending and market performance.

Hanel and Pierre (2002) investigated the impact of R&D policies of companies operating in Canada on profitability. According to the results of the empirical analysis, R&D expenditures were found to have a positive effect on profitability.

Güneş and Akın (2019) used the VAR model to conduct a study for Turkey from 1989 to 2016 to discover the main determinants of high-tech product exports. When the impulse response functions were examined, it was found that only the value-added variable in the industrial sector was statistically significant.

Coad and Rao's (2008) study examined the number of patents, innovations, R&D expenditures, and sales of U.S. advanced technology firms (1963-1998). For a small number of fast-growing superstar companies, innovation matters. R&D investments and patents made for many companies result in poor performance and have a negative impact on increasing sales. This is because technological innovation is inherently uncertain, and it is not always possible to convert R&D spending into R&D investment.

4. RESEARCH METHOD

Since the 1980s, there has been a growing interest in panel data analysis, which reflects the need to control individual-specific effects that can be related to other variables within the scope of the model but cannot be observed when evaluating an economic relationship (Hausman and Taylor, 1981: 1377). In panel data analysis, regression is performed using observations from more than one cross-sectional object during the analysis period, and therefore cross-sectional variation in time series is allowed. In a typical panel data analysis, the time series data of N individuals for the dependent variable over a T period are used for the analysis. In general, the equation for panel data is expressed by the following equation (1) (Kaya & Yılmaz, 2006: 69):

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

The most basic method of panel data analysis is to hold the coefficients in the model constant for all cross-sectional individuals, which is represented by an equation like the following:

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

Equation (2) predicts that all independent variables affect all cross-sectional individuals equally. This equation, however, is insufficient if it is assumed that independent variables influence different individuals differently. The most important question that arises at this point is how to define the starting point (***β1***). The starting point may be held constant for all individuals, or different starting points may be allowed for different cross-sectional individuals without such a restriction. There are two approaches to defining the starting point in this direction: the "fixed effects model" and the "random-effects model." In panel data analysis, models in which coefficients are assumed to change by unit or unit and time are called "fixed effects models." The general formulation of the model is based on the fact that the differences between units can be captured by the differences occurring in the constant term. Therefore, only the constant term changes in these models and the constant term does not differ over time but on a cross-sectional basis. In other words, while the constant variable maintains the time dimension, individual behaviours differ (Pazarlolu & Gürler, 2007: 37-38).

Model : $RETURN = \beta 0 + \beta 1\ RD + \varepsilon i$ (3)

5. STUDY RESULTS

The study evaluated the R&D capital expenditures of the Foreign Trade Capital Companies included in the Sustainability index before and after the index, and the relationship between R&D capital expenditures and stock returns was examined using the Panel Data Analysis method.

Table 1. R&D Intensity of Foreign Trade Capital Companies included in the sustainability index

YEAR/ COMPANIES	ARCLK	EREGL	FROTO	ŞİŞECAM	TOASO	TUPRS	TTRAK	VESTL
2010	0.00872	0.00011	0.01108	0.00776	0.00178	0.00035	0.00182	0.01331
2011	0.00769	0.00016	0.01023	0.007	0.00096	0.00016	0.00178	0.01266
2012	0.00696	0.00016	0.01147	0.00531	0.00222	0.00029	0.00342	0.00992
2013	0.0075	0.00039	0.01279	0.00662	0.00181	0.00045	0.00424	0.01547
2014	0.00816	0.00061	0.01439	0.00625	0.00204	0.00041	0.00438	0.01328
2015	0.00884	0.00078	0.01587	0.00853	0.001	0.00062	0.00392	0.01306
2016	0.00942	0.00095	0.02099	0.00863	0.0016	0.00073	0.00393	0.01562
2017	0.00817	0.0007	0.01252	0.00505	0.00318	0.0003	0.00355	0.01572
2018	0.00761	0.00065	0.01107	0.00484	0.00357	0.00024	0.00467	0.01577
2019	0.00804	0.00091	0.0107	0.00411	0.00363	0.00027	0.00815	0.01525
2020	0.00779	0.00092	0.00929	0.00275	0.00323	0.00055	0.00632	0.01555

When the enterprises' R&D investment intensities are evaluated in general, and the change before and after the index is studied over the values in Table 1, the following results are revealed.

The general average R&D intensity of **ARCLK** company was 0.008, the highest value was 0.00942 in 2016, and the lowest value was 0.006959 in 2012. While the R&D intensity was 0.007805 before the company was included in the sustainability index, it increased to 0.00831 after the index.

The general average R&D intensity of **EREGL** company was 0.000577, the highest value was 0.000953 in 2016, and the lowest value was 0.000113 in 2010. While the R&D intensity before the company was included in the sustainability index was 0.000286, the R&D intensity after the index increased to 0.000818.

The general average R&D intensity of **FROTO** company was 0.01276, the highest value was 0.02098 in 2016, and the lowest value was 0.00929 in 2012. While the R&D intensity was 0.01199 before the company was included in the sustainability index, it increased to 0.0134 after the index.

The general average R&D intensity of **ŞİŞECAM** company was 0.006, the highest value was 0.0086 in 2016, and the lowest value was 0.00274 in 2020. While the R&D intensity was 0.00658 before the company was included in the sustainability index, it dropped to 0.00565 after the index.

The general average R&D intensity of **TOASO** company was 0.0023, the highest value was 0.0036 in 2019, and the lowest value was 0.00096 in 2011. While the R&D intensity was 0.00176 before the company was included in the sustainability index, it increased to 0.002701 after the index.

The general average R&D intensity of **TUPRS** companies was 0.0004; the highest value was 0.00073 in 2016, the lowest value was 0.000157 in 2011. While the R&D intensity before the company was included in the sustainability index was 0.00033, the R&D intensity after the index increased to 0.00045.

The general average R&D intensity of **TTRAK** companies was 0.0042, the highest value was 0.0081 in 2019, and the lowest value was 0.00177 in 2011. While the R&D intensity was 0.0031 before the company was included in the sustainability index, it increased to 0.0051 after the index.

The general average R&D intensity of **VESTL** companies was 0.014, the highest value was 0.0157 in 2018, and the lowest value was 0.0099 in 2012. While the R&D intensity was 0.013 before the company was included in the sustainability index, it increased to 0.015 after the index.

As a result of being included in the sustainability index, businesses raised their R&D investments.

Table 2. Descriptive Statistics

Variables	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Number of Observations**
RETURN	1.2979	0.5739	0.4434	4.6	88
RD	0.0060	0.0052	0.0001	0.0209	88

Table 3. Horizontal Section Dependency Test

METHOD	CD (Pesaran 2004)	
Variables	Statistics	Probability (p)
RETURN	7.9870*	**0.0000**
R&D	3.8750*	**0.0000**
Pesaran CD Test Statistics	8.050*	**0.0000**
Friedman R	43.545*	**0.0000**

Note*, ** and *** indicate 1%, 5% and 10% significance levels, respectively.
H0: There is no dependence between the sections
H1: There is a dependency between the sections.

As a result of the analysis, the null hypothesis is rejected because the probability values of the variables RETURN (Stock Return) and R&D (Research and Development) are less than 0.05, which is considered a critical value. In other words, there is a cross-sectional dependence problem with these two variables.

Table 4. Pesaran CADF (CIPS) Unit Root Test

Variables	**Model**	**Pesaran CADF (CIPS) Statistics**	**Lag Length**	**Critical Table Value**			**Probability (p)**
				10%	**5%**	**1%**	
RETURN	**With Constant**	**-2.531**	**0**	**-2.220**	**-2.370**	**-2.660**	**0.0170****
	with Constant-trend	**-1.835**	**0**	**-2.161**	**-2.920**	**-3.210**	**0.5890**
RD	**With Constant**	**-1.381**	**0**	**-2.220**	**-2.370**	**-2.660**	**0.8040**
	with Constant-trend	**-3.296**	**1**	**-2.760**	**-2.920**	**-3.210**	**0.0040***

Table 4. On examination, it is evident from the probability values that the series contain a unit root. (p>0.05)

Because of the series' cross-sectional dependence, the CADF (Cross-sectional Augmented Dickey-Fuller) Unit Root Test, developed by Pesaran in 2007, one of the second generation panel unit root tests, was used to analyze the series' stationarity. From the probability values, it is evident that the rows become stationary at the 2nd difference.

Table 5. Pesaran CADF(CIPS) Unit Root Test (1st DIFFERENCE)

Variables	Model	Pesaran CADF (CIPS) Statistics	Lag Length	Critical Table Value			Probability (p)
				10%	5%	1%	
D.RETURN	With Constant	-3.328	0	-2.280	-2.470	-2.850	0.0000*
	with Constant-trend	-3.130	1	-2.870	-3.100	-3.510	0.0540***
D.RD	With Constant	-2.760	0	-2.280	-2.470	-2.850	0.0120**
	with Constant-trend	-1.580	1	-2.870	-3.100	-3.510	0.0380**

Note: *%1, **5%, ***10% denotes significance level.

Table 6. Pesaran CADF(CIPS) Unit Root Test (2nd DIFFERENCE)

Variables	Model	Pesaran CADF (CIPS) Statistics	Lag Length	Critical Table Value			Probability (p)
				10%	5%	1%	
D2.RETURN	With Constant	-4.141	0	-2.280	-2.470	-2.850	0.0000*
	with Constant-trend	-3.787	0	-2.870	-3.100	-3.510	0.0030*
D2.RD	With Constant	3.898	0	-2.280	-2.470	-2.850	0.0000*
	with Constant-trend	-3.731	0	-2.870	-3.100	-3.510	0.0044*

Note: *%1, **5%, ***10% denotes significance level.

Table 7. Results of Analysis on the Relationship Between the Level of Investment in Research and Development and Stock Returns

Variables	Coefficient	Standard Error	t-Statistic	P Value
constant	0.0623	0.1360	0.4600	0.6590
R&D	0.0601	0.2064	0.2900	0.7780
R-Squared	0.0007			
F-Statistic	0.08			
Probability (F-Statistic)	0.7781			
Number of Observations	72			
Number of Groups	8			
Method	Pooled OLS			

Dependent Variable: RETURN, Method: Panel Pooled OLS (Random-effects GLS regression) Sample Period: 2010-2020, Number of Horizontal Sections: 8, Total number of observations: 88 Note: *%1, **5%, ***10% indicates significance level.

When the model is examined, we can say that the F statistic probability value of 0.08 is significant. The R-Squared value of the model was found to be 0.07%. Thus, it can be said that the independent variables included in the model can explain 0.07% of the changes in the dependent variable. If we look at the significance levels of the variables, we can see that the coefficients of the constants and the R&D variables are not statistically significant. In other words, no statistically significant relationship was found between R&D investment expenditures of Foreign Trade Capital Companies and their stock returns.

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Ahmet KARACA (b. January 01, 1967) received his BSc in Public Finance (1993), MSc in Business-Administration (2010), PhD in Business and Administration (2016) from Istanbul Halic University. Now he is assistant professor doctor of international trade in department of international trade and logistic, Faculty of Applied Sciences, "Pamukkale University, Denizli/TURKEY. His current research interests international trade and international marketing.