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Investigating the Impact of Renewable Energy Investment Announcements on Stock Returns of Borsa Istanbul Energy Companies

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ABSTRACT

Aim of this study is to investigate whether renewable energy investment announcements impact the stock returns of 10 energy companies listed in Borsa Istanbul. Event study method is employed to analyze 25 renewable energy investment announcements during April 2015 and December 2023 period. Announcement date is defined as the event day and the 5 day period before and after the event day is selected as the event window. The length of the pre-event window in the timeline is chosen as 244 days. The total length of the period studied in the study is 250 days. The result of the study reveals that the renewable energy investment announcements of the energy companies listed in Borsa Istanbul seem to have no significant impact on the stock returns. Thus, Borsa Istanbul appears to be semi-strongly efficient.

Keywords: Renewable Energy, Event Study Method, Energy Companies, Stock Returns

JEL Classifications: G11, G14

1. INTRODUCTION

Economic growth and industrialization have led to an increase in the utilization of fossil fuels (Paramati et al., 2022). However, fossil fuel reserves are primarily located in specific regions worldwide. Furthermore, while demand continues to rise globally, the supply of fossil fuels is limited (Crabtree et al., 2004, p. 39). Besides, the amplified production and consumption of these fuels have numerous adverse environmental consequences, including global warming, air pollution, and heightened health risks (Paramati et al., 2022).

Due to problems summarized above, there is an expanding market for renewable energy (Ali et al., 2023, p. 25). The expansion in the utilization of renewable energy sources (RES) has various advantages upon society, including the alleviation of climate change, reduction in air pollutant emissions, increase in fuel

diversity and the reduction of energy price volatility impact on the economy (European Environment Agency, 2023; Menegaki, 2008, p. 2423). Furthermore, renewable energy is also conceived as a tool for maintaining national economic security. Since fossil energy is sensitive to embargoes, political uncertainties, trade disputes and other adverse effects (Menegaki, 2008, s. 2423). Moreover, renewable energy contributes to employment. According to 2022 global renewable energy employment in the 2023 report of the International Renewable Energy Agency (IRENA), solar photovoltaic (PV) ranks first in renewable energy employment in the world with 4 million 902 thousand jobs. Subsequently, liquid biofuels employ 2 million 490 thousand people and are followed by hydropower, wind energy, solid biomass, solar heating/cooling, biogas, heat pumps, geothermal energy, others, concentrated solar power, municipal and industrial waste energies respectively. In tidal, ocean and wave energy, which ranks last, there is much less information available and employs much fewer people. However,

various occupational groups emerge under the name of green jobs. Green jobs define occupations that do not harm ecological balance within the framework of sustainable development. Jobs categorized as green include organic food and agriculture, water management and conservation, battery technologies, electric vehicle technologies, pollution reduction, air and water purification technologies, carbon storage and management, recycling, treatment and waste management, renewable energy, and alternative fuels (biofuels, geothermal, hydroelectric, solar photovoltaic, solar energy, ocean wave, wind power, waste incineration, hydrogen fuel cells) (Günaydın, 2015, p. 507-508).

In 2023, Turkey's electricity production consists of 36.3% coal, 21.4% natural gas, 19.6% hydroelectric energy, 10.4% wind, 5.7% solar, 3.4% geothermal energy, and 3.2% from other sources (Republic of Turkey Ministry of Energy and Natural Resources, 2024). When we consider the current energy data of Turkey, it is clear that Turkey mainly depends on external sources in electricity production. However, Turkish government intends to mitigate dependence on external energy sources by increasing the share of renewable energy sources such as wind and solar in total electricity production. By the year 2035, the installed capacity is projected to rise to 29.6 GW in wind energy (24.6 GW onshore, 5 GW offshore) and 52.9 GW in solar energy. The installed capacity for other renewable energy sources is expected to increase to 35.1 GW in hydroelectric power plants and a total of 5.1 GW in geothermal and biomass energy plants (Republic of Turkey Ministry of Energy and Natural Resources, 2022, p. 15). Moreover, Turkey has a great renewable energy potential. The share of renewable energy sources in primary energy consumption, which was 16.7% in 2020, is expected to reach 50% by 2053. Nuclear energy reaches a share of 29.3%. The share of fossil fuels, which was 83.3% in 2020, is expected to decrease to 20.8% by 2053. While the share of coal, oil and natural gas are expected to be reduced to 3.6%, 5.6%, and 11.7%, respectively (Republic of Turkey Ministry of Energy and Natural Resources, 2022, p. 29).

It is an important to examine whether the energy investment announcements made by companies have impact on stock prices. Examining how market participants respond to such announcements can provide insights into the degree to which these decisions are awarded or well-received by investors, and whether their reactions vary across companies and countries (Almaskati, 2023, p. 845). In order to understand the responses of investors to strategic investment decisions, Woolridge and Snow (1990) test three alternative hypotheses. The first one is the shareholder value maximization hypothesis. The hypothesis suggest that the stock market will exhibit a positive reaction to corporate announcements regarding strategic investment decisions. The second one is the national expectations hypothesis. The hypothesis suggest that the stock market will demonstrate a negative reaction to corporate announcements concerning strategic investment decisions. The third one is the rational expectations hypothesis. The hypothesis suggest that the stock market will show no significant reaction to corporate announcements regarding strategic investment decisions (Woolridge and Snow, 1990, p. 356).

In this study, the stock of energy companies listed in Borsa Istanbul is selected as sample. In the literature, there are a limited

number of studies analyzing the impact of renewable energy investment announcements on stock returns of Borsa Istanbul energy companies. Therefore, this study is expected to make a contribution to the existing literature.

The rest of the paper is organized as follows. The literature is summarized in Section 2. Data and methodology are explained in Section 3. Empirical findings are reported in Section 4. Section 5 concludes the paper.

2. LITERATURE REVIEW

In the literature, there are a limited number of studies analyzing the impact of renewable energy investment announcements on stock returns of Borsa Istanbul energy companies by using event study method. Firstly, studies that examine the impact of investment announcements on stock returns using event study methodology are summarized. Secondly, studies that examine the impact of investment announcements, including environmental issues, on stock returns using event study methodology are summarized.

Woolridge and Snow (1990) examine the impact of strategic investment decisions on the stock market by using event study method. The sample period spans from 1972 to 1987. The findings show that the stock market reacts positively and significantly to the announcements of investments decisions. Nagm and Kautz (2008), investigate the effects of IT investment announcements on Australian companies. The sample period is between 1996 and 2003. Event study method is applied. 10th, 14th and 15th days before the event day are found to be statistically significant. The results for period within and around the announcement are found not to be statistically significant. Kaderli and Demir (2009) examine whether investment announcements affect BIST stock returns by using event study method. Regarding the event days, investment decisions announced by companies during the year 2008 are analyzed. Findings show that the investment announcements have significant effect on the stock returns. Achjari and Wahyuningtyas (2011), investigate the impact of information technology (IT) investment announcements in Indonesian financial and non-financial industries by using event study method. The sample period is between 2000 and 2007. The findings show that IT investment announcements have no significant impact on Indonesian financial and non-financial companies. Elbir and Kandır (2017), examines the impact of investment announcements on iron and steel industry stock returns. Event study method is used and the sample period is between 2005 and 2015. The results indicate that the investment announcements have a significant impact on the stock returns. Akbaba (2021) examines the impact of strategic investment announcements (asset acquisition, initiatives, financial asset consolidation and aircraft acquisition etc.) on the stock returns of logistics business via event study method. The period spans from 2014 to 2020. The results indicate that the investment announcements have a significant impact on the stock returns.

Halme and Niskanen (2001) analyze the impact of environmental investments on stock prices, utilizing data from the Finnish forest industry. Event study method is used to find the impact of

environmental investments on stock prices during the period from 1970 to 1996. This study observes a negative stock market reaction to the announcement of environmental investment. Jacobs, Singhal and Subramanian (2008) study how the market responds to two classifications of environmental performance (CEIs-Corporate Environmental Initiatives and EACs-Environmental Awards and Certifications) by the event study method. Findings vary according to the subcategories of the announcements. Ramiah, Martin and Moosa (2013) investigate the influence of environmental regulation announcements on equities listed on the Australian Stock Exchange from February 2004 to March 2011. Event study method is employed. The findings indicate that green policy announcements affected 21 out of 35 industries, leaving only 14 unaffected. Moreover, seven out of the 19 announcements had no significant impact. Wallace and McIver (2019), examine the influence of environmental announcements on Exchange Traded Funds (ETFs) comprising either polluting or green companies by employing event study methodology. The data sample spans from 2006 to 2014. The findings reveal that only a few environmental announcements generate statistically significant abnormal returns.

Ding (2020) explore the impact of corporate green announcements on the stock performance of listed firms in New Zealand by using event study method. The period is between 1980 and 2012. The sample comprises 30 green announcements issued by nine companies spanning across eight industries (air services, electric utilities, money center banks, general building materials, entertainment, oil and gas refining, department stores and wireless communications). The results suggest that the market shows a positive response to the announcements, though not statistically significant around the announcement day. Almaskati (2023) examines the reactions of investors to the announcements of renewable energy investments made by global oil companies. Event study method is used. The sample period is between 2015 and 2022. The results indicate that not all investment announcements are equally appreciated by market participants. The findings show that investors react to some announcements, while observing no response to others. Kinnunen (2023) investigates how both the stock market and analysts responded to corporate announcements concerning new investments in the hydrogen economy. The industries selected includes oil refining and the steel industries. Types of announcements include corporate news from companies, positive progress reports on ongoing projects and the advancement of projects to the next stage. Even study method is employed. 24 announcements are selected from 2015 to 2023. The findings indicate that average abnormal returns vary according to the type of announcement.

3. DATA AND METHODOLOGY

In this study, renewable energy investment announcements for companies operating in the energy industry are examined for the period between April 2015 and December 2023. The event study method is employed. 25 investment announcements made by 10 companies are defined as the events. Data related to these announcements are obtained from the Public Disclosure Platform. The stock prices of these companies and the BIST100 index values

are accessed from the FINNET2000 Plus database. Reactions of investors to these announcements on the days before and after the investment announcements are examined. In this context, abnormal returns are calculated to measure the market's reaction to investment announcements in the days around the dates of the investment announcements. Abnormal returns are calculated using the market model. The event window is defined as the 5 day period before and after the announcement days ($-5/+5$). The data for the 10 companies shown in Table 1 are utilized.

The event study methodology is the standard method of measuring stock price response to certain event or announcement (Binder, 1998, p. 111). Event study method also provides information about market efficiency. The events included in the study are the announcements of renewable energy investment decisions by companies operating in the energy industry. Event day is defined as the date when investment decisions are publicly disclosed. The event window is defined as the period of 5 days before and after the announcement day ($-5/+5$). To assess the impacts of the events, calculations are made for abnormal returns, average abnormal returns, the student t-statistic (t_{sd}) and P-value. Finally, the findings obtained from these calculations are interpreted.

The event window is demonstrated in Figure 1. The event date of each company is considered within an event interval ($-5,+5$), indicating 5 days before and 5 days after the announcement. The length of the pre-event window in the timeline is chosen as 244 days. In this timeline, the forecasting period is 239 days, and the event window's length is determined as 11 days. Accordingly, the event day, along with the 5 days before and after the event day, is included in the event window. Thus, total duration of the examination period is 250 days. The reason for including the days before the event in the event window is to assess whether there is any information leakage regarding the events under examination. The reason for including the days after the event in the event window is to examine whether there is a delayed response to the event.

Total returns encompass price changes and dividend yields and are calculated using the following formula. (Fama et al., 1969, p.3):

$$R_{id} = \ln \left[\frac{P_{i,d} + D_{i,d}}{P_{i,d-1}} \right] \quad (1)$$

R_{id} : return of stock i in period d

$P_{i,d}$: price of stock i in period d

$P_{i,d-1}$: price of stock i in period d-1

$D_{i,d}$: Dividend paid to the owners of stock i in period d.

The market model is expressed as a statistical model that relates a specific security return to the market portfolio return (MacKinlay, 1997, p. 18). The market model is estimated as follows (Sharpe, 1963):

$$R_{id} = \alpha_i + \beta_i R_{md} + e_{id} \quad (2)$$

R_{id} , return of stock i in period d ; R_{md} , return of the market portfolio in period d ; α_i , Intercept term (Intercept parameter); β_i , Systematic risk (Slope parameter); e_{id} represents the error term.

The standard approach involves estimating a market model for each company and subsequently calculating abnormal returns. It is assumed that these abnormal returns reflect the stock market's response to the arrival of new information. The return rate of the stock is determined by subtracting the expected return from the actual return. Any substantial difference is expressed as an abnormal or excess return (McWilliams and Siegel, 1997, p. 628). Abnormal return is obtained using the following formula (Pettit, 1972, p. 996):

$$AR_{id} = R_{id} - \alpha_i - \beta_i R_{md} = R_{id} - (\alpha_i + \beta_i R_{md}) \quad (3)$$

AR_{id} represents the abnormal return of stock i on day d ; R_{id} is the actual return of stock i on day d , R_{md} is the return of the market portfolio on day d ; α_i is the intercept term (intercept parameter) representing the estimated value for α_i ; β_i symbolizes the sensitivity of the financial asset return to the market return and β_i represents the estimated value for systematic risk.

The student t -statistic value (t_{sd}) for the event day and other days in the event window is calculated using the following formulas (Brown and Warner, 1985, p. 7):

$$t_{sd} = \frac{AAR}{S(AAR_d)} \quad (4)$$

$$AAR_d = \frac{1}{N} \sum_{i=1}^N AR_{id} \quad (5)$$

$$S(AAR_d) = \sqrt{\frac{\sum_{i=1}^N (AR_{id} - AAR)^2}{N}} \quad (6)$$

The Average Abnormal Return (AAR) for a specific time period is computed by summing the abnormal returns at that event point and then dividing by the number of stocks in the sample (Halpern, 1983, p. 303). In the formula, t_{sd} represents the student t -statistic; AAR_d is the Average Abnormal Return on day d ; $S(AAR_d)$ is the standard deviation of abnormal returns on day d ; AR_{id} is the abnormal return on day d for stock i ; N symbolizes the number of stocks in the sample on dated.

4. FINDINGS

The study investigates whether the renewable energy investment announcements initiate abnormal returns in the stock yields of energy companies listed in BIST. Table 2 includes the calculated average abnormal returns (AAR_d), t -statistic (t_{sd}) values, and P -values (Sig.) for the event day, 5 days before the event day, and 5 days after the event day.

When Table 2 is examined, the findings indicates that the renewable energy investment announcements of the companies operating in the energy industry have no significant impact on the stock returns in terms of t_{sd} statistic value and P -value (Sig.). Additionally, the findings obtained in this study reveal that Borsa

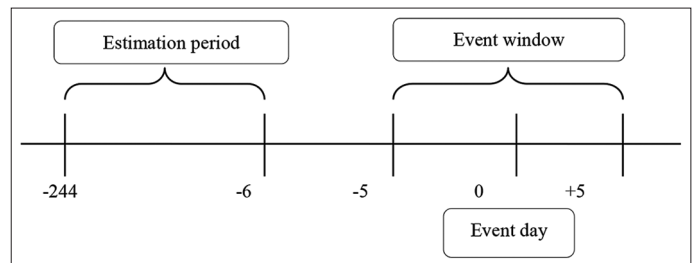
Table 1: Companies included in the study

Code	Company name
AKSUE	Aksu Enerji ve Ticaret A.Ş.
AYDEM	Aydem Yenilenebilir Enerji A.Ş.
AYEN	Ayen Enerji A.Ş.
BIOEN	Biotrend Çevre ve Enerji Yatırımları A.Ş.
ESEN	Esenboğa Elektrik Üretim A.Ş.
GWIND	Galata Wind Enerji A.Ş.
KARYE	Kartal Yenilenebilir Enerji Üretim A.Ş.
NATEN	Naturel Yenilenebilir Enerji Ticaret A.Ş.
SMRTG	Smart Güneş Enerjisi Teknolojileri Araştırma Geliştirme Üretim Sanayi ve Ticaret A.Ş.
ZOREN	Zorlu Enerji Elektrik Üretim A.Ş.

Table 2: Calculated average abnormal returns, t_{sd} statistic value, P -value (Sig.)

Event days	AAR	t_{sd} statistic value	P -value (Sig.)
-5	-0.007	-1.404	0.173
-4	0.003	0.627	0.537
-3	-0.001	-0.472	0.641
-2	0.009	1.367	0.184
-1	0.005	0.720	0.479
0	0.010	1.830	0.080
1	0.007	0.943	0.355
2	-0.002	-0.548	0.588
3	0.002	0.367	0.717
4	0.000	-0.028	0.978
5	0.012	1.176	0.251

Figure 1: The timeline is in the event study (-5, +5)



Istanbul is semi-strong form efficient. The results obtained are in line with the results of studies; Ding (2020), Nagm and Kautz (2008), Achjari and Wahyuningtyas (2011).

This result supports the rational expectations hypothesis tested by Woolridge and Snow (1990), which suggests that the stock market will not respond to announcements regarding strategic investment decisions. The foundation of this hypothesis is that the investments serve the purpose of maintaining the company's competitive strength rather than gaining a greater advantage over competitors (Lynn and Shaikh, 2010, p. 306). Thus, investors may not react to such announcements from companies operating in the energy industry because they might perceive that these announcements are already required for maintaining the company's competitiveness. According to Republic of Turkey Ministry of Energy and Natural Resources in Turkey national energy plan (2022), considering Turkey's current renewable energy potential and its future prospects, the aim has been determined as to increase the share of renewable energy sources (wind, solar etc.) in total electricity generation. Due to the expectation that

there may also be an increase in renewable energy investments, the announcements may not come as a surprise to the market. Furthermore, renewable energy investments may initiate benefits in the long-run. Nevertheless, it may take several years for renewable energy investments to recover initial investment. Thus investors may not quickly respond to renewable energy investment announcements. Since most of the investors have myopic perception towards certain type of investments, they usually prefer short-term gains and disregard long-term returns. This is known as investor myopia. Investor myopia may cause market participants to focus on short-term changes in prices rather than long-term changes in prices when making investment decisions (Docherty and Hurst, 2018, p. 2466).

5. CONCLUSION

The energy demand is increasing day by day with the growing world population and industrialization. Different solutions are being sought due to the rapid depletion of fossil resource reserves, which also lead to environmental pollution. Additionally, the primary focus of any business should be to protect the environment for the well-being of future generations. Therefore, effectively utilizing a country's renewable energy potential and diversifying energy production sources are crucial. Additionally, increasing the share of renewable energy in installed production capacity contributes to both government's environmental and economic development concerns. It is crucial from an environmental perspective, because the consumption of fossil fuels for energy production results in harmful gases and waste, leading to air, water, and soil pollution, in turn adversely affecting human health. It is also economically significant because energy production from renewable sources has a positive impact on economic growth in the short and long term. In addition, the economic activity and additional employment created by the renewable energy production process, from equipment production to energy production, provide a significant input to the national economy (Elüstün, 2021). The use of renewable energy contributes positively to the foreign trade balance of countries that are dependent on fossil primary sources such as Turkey. It is observed that the export excluding energy is \$239.4 billion, the import excluding energy is \$292.7 billion, and the trade deficit excluding energy is \$53.3 billion. In 2023, energy exports are \$16.4 billion, while energy imports are \$69.1 billion, and the energy trade deficit is \$52.7 billion. The foreign trade data including energy for 2023 indicate that exports are \$255.8 billion, while imports are \$361.8 billion, and the trade deficit is \$106 billion. Consequently, it can be expressed that the energy imports in the last year constitute 19% of the total imports, and the energy trade deficit account for 50% of the total trade deficit during the same period (The Central Bank of the Republic of Turkey, 2023).

The purpose of this study is to examine whether the public announcements of "renewable energy investment decisions" made by companies operating in the energy sector listed on Borsa Istanbul have any impact on the stock returns of these companies, using the event study method. Another aim of this study is to test the semi-strong form efficiency of the market. In Turkey, investors can access such information about companies through the Public Disclosure Platform. The study analyzes 25 renewable energy

investment announcements made by 10 companies in the energy sector through the Public Disclosure Platform during the April 2015 and December 2023 period. An event window is created considering five days before and after the announcement date (event date) (-5,+5). Sharpe model, also known as the market model, is employed to calculate abnormal returns. Average abnormal returns (AAR), t_{sd} statistic values, and P-values (Sig.) are calculated to measure the market's reaction to renewable energy investment announcements around the announcement dates of the companies. The result of the study reveals that the renewable energy investment announcements of the energy companies listed in Borsa Istanbul seem to have no significant impact on the stock returns. Thus, Borsa Istanbul appears to be semi-strongly efficient.

It is expected that this study will provide significant contributions to the finance literature and financial market participants. Individual and institutional investors planning to invest in companies operating in the energy industry would benefit from the results of this study. Our study could serve as an example for researchers interested in examining the impact of investment announcements on stock returns of companies in other industries.

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