New Horizons in Social Sciences and Humanities

Ömer Kürşad Tüfekci (ed.)
New Horizons in
Social Sciences and Humanities
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New Horizons in Social Sciences and Humanities

Ömer Kürşad Tüfekçi (ed.)
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SENIOR MARKETING EXECUTIVES’ STRATEGIES TO IMPLEMENT MULTICULTURAL MARKETING CAMPAIGNS

Derine McCORORY
IS THERE A LINEAR CORRELATION BETWEEN R&D CENTERS IN TURKEY AND THEIR VALUES IN STOCK EXCHANGE?

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IS THERE A LINEAR CORRELATION BETWEEN R&D CENTERS IN TURKEY AND THEIR VALUES IN STOCK EXCHANGE?

Banu OZKESER
**Introduction**

Particularly, after the influence of industry 4.0 in the world, innovation becomes a part of our daily life. Mostly, this era has jumped to another stage, called digital-earth where the people get the ability to reach everything with the top of a finger. Thus, it can be said that industry 4.0, in other words, e-life or e-world makes the importance of innovation go up and up. In this point; the procedures, laws (by the government) provide tax incentives and more for innovation projects. Since, the development level of a country depends on the expenditures of research and development (R&D) activities and undoubtedly, the way of R&D activities passes through innovation gaps. Briefly; innovation, industry 4.0 and R&D can be considered as various and integrated drivers, leading the technology.

In Turkey, incentives ensured with Law on The Support of Research and Development Activities, No:5746, released in the year 2008. With this law, additional benefits are provided by the government so as to develop the national companies in R&D way. Also, Turkey’s R&D reform package increases current R&D incentives to complete these gaps.

With this 5746 law, R&D Centers, having minimum of 30 full-time-equivalent R&D personnel are employed, have applicable incentives in the following after certified:

- %100 deduction of R&D expenditure from corporate tax base. (If the number of full-time-equivalent R&D personnel exceeds 500, in addition to the 100% deduction, half of the R&D expenditure increase incurred in the operational year compared to the previous year will also be deducted.)
- Income withholding tax exemption for employees (80% or 90% of the employee income tax)
- %50 of social security premium exemption for employers during 5 years period.
- Stamp duty exemption for applicable documents.
- Techno-initiative capital for new scientists up to TRY 100K
After this 5746 law is declared, the applications from companies for having an R&D center has increased due to available incentives. When it’s thought in the big picture of the company, this has a significant impact to all departments. Requirements of this law, 5746, bring some necessities about producing new products, technical trainings for R&D employees, applications and registrations for intellectual properties, qualified staff and R&D projects etc. Therefore; continuous improvement can be thought as one of the dynamics round the company. In another aspect, R&D center gathers more than one dynamic in its structure. Owing to this, various factors can be evaluated by analyzing these centers.

With the observation of R&D centers’ effecting the other parametres, financial and non-financial indicators may be clarified by this way. For example; public relations (PR) management can be taken as non-financial; on the other hand stock market/exchange values may be financial ones. Anything effects the financial indicators can change the speed and direction of money flow. Hence, the R&D centers, beginning from the first step, may have a deep impact in the variability of financial data.

The stock exchange values are the major factors having considerable and permanent influence on both financial and non-financial road-map of companies. Their values’ increasing allows competitors’ being dynamic, deciding on growth, determining the future strategies and the rapidity of cash money flow.

In briefly, companies’ establishing R&D centers, with the law of 5746, can also be taken into account as they invest for their future and strategy map.

**Literature Review**

There has been many sources written about R&D centers in Turkey. However, most of them are written in Turkish or only give information about data management in R&D centers. Every year, Ministry of Science, Industry and Technology requires data about the completed term so as to evaluate the performance of the centers. Number of scientific papers, number of registered intellectual property applications, employees’ having or studying in MSc or PhD degrees, total hours of technical trainings, completed-on going and planned R&D projects are asked in various questionnaires. This information mostly used in statistics, graphics or tables, but there has not been a scientific paper for searching the relationship between R&D centers in Turkey and other indicators till now. It’s no doubt that R&D center management brings a different aspect and performance to the foundation.
This paper is the first one in the world literature of testing the hypothesis of whether there is a linear correlation between stock exchange values, an important financial indicator and getting certification of R&D centers in Turkey.

In literature review, there are many sources explaining the influence of elements in R&D activities. For example, Lichtenberg (1993), studied the interaction between the economic growth and R&D expenditures by means of panel data method between the years 1964 and 1989. He found a negative relation between the expenditures of public field and economic growth, whereas no relations can be found between private field and economic growth.

Goel and Ram (1994) studied the R&D expenditures of developed countries between the years 1960 and 1985. In the result of this study, they found out that there was a positive relationship.

Gittleman and Wolff (1995) divided into elements of R&D expenditures and examined the effects per employee. Sylwester (2001) found the similar positive interaction between development level and R&D in long term.

As launched in the global innovation index report 2017, research articles and level of research & development expenditures may be thought as measures of innovation. It is also declared that increase of the rate of R&D effects the knowledge diffusion and creation (Dutta, Lanvin and Wunsch-Vincent, 2017)

R&D discovers the potential of radical innovations, in other words newness, too. Thus, new products/services are presented into different market aggressively in different techniques. Because, in literature the meaning of “newness” can be in various kinds as shown in table 1.
Table 1. Newness factors from literature review

<table>
<thead>
<tr>
<th>New to</th>
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<td>New to the industry</td>
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<td>New marketing/sales/distributi on skills</td>
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<td>New learning/experience/knowledge</td>
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<td>New quality/benefits</td>
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</tbody>
</table>
The references of table 1 are listed below.
1. Cooper (1979)
2. Lawton & Parasuraman (1980)
5. Yoon & Lilien (1985)
17. Song & Montoya-Weiss (1998)

Material and Method

Definition of the Problem

In Turkey, the law of 5746, regarding to R&D centers, has been available since 2008. Especially, investment of the Turkish government to the company, having R&D center, has the strongest effect in all the major factors. Prestige in competition and making effort for technology improvement are the other inputs of this law. However, there are many unlimited benefits.

The papers or reports, released till now, are in the content of data management and written in Turkish. For instance, the number of the employees are shown in pie-charts or the project types (completed-on going-planned) are explained in graphics. Hence, the statistical values and data give only detailed information in Turkish. On the other hand, the advantages of having an R&D center in a company brings the invisible valuable part of an iceberg. Like a bull-whip effect from the raw material to the last-user; R&D center may be thought as the same. R&D both lets the value management of a foundation increase by producing new products and/or components and allows to meet the demands of new markets. This also means money flow in finance. Meanwhile, the positive acceleration in finance increases the values in stock exchange. In the literature, there has not been seen any documents about whether there is a linear correlation between R&D Centers in Turkey and their values in Stock Exchange/Market or not.
Finally, the reasons as follows make this paper be both original and different from the others;

- It’s the first example in this specific field in the the world-literature written in English
- all data, used in case-study, is taken from real dynamic life
- it is an important presentation of how Turkish government supports its domestic capital and R&D potential of country
- it is a first study that shows the relation between R&D and Stock Exchange/Market Values
- it is an opportunity for gathering the data into significant statistical results and showing the next way in the future
- it is a decision-point of the stock-exchange values.

Material

In the first phase of this study, the updated R&D center list is taken from the link of http://biltek.sanayi.gov.tr. After careful consideration, second list is formed (from approximately 800 R&D centers), consisting of the cross names of the companies both having R&D centers and existing in stock exchange/market. Since, every company has different corporate profiles. Some can prefer in existing stock exchange, whereas the rest may have different strategies. Additionally, it’s a well-known fact that writing the names of the companies is prohibited without permission due to confidentiality. Thus, the names are symbolized as RD-1, RD-2, RD-3 etc. in the tables. In the last step of this first phase is completed with the determination of ten existing centers, chosen in random so as to test the hypothesis.

Hypothesis: “There is a linear correlation between R&D Centers in Turkey and their values in Stock Exchange.”

While choosing this random 10 company names, the way is shown in the figure 1.
IS THERE A LINEAR CORRELATION BETWEEN R&D CENTERS IN TURKEY AND THEIR VALUES IN STOCK EXCHANGE?

Banu OZKESER

Figure 1. The way of determination of the material

List of all R&D centers (app. 800 centers) (List-A)

List of the companies having both R&D centers and stock exchange value (app. 200 companies) (List-B)

List of the companies, random chosen from the list B (10 companies) (List-C)

In the second phase, the table is formed depending on these 10 centers and the establishment date of them. It’s shown in the table 2 and owing to confidential information, symbols are used instead of real names and values.

Table 2. The R&D centers of which data is used (List-C)

<table>
<thead>
<tr>
<th>Number</th>
<th>R&amp;D center name</th>
<th>Establishment date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RD-1</td>
<td>Date-1</td>
</tr>
<tr>
<td>2</td>
<td>RD-2</td>
<td>Date-2</td>
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<td>3</td>
<td>RD-3</td>
<td>Date-3</td>
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<td>RD-9</td>
<td>Date-9</td>
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<tr>
<td>10</td>
<td>RD-10</td>
<td>Date-10</td>
</tr>
</tbody>
</table>

Before passing the third phase, the list of ten centers with the establishment date is completed. The pivot point is defined as these dates for testing hypothesis, as shown in figure 2.
IS THERE A LINEAR CORRELATION BETWEEN R&D CENTERS IN TURKEY AND THEIR VALUES IN STOCK EXCHANGE?

Banu OZKESER

Figure 2. The calculation way of average return in stock exchange

Average of last five years | The establishment date of R&D Center | Average of the left years till 2018
---|---|---

Each R&D center is studied about its average return % before and after establishment date. Due to the dates’ being different from each other, in this point, the average is calculated for the past five years before established. Then, the second average return % is calculated from establishment date till now (http://www.bloomberght.com/borsa)

Table 3. The table of average returns (%) of 10 R&D Centers

<table>
<thead>
<tr>
<th>Number</th>
<th>R&amp;D center name</th>
<th>Establishment date (E.D.)</th>
<th>The average return before E.D. (for 5 years) (%)</th>
<th>The average return after E.D. till 2018 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RD-1</td>
<td>Date-1</td>
<td>-7.48</td>
<td>+16.48</td>
</tr>
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<td>2</td>
<td>RD-2</td>
<td>Date-2</td>
<td>-4.45</td>
<td>+16.38</td>
</tr>
<tr>
<td>3</td>
<td>RD-3</td>
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<td>-1.87</td>
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<td>+0.78</td>
<td>+5.28</td>
</tr>
<tr>
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<td>RD-5</td>
<td>Date-5</td>
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<td>+4.95</td>
</tr>
<tr>
<td>6</td>
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<td>Date-6</td>
<td>-11.77</td>
<td>-1.81</td>
</tr>
<tr>
<td>7</td>
<td>RD-7</td>
<td>Date-7</td>
<td>-6.55</td>
<td>-2.83</td>
</tr>
<tr>
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<td>RD-8</td>
<td>Date-8</td>
<td>-0.54</td>
<td>+1.99</td>
</tr>
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<td>+8.47</td>
</tr>
<tr>
<td>10</td>
<td>RD-10</td>
<td>Date-10</td>
<td>-3.19</td>
<td>+4.59</td>
</tr>
</tbody>
</table>

Table 3 defines the previous averages and how they are effected from the foundation of R&D center.

Method

The Data Collection

The first step of this methodology has started with listing data from the official web sites regarding to R&D centers in Turkey. The list consists of name of the owner companies and establishment date of the centers. List has the all the certified ones, released in official web site called; biltek.sanayi.gov.tr

In the second step of data from financial web site (http://www.bloomberght.com/borsa) are collected for completing the table of the stock exchange values. The establishment date of R&D centers is taken into consideration as a pivot point so that the previous five years show the older average return percentage whereas average of the left
years (from the establishment date to 2018) indicates the updated percentage. This is shown in table 3.

The Data Classification

After completing table 3, the data is classified by relevant categories so as to be used more efficiently in the next time. Classification also has advantages to meet various objectives or provide a clear picture for data. In this study, data is classified into fields (like automotive, agriculture, energy etc.) This may give an alternative information and guidance for both discussion of the results and future studies.

SPSS (Statistical Package for the Social Sciences) and Correlation Analysis

In this study, SPSS software is used like a bridge for analyzing the data in effective management. Additionally, it’s a scientific proof to show whether there is a correlation or not. Since, it’s based on real data. As it’s known that correlation coefficient is a value between -1 and +1. Should this value be near to -1, this means a strong negative relationship; whereas its being near +1 means strong positive relationship. Finally, correlation analysis is one of the optimum solutions to measure the power of relation between two values and it may be a tool to guess the similarities in the future.

Material, the data in table 3, is used in this methodology. The table 4, below, is formed with the average returns of pivot point, establishment date. The graphic 1 shows that establishment of R&D center makes a big influence to the average return in stock exchange.

Pearson’s correlation coefficient formula (1), below, is the well-known one in this field;

\[
r = \frac{n \sum xy - (\sum x)(\sum y)}{\sqrt{n(\sum x^2)-(\sum x)^2} \sqrt{n(\sum y^2)-(\sum y)^2}} \tag{1}
\]

| Material, the data in table 3, is used in this methodology. The table 4, below, is formed with the average returns of pivot point, establishment date. The graphic 1 shows that establishment of R&D center makes a big influence to the average return in stock exchange.

| Table 4. The average returns before E.D. and after E.D. |
|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|                  | -7.48            | -4.45            | -6.48            | +0.78            | +3.55            | -11.77           | -6.55            | -0.54            | +0.36            | -3.19            |
|                  | +16.48           | +16.38           | -1.87            | +5.28            | +4.95            | -1.81            | -2.83            | +1.99            | +8.47            | +4.59            |

<table>
<thead>
<tr>
<th>Table 5. The average returns of 10 centers</th>
</tr>
</thead>
<tbody>
<tr>
<td>The average return before E.D. (for 5 years) (%)</td>
</tr>
<tr>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>The average return before E.D. (for 5 years) (%)</td>
</tr>
<tr>
<td>The average return after E.D. till 2018 (%)</td>
</tr>
</tbody>
</table>
This table 5 indicates that there is a strong positive relationship between the average returns in different times. Thus, the establishment of R&D effects in a better way of these values.

Secondly, from the Table 3, it’s easily noticed that the average returns of all companies increase after R&D centers’ establishment. In other words and detailed information, investments of R&D and new products in market affects the financial situation of the company to be brighter. It’s like a chain method, reflecting one by one.

**Results and Discussion**

Graphic 1 clearly shows that after the implementation of R&D center activities, there is a significant improvement in the companies. This brief graphic supports the hypothesis, “There is a linear correlation between R&D Centers in Turkey and their values in Stock Exchange”, too.

After these basic results, it’s also searched why there is a big difference between the previous values and existing values with the pivot of establishment date. Consequently, it’s found that the positive difference is based on the date. For instance; E.D. of RD-1 is earlier than the E.D. of RD-8. E.D. of RD-5 is later than the E.D. of RD-4.

This means that the more profit the company gets, the faster it’s applied for being R&D Center in the Ministry of Science, Industry and Technology.
Table 6. The differences between the average returns

<table>
<thead>
<tr>
<th>Number (column A)</th>
<th>R&amp;D center name (column B)</th>
<th>Establishment date (E.D.) (column C)</th>
<th>The average return before E.D. (for 5 years) (%) (column D)</th>
<th>The average return after E.D. till 2018 (%) (column E)</th>
<th>The difference between the column D and column E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RD-1</td>
<td>Date-1</td>
<td>-7.48</td>
<td>+16.48</td>
<td>23.96</td>
</tr>
<tr>
<td>2</td>
<td>RD-2</td>
<td>Date-2</td>
<td>-4.45</td>
<td>+16.38</td>
<td>20.83</td>
</tr>
<tr>
<td>3</td>
<td>RD-3</td>
<td>Date-3</td>
<td>-6.48</td>
<td>-1.87</td>
<td>4.61</td>
</tr>
<tr>
<td>4</td>
<td>RD-4</td>
<td>Date-4</td>
<td>+0.78</td>
<td>+5.28</td>
<td>4.5</td>
</tr>
<tr>
<td>5</td>
<td>RD-5</td>
<td>Date-5</td>
<td>+3.55</td>
<td>+4.95</td>
<td>1.4</td>
</tr>
<tr>
<td>6</td>
<td>RD-6</td>
<td>Date-6</td>
<td>-11.77</td>
<td>-1.81</td>
<td>9.96</td>
</tr>
<tr>
<td>7</td>
<td>RD-7</td>
<td>Date-7</td>
<td>-6.55</td>
<td>-2.83</td>
<td>3.72</td>
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<tr>
<td>8</td>
<td>RD-8</td>
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<td>-0.54</td>
<td>+1.99</td>
<td>2.53</td>
</tr>
<tr>
<td>9</td>
<td>RD-9</td>
<td>Date-9</td>
<td>+0.36</td>
<td>+8.47</td>
<td>8.11</td>
</tr>
<tr>
<td>10</td>
<td>RD-10</td>
<td>Date-10</td>
<td>-3.19</td>
<td>+4.59</td>
<td>7.78</td>
</tr>
</tbody>
</table>

The differences of column D and column E are shown in the last column in table 6. These results are parallel with the establishment dates. Consequently, RD-5 is the newest of all, while RD-1 is the first established in all 10 centers.

When looked at the details of R&D Centers, gradient of these 10 centers goes up in positively because of R&D activities’ effects. Graphic 2 and graphic 3 are shown as examples of this positive acceleration.

**Graphic 2. Gradient of Stock Exchange Average Return of RD-1**

![Graphic 2](image-url)
Anyway, it can be said that there is a positive difference after R&D centers.

Considering table 6, the establishment date of R&D centers (from the first to the last) are in the line, as follows; RD-1, RD-2, RD-6, RD-9, RD-10, RD-3, RD-4, RD-7, RD-8, RD-5. This is found from the difference between column D and column E. When these outputs put in order, it automatically arranges the establishment dates in order. Also, this supports the hypothesis again.

**Conclusion and Future Research**

This study gives a smart history of values in stock exchange of a company after foundation of R&D center in company profile. For future research, data classification can be added before statistical analysis. For example, the average returns of R&D centers in specific fields can be grouped. Each group can be compared in itself or the average of the groups may be taken into account. It may be repeated in the attention of specific fields. For instance; the stock exchange value of an R&D center in automotive field can be compared with the one in agriculture field. Thus, this may give the opportunity of comparison in different fields with similar key performance indicators.

Except for stock exchange/market values, any other parameters can be searched depending on research and development. Turnover rate of raw materials, inventories of R&D department or circulation of human resources may be studied whether there is dependency of R&D or not. Both long and short term affects of R&D can be considered in different aspects. In finally, investment in R&D means invest in future.
References


Dutta, S, Lanvin B. and Wunsch-Vincent S. The global innovation index 2017


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