

MARKET REACTION TO E-SPORTS CLUB'S ON-STAGE
PERFORMANCE:
The Empirical Research of Astralis Group

57201506 ZHOU JIAXI

SEMINAR ON HOT PAPERS

C.E. PROF. COAD, ALEX

D.E. PROF. IKEDA, MASAYUKI D.E. PROF. CHEUNG, MING YAN
WILLIAM

Summary

There are many prior studies about relationship between on-field performance results and stock returns of listed traditional sports companies (such as football and baseball) or even stock market index. As E-sports gain more popularity, the E-sports market becomes more commercial as well. However, compared with its vast market, there is a dearth of E-sports-related study. The recent public listing of a E-sports company, Astralis Group, on Nasdaq First North Growth Market provides a unique chance for the current study to examine if the on-stage performance of Astralis Group's CS:GO club would impact its stock price returns. The results show that championship wins and its stock returns are significantly positively correlated, which suggests that investors regard championship wins as a key element of Astralis Group's future profitability.

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Table of Contents

1. Introduction	1
1.1. E-Sports Industry Overview	1
1.2. Astralis Group	4
1.3. The Game (CS:GO)	9
1.4. Terminology	10
2. Literature Review	14
3. Hypothesis	20
4. Methodology	21
5. Data	23
6. Empirical Results	27
7. Conclusions	33
REFERENCES	35

1. Introduction

The purpose of the current study aims to investigate whether the wins and losses of listed E-sports company, Astralis Group, affect its stock prices. In order to do this, it firstly requires a top-down understanding of the whole industry chain, namely, the E-sports industry, the E-sports company (in the thesis, it's Astralis Group) and the E-sports game itself (in the thesis, it's CS:GO). Therefore, the current study starts with the introduction of the E-sports industry chain.

1.1. E-Sports Industry Overview

E-sports, or electronic sports in full title, is a competitive gaming at a professional level and in a organized format, such as a tournament or a league, with a certain end, for instance, winning a championship title or gaining money of prize pool. And there is a straightforward distinction between different E-sports teams that are going to compete against each others (NewZoo, 2021a).

According to NewZoo, one of the most authoritative game industry data platforms, E-sports industry in 2021 had a total revenue of \$1136.5 million with a 14.1% year on year growth rate (NewZoo, 2021b), and was expected to grow to \$1384 million in 2022 with a year on year growth of 21.8%, and to \$1866.2 million in 2025 at a CAGR (compounded annual growth rate) of 13.4% (NewZoo, 2021c). Based on the revenue forecast in 2022, most of them, around \$1175.8 million, came from sponsorship, media rights and publisher fees. While the revenue from live streaming merely accounts for 3.3%, the pandemic has accelerated the adoption of live streaming (NewZoo, 2021b). As expected by NewZoo, the growth rates of live streaming will stay in the double digits for most developing economies throughout 2024: Latin America with a CAGR of 14.0%, the Middle

East and Africa with a CAGR of 15.1%, Central Southern Asia with a CAGR of 14.8%, and Southeast Asia with a CAGR of 14.8% (NewZoo, 2021a). Besides, it's recorded that 397.8 million people watched E-sports in 2019, 435.7 million people in 2020, 489.5 million people in 2021, and the number is expected to increase to 640.8 million in 2025 at a compounded annual growth rate of 8%. The ratio of occasional viewers to E-sports enthusiasts in all of the E-sports viewers is roughly 1:1 at present. The global average revenue per E-sports enthusiast was \$4.63 in 2021, a 2.8% increase from \$4.40 in 2020 (NewZoo, 2021d). As for E-sports players, or gamers, it's estimated that in 2021 there were total 3 billion E-sports game players all over the world, with a year on year growth of 5.3%, while 55% of them were from Asia-Pacific region, followed by Middle East and Africa (NewZoo, 2022a). So far, there are total 2469.5 million people who have E-sports awareness globally (NewZoo, 2021a). Charts 1, Chart 2, Chart 3 and Chart 4 provide a better understanding and clearer perspective of these statistical data elaborated above.

To sum up, E-sports industry is a broad and promising market worthy of investors' attentions and scholars' researches.

Chart 1. 2022 Global Players

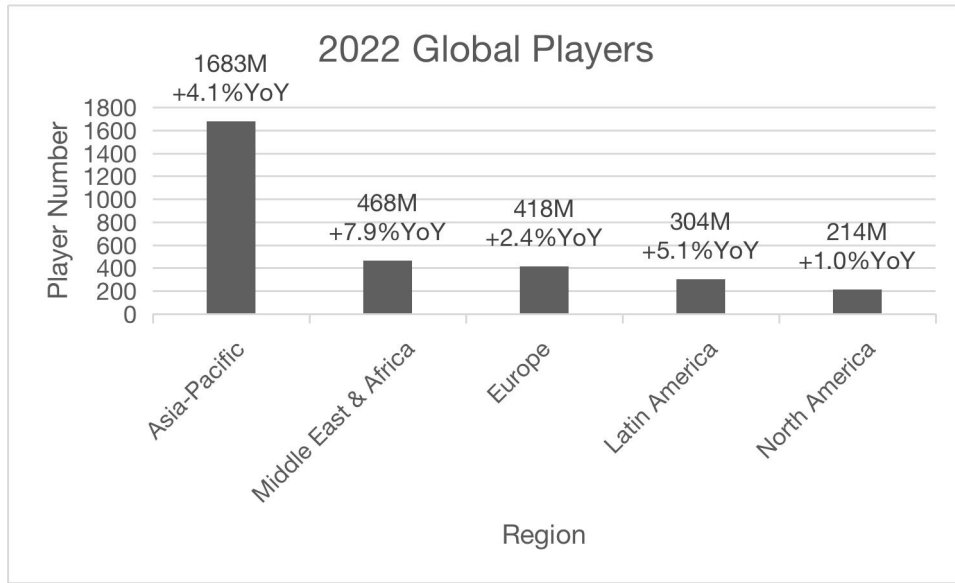


Chart 2. 2022 E-sports Revenue Streams

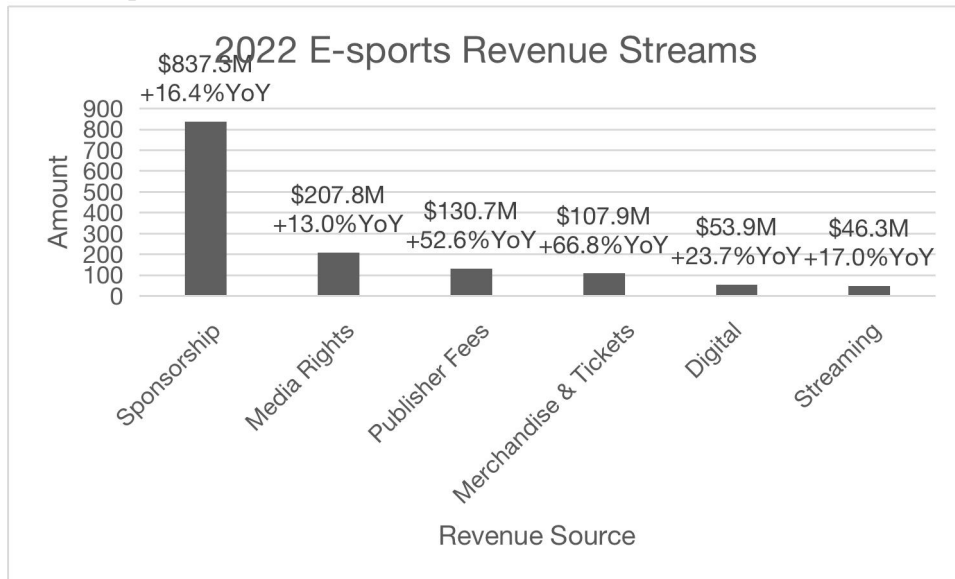


Chart 3. E-sports Audience Growth

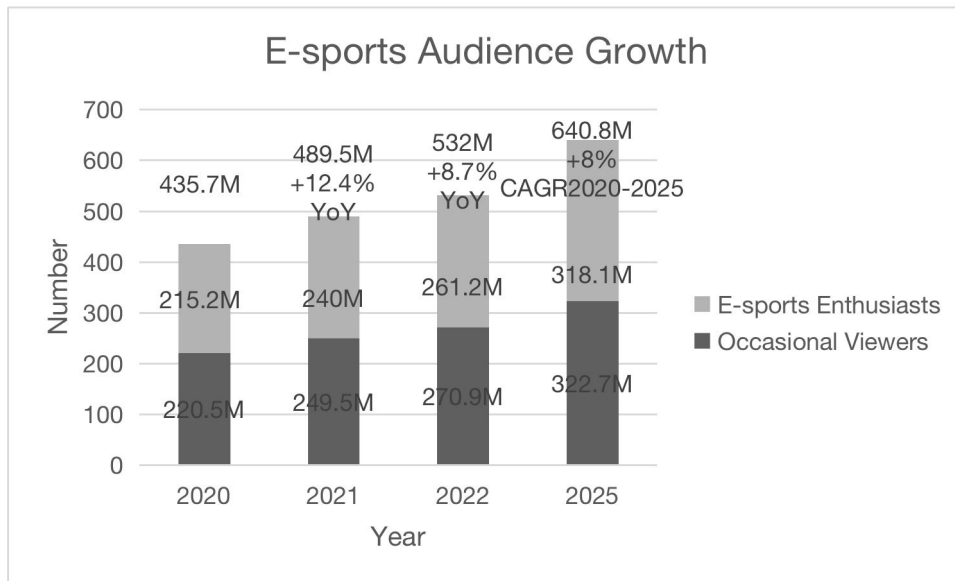
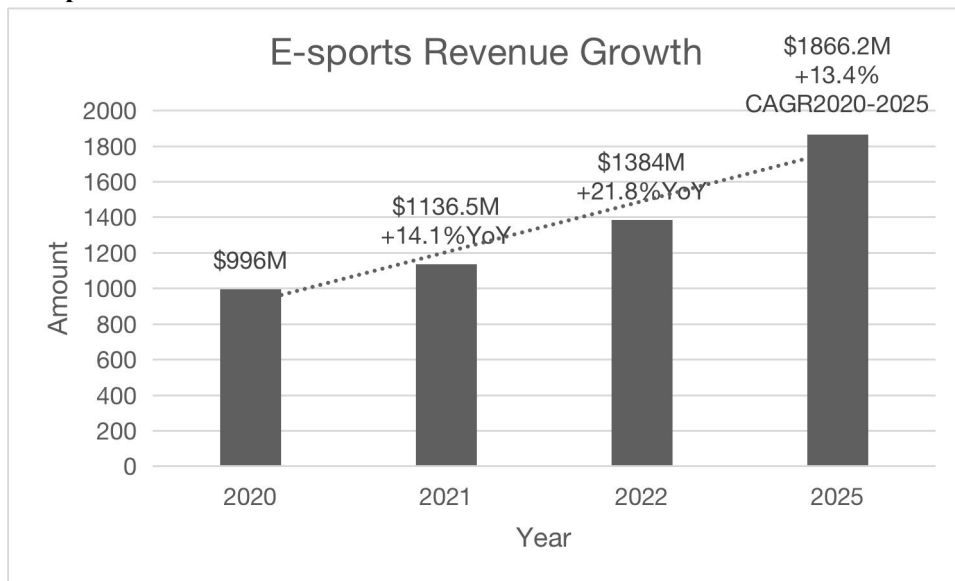


Chart 4. E-sports Revenue Growth



1.2. Astralis Group

Founded in Copenhagen, Denmark, Astralis Group currently owns and operates five E-sports clubs, namely, Astralis in CS:GO, Origen (OG) in League of Legend (LOL), Future FC in FIFA, as well as two start-up clubs in Rainbow Six: Seige (R6) and Fortnite (Astralis Group).

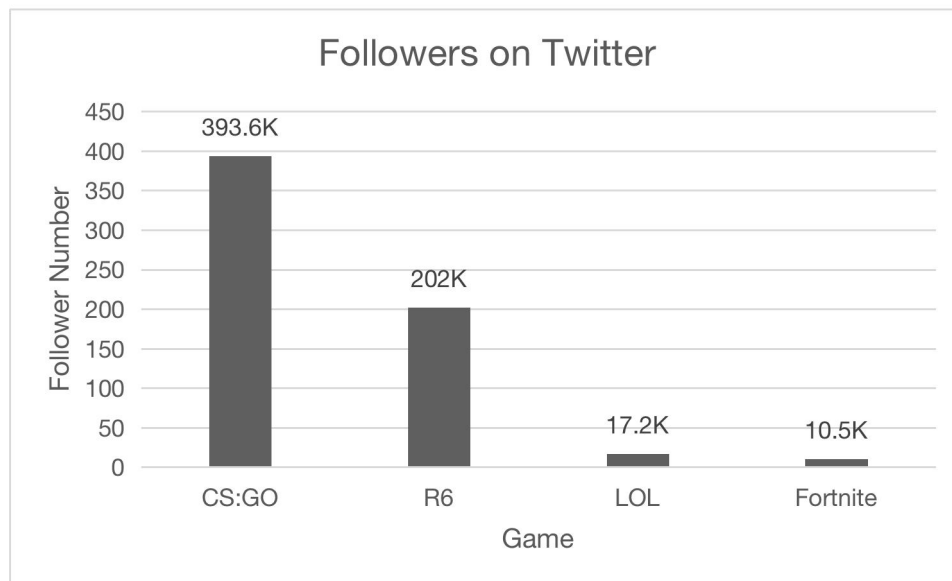
Astralis Group’s business model has been designed to build brand value by improving its

attractiveness to E-sports players, E-sports fans, business partners and business sponsors as well. The “value-creation engine”, as they called, consisted of three points: performance model, brand building capabilities and commercial platform.

Firstly, the performance model mainly focuses on exploring, attracting and training E-sports players. Same as traditional players, E-sports players spend most of their time on practicing in order to improve their E-sports skills. Training contents include a combination of physical (nutrition, exercise and relax), mental, and technical (skills and reviews) elements under the supervision of their coaches, such as chief coaches, data analysts, psychologists, nutritionists and so on. Astralis Group’s operation is under an idea that performance is equal to skills multiplied by motivation, and they believe that the model can be commonly applied across professional E-sports games. Relying on the training contents, Astralis Group’s CS:GO club enhanced its win-to-loss ratio from 2 to 7, won Major championship titles and had sustained a leadership position in CS:GO game for a long time period.

Secondly, brand building mainly focuses on E-sports fans and potential business partners. When Astralis Group started up, the goal was to attract not only E-sports enthusiasts, but also the majority of occasional E-sports viewers. The E-sports clubs’ ability to connect with their fans, especially the mainstream audience, counts for an essential part of success. Because the majority of audience is millennials, Astralis Group highly depends on social media platforms to communicate with their fans. As of April 2022, the Astralis CS:GO had 393.6K followers on Twitter, Astralis League of Legends had 17.2K followers, Astralis Rainbow Six and Astralis Fortnite had 202K and 10.5K followers respectively (see Chart 5).

Chart 5. Astralis Group's followers on Twitter



Finally, Astralis Group have invested a lot in constructing a commercial platform. Almost every successful club would create a group of fans full of loyalty, which, in turn, could help the club construct a unique brand. The brand would become the foundation for the company's future profitability. Astralis Group currently has three main revenue streams, namely, business partnerships with sponsors, revenue sharing from leagues and tournaments, and merchandise sales. The fourth revenue stream is from prize pool money and other leagues revenues, but this revenue is not full of certainty, because it highly depends on the performance results and a large part of it should be shared with the players.

In the history of professional E-sports competition, Astralis Group is considered as one of the most excellent clubs in professional Counter Strike: Global Offensive (CS:GO) field. During 2017 to 2019, Astralis Group had won three consecutive CS:GO Major Championship titles (the Major), which is considered as the most important championship title among all of the professional CS:GO competitions, and owns four Major titles in total. Besides, it was the NO.1-ranked team for 86

consecutive weeks among all of the professional CS:GO clubs (Astralis Group, 2019).

Attributed in a large part to its excellent championship records, Astralis Group has become the first E-sports company to raise an initial public offering (IPO) by listing on Nasdaq First North Growth Market in December 8, 2019, trading under the symbol ASTRLS and ISIN DK0061155785 (Astralis Group).

According to its 2021 annual report, the net revenue increased from DKK 51.5 million in 2020 to DKK 75 million in 2021, which was within the expectation in corporate announcement NO.4-2021 of DKK 70 to 80 million. The EBITDA grew from DKK -14.5 million in 2020 to DKK -7.9 million in 2021, which was in line with the financial guidance of DKK -5 to -10 million. The financial targets of Astralis Group in 2022 fiscal year aims at a net revenue in the range between DKK 85 million and DKK 90 million, which is a 13 to 20 percent increase, and an EBITDA in the range between DKK 0 million and DKK 5 million, which is to turn loss into profits (Astralis Group). Both the realized goals for 2021 and financial targets for 2022 show continued and positive expectations, as well as a high growth rate of Astralis Group.

Table 1, Table 2 and Table 3 provide the consolidated income statement, consolidated balance sheet and consolidated statement of cash flows of Astralis Group for fiscal year 2020 and 2021 respectively.

Table 1. Consolidated income statement for fiscal year 2020 and 2021

(DDK'000)	2020	2021
Revenue	51504	75004
Other operating income	3513	6692
External expenses	-19244	-25115
Staff costs	-50291	-64416
Gross loss (EBITDA)	-14518	-7875

Depreciation and amortisation	-35491	-25151
Operating loss (EBIT)	-50009	-33026
Financial income	181	95
Financial expenses	-3393	-2264
Loss before tax	-53221	-35195
Tax on loss for the period	246	0
Loss for the period	-52975	-35195
Proposed distribution of loss		
Retained earnings	-52975	-35195
	-52975	-35195

Source: Astralis Group Annual Report 2021

Table 2. Consolidated balance sheet for fiscal year 2020 and 2021

DKK'000	2020	2021
Goodwill	12242	14209
Trademark	6826	6259
Player rights	16635	0
League tournaments rights	46455	40856
Intangible assets	82158	61324
Property, plant and equipment	557	7415
Tangible assets	557	7415
Deposits	333	2145
Financial assets	333	2145
Non-current assets	83048	70884
Inventory	0	218
Inventory	0	218
Trade receivables	25031	27293
Other receivables	3992	5412
Receivables	29023	32705
Cash	52039	22900
Current assets	81062	55823

Assets 164110 126707

Source: Astralis Group Annual Report 2021

Table 3. Consolidated statements of cash flows for fiscal year 2020 and 2021

DKK'000	2020	2021
Operating loss (EBIT)	-50009	-33026
Depreciation and amortisation	35491	25151
Non-cash items and reversals	-3513	-6692
Working capital changes	-14270	-4789
Cash flows from ordinary primary activities	-32301	-19356
Financial income received	181	95
Financial expenses paid	-1154	-164
Cash flows from operating activities	-33274	-19425
Deposits	0	-1811
Aquisition of contractual rights	-642	0
Sale of contractual rights	3513	6692
Aquisition of property, plant and equipment	-1104	-6681
Cash flows from investing activities	1767	-1800
Repayment of financial loans	-4694	0
Repayment of payables related to league tournament rights	0	-7914
Repayment of debt to related parties	-200	0
Cash flows from financial activities	-4894	-7914
Increase/(decrease) in cash and cash equivalents	-36401	-29139
Cash and cash equivalents at beginning of period	88440	52039
Cash and cash equivalents at end of period	52039	22900

Source: Astralis Group Annual Report 2021

1.3. The Game (CS:GO)

Based on the most recent data published by NewZoo in March 2022, CS:GO and LOL (League of Legend) are among the top 10 most watched games on Twitch (NewZoo, 2022b). And historically, CS:GO and LOL were two of the most popular E-sports games. Though Astralis Group

owns five professional E-sports clubs in different games, including both of CS:GO and LOL, the current study focuses exclusively on the performance of Astralis Group in CS:GO because its CS:GO-related revenues accounted for 70.5% of total Astralis Group revenues in 2021 (Astralis Group).

To put it simply, Counter-Strike: Global Offensive (CS:GO) developed by the American company Valve Corporation, launched in 1999, is a leading team-based first person shooter game where two teams, each of them consisting 5 players, compete in different “maps” (Dust, Inferno, Nuke, Train, and so on) for multiple rounds of objective-based game modes with the goal of winning enough rounds to win the match, that is, one team plays the terrorists whose goal is to plant a bomb in a specific location without being shot by their opponents, while another team played counter-terrorists needs to eliminate all the terrorists or defuse the bomb before its explosion. After 15 rounds, the game requires the two teams to switch their sides. To win, a team needs to win 16 rounds in a particular map. In general, each round lasts up to 2 minutes and a whole match lasts approximately 45 minutes (Valve Corporation).

According to Statista, Counter-Strike: Global Offensive (CS:GO) had on average 991.63 thousand peak concurrent players on Steam in January 2022 (Statista).

1.4. Terminology

In order to make the study more clear and understandable, this part gives definitions of often-used terms in E-sports field (NewZoo, 2021a).

E-sports means competitive gaming at a professional level and in an organized format (a

tournament or league) with a specific goal (i.e., winning a champion title or prize money) and a clear distinction between players and teams that are competing against each other.

Tournament stands for an event that typically happens over a short period of time. Its format frequently includes a group stage, from which teams can advance to a knock-out phase. As some teams are eliminated before the final, not all teams will play directly against one another.

League means an event featuring regular matches played over several months following a planned schedule. Teams typically play at least one game against every other competing team.

Game revenues are consumer revenues generated by companies in the global games market, excluding hardware sales, tax, business-to-business services, online gambling and betting revenues, and advertising revenues earned in and around games.

Digital Revenues are generated from digital sales of in-game items that utilize team IP or signed player likeness. These are currently limited to the revenues that teams earn. Publisher cuts of these revenues will arrive in a future update.

Sponsorship revenues are the revenues generated by teams and organizers through business sponsorship deals, including product placement, sponsoring teams, and payments by brands for the use of team, event, or game-specific IP rights in their marketing communications. Any advertisement sold as a part of a sponsorship package is also included in sponsorship revenues.

Media rights revenues are the revenues generated through media property, including all revenues paid to industry stakeholders to secure the rights to show E-sports content on a channel. This includes payments from online streaming platforms to organizers to broadcast their content, foreign broadcasters securing rights to show content in their country, or copyright costs to show

video content or photos of an E-sports competition.

Subscriptions revenues are generated by periodical fees paid for subscriptions to gaming content. A service a user can access by paying for a pre-determined time period. It's often used in the context of a game subscription service, which is a service that offers access to software content without providing the platform/hardware access that a cloud gaming service provides.

Publisher fees are paid by game publishers to independent E-sports organizers for hosting events. This excludes investments or spending by game publishers on their own events, as considered that to be part of their regular marketing efforts.

Live streaming revenues are generated through professional players or signed streamers streaming, either on their own channels or on team channels.

Live streaming means when one person, or sometimes a group of people, streams live video of him/herself via a streaming platform, allowing viewers to see what he/she is playing at that moment in time.

Occasional viewers represent people who watch professional E-sports content less than once a month, while E-sports Enthusiasts stand for people who watch professional E-sports content more than once a month.

E-sports audience stand for all people who watch professional E-sports independent of frequency: E-sports enthusiasts and occasional viewers combined.

Games live streaming audience are the people who have watched live-streamed gaming content at least once in the last six months.

Revenue per enthusiast means average annual revenue generated per E-sports enthusiast

(total E-sports revenues divided by total E-sports enthusiast numbers).

Players or gamers are people who play games on a PC, console, or mobile device.

Console games are these games played on a TV screen directly or through a console, such as X-box, PlayStation, and Nintendo, or on handheld devices, such as a Nintendo DS or PS Vita.

Compound annual growth rate (CAGR) is the constant growth rate over a period of years. In the current study, all of the CAGR data are based on the years of 2019 to 2025.

E-sports awareness means people who have heard of E-sports, including the group of people who are aware of E-sports but are not participants or viewers.

2. Literature Review

About the relationship between the performance of a sport team and the fluctuations of its stock prices, one of the earliest event studies was made by Brown and Hartzell (2001) (Brown and Hartzell, 2001). According to their study, the Boston Celtics Limited Partnership is a listed company so that its performance results can be correlated to its share returns, trading volumes, volatility and so forth. Besides, other events linked to the Celtics aside from its basketball on-field performance also had impact on its share price performance, such as the appointment of a head coach or the construction of the Boston Garden.

To some extent, it's found that investors make use of match results as a reference of their trading decisions. While stock returns are a function of match results, the effect of losing a match is far more significant than winning a match on stock prices. This conclusion, however, is not solid when it comes to playoffs because both wins and losses are important during playoff period. It's found that each additional win could bring an additional \$0.06 net earnings per share in the next fiscal year, excluding all the incomes and expenses related to the playoffs. What's more, the stock volatility and trading volumes are significantly higher during the sports competition seasons than during the off-seasons. Based on their study (Brown and Hartzell, 2001), one of the most significant results was the appointment of Pitino as the head coach of the Boston Celtics, which led the trading volumes largely increase to approximately 70 times the daily average value. Therefore, these results suggest that, for sports firms, it is not only the on-field performance matters, but also events related to the welfare of the team.

Palomino *et al.* in 2009 (Palomino et al., 2009) pointed out the question whether the stock

market incorporates the information related to listed British football clubs, such as wins, losses and draws of their on-field matches. The results showed that, over a three-day-period, the average cumulative abnormal returns are highly statistically significant for match outcomes, amounting to +0.88% for a win, -1.01% for a loss and -0.33% for a draw. On the contrary to Brown and Hartzell's study, it was found by Palomino *et al.* that the stock market is more sensitive when it comes to good news (wins), while it is comparatively slower in processing bad news (losses).

Ashton, Gerrard and Hudson in 2003 (Ashton *et al.*, 2003) examined the relationship between the on-field performance of the England soccer team and the fluctuation of the FTSE 100 index. They found that, in general, the wins of the England national soccer team could bring good returns of the stock market, while the loss of the soccer team would lead to bad returns of the market. Furthermore, it's found that the level of matches matter, namely, the more important the matches, such as tournament matches or playoff matches, the larger the fluctuation of the share prices, while the less important the matches, for instance, the friendly matches, the smaller the fluctuation of the share prices. To draw a conclusion for their empirical study, there is strong association between the the England national soccer team and the stock market, especially the stock prices in the FTSE 100 index, which represents the 100 largest listed company traded on the London Stock Market.

However, Klein, Zwergelb and Fock in 2008 (Klein *et al.*, 2009) refuted the study of Ashton *et al.* by giving several compelling reasons. Firstly, Klein *et al.* questioned the capital amount of the soccer industry. To illustrate, they took an example of World Cup 2006 in Germany. During that period, *Federation Internationale de Football Association* (FIFA) generated a revenue of \$2.594 billion in total. In terms of the Germany's Gross Domestic Production (GDP), the profitability seems to be

insignificant at all. Second, Klein *et al.* disagreed with the assumption made by Ashton and his colleagues that the result of a football match have an impact on the stock market next trading day, which could also be exemplified by World Cup 2006. In the World Cup 2006 semi-final, the Germany national soccer team was defeated by Italy, which was, based on the hypothesis of Ashton *et al.*, a big shock for German shareholders or investors. However, the World Cup 2006 event still generated a positive economic benefit for German's GDP, which would feed through into German stock market. Besides, there is a large proportion of German stock market investors are foreigners, who were possibly not interested in the result of that match, or even some of them were Italians. In this case, it's unlikely to conclude that the loss of German soccer team would led to the bad market returns, so did the England national soccer team. Third, Klein *et al.* argue that in Ashton's study the only statistically appropriate significant result seems to be the bad stock market returns after the losses of England national soccer team, while this result is also skeptical because they are doubtful about that England soccer fans have the ability of large amount of short-selling capacities, which is not usual for private stock investors even for now, and was surely not available several years ago. The explanation of this statistically significant result is sheer coincidence since the data sets are large enough and contain lots of variables.

Nevertheless, Ashton *et al.* then in 2011 (Ashton et al., 2011) reassessed the association between the results of football matches and the stock market reactions as a response to the criticism made by Klein *et al.* in 2008. To be specific, their new analysis makes use of a broader data set, employed an extended range of tests and allowed for the existence of outliers. The outcomes, contrary to the conclusion of Klein *et al.*, still confirmed that the statistically significant relationship

between the results of England national football team and the UK stock market returns, especially the FTSE 100 index. Besides, after employing a broader data set, namely, including observations from 2002 to 2009, Ashton *et al.* found that the impact of on-field performance, especially the wins, on the stock market reactions has decreased over this period.

Same as Ashton *et al.*, Coates and Humphreys in 2008 (Dennis and Brad, 2008) tested the link between on-field performance of Japanese baseball teams in the Nippon Professional Baseball League and the stock prices' movements of owning companies, which verified the assumption that wins (losses) would have positive (negative) impacts on the owning companies' stock returns. In addition, the win of a baseball team would have an positive effect on its stock prices, but the effect is not as significant as a loss would negatively influence its stock prices. Accordingly, based on their research, the impact of unexpected losses outweigh the impact of unexpected wins, which means losing a match that was expected to win has a larger impact than winning a match that was expected to lose.

Another intriguing finding was discovered by Edmans, Garcia and Norli in 2007 (Edmans *et al.*, 2007). They examined the association between stock market returns and events related to sports teams. To be specific, Edmans *et al.* employed a large sample of sports types, such as soccer, rugby, baseball and basketball, as well as extensive sample regions including North America, Europe and Asia, and they put forward a null hypothesis that the results of a event related to sports teams would not bring a statistically significant change on the stock market. The outcome was that there was indeed a significant bad (good) market return after a loss (win) or other kinds of negative (positive) events. For instance, elimination of a soccer team from the World Cup would lead to a negative

abnormal return of -0.49% of owning company. Besides, a sponsorship announcement would contribute a positive abnormal return of $+0.36\%$ at least. What's more, it's observed that the degree of the abnormal returns is inversely proportional to the firm size. The reasonable explanation might be that the economic effect of a sponsorship on a small-sized firm is more apparent and efficient, compared with large-sized firms.

Kim in 2015 (Kim, 2015) explored how both of positive and negative events related to Chinese and Korean soccer teams affect the stock price returns of the owning companies. According to Kim's study, the ownership of a soccer team does have, to some extent, economic effects on investments reflected by the stock price returns of owning companies, which shows that the investments in the soccer clubs could create win-win situations for both of the owning companies and the soccer clubs. For instance, on October 31st, 2009, after Beijing Guoan Football Club won the championship title of the Chinese Super League, the stock price of its owning company, the China Citic Group Co. LTD (CITIC group), had a much higher abnormal return on the next trading day. In addition, on March 1st, 2010, the acquisition of Guangzhou Evergrande Football Club by Evergrande Group contributed a significantly positive effect on its stock price return. Furthermore, it's recorded that the transfer events of famous players also had significant impact on stock prices, evidence from the event that Darko Matic transferred to Beijing Guoan Football Club on February 4, 2009.

Other than this, there are also twofold benefits of sponsoring a sports club. Agrawal, Jagdish, Kamakura and Wagner in 1995 (Agrawal and Kamakura, 1995) examined the effects of announcing celebrity endorsements, and the results showed a statistically significantly positive effect on stock

price returns, which means celebrity endorsements in advertisement are worth of investing. A good example is from Korean E-sports industry, which has become one of the mainstream cultural industries in Korea, Korean E-sports players' social status can be totally same as any traditional athlete's or movie star's. In this case, a company can not only get positive abnormal stock returns from investing in a E-sports club, but also from the celebrity endorsement of professional E-sports players.

In fact, Goetomo and Filbert in 2016 (Filbert, 2016) conducted an event study to explore the impact of League of Legend (LOL) clubs on the stock prices of their owning companies' or parent companies, namely SK Telecom (SKT), KT Corporation (KT), Korean Air (KA), CJ Corporation (CJ), as well as Samsung Electronics Co Ltd (SSG). Goetomo *et al.* hypothesized that events related to LOL clubs, such as transfers of star players and sponsorship announcements, could positively effect the targeted companies' stock prices. And ultimately the results confirmed that there were indeed significantly positive correlations between stock returns and such events.

3. Hypothesis

As literature review shown above, events (such as sponsorship, celebrity endorsements, transfers of players and so forth) related to sports teams, both traditional sports and E-sports (though relative studies are pretty rare so far), would have measurable effects on owning companies' stock prices. And on-field performance of traditional sports clubs undoubtedly have a statistically significant impact on their owning companies' stock returns. As such, a question should be raised, namely, does the same apply to E-sports? Therefore, the current study hypothesizes that there is a significantly positive relationship between winning matches and Astralis Group's stock returns, and a significantly negative relationship between losing matches and Astralis Group's stock returns.

4. Methodology

According to the empirical model used by Edmans, Garcia & Norli (2007) (Edmans et al., 2007), as well as Palomino, Reneboog and Zhang (2009) (Palomino et al., 2009) in their research about the impact of traditional sports' on-field performance on stock price returns, the current study still employs a two-step regression process to evaluate the impact of Astralis Group's on-stage performance in major league matches on the stock price rate of returns. In the model, the study first calculates the daily abnormal returns of Astralis Group. Then, the study continues to refer to Dimson's (1979) (Dimson, 1979) method, and uses the daily and the previous trading day's relative rate of return, R_{t-1} , to do regression, obtaining the coefficients of predicted rate of return. At the same time, the daily and 1-day lag market index rate of return is used to control the autocorrelation variables, and adapt to the situation of asynchronous trading.

$$R_t = \alpha_0 + \sum_{t-1}^{t+1} \beta_M R_M + \alpha R_{t-1} \quad (1)$$

where α_0 is the constant, R_t is the daily stock price rate of return for the Astralis Group, R_M is the daily rate of return on the market index, R_{t-1} is the lagged stock return, β_M stands for the coefficient of daily rate of return on the market index and α is the coefficient of lagged stock return. Day-of-the-week dummy variables were excluded in Equation (1) because, according to the previous study made by Kohers *et al.* in 2004 (Kohers et al., 2004), such anomalies have disappeared over time.

The second step is to calculate the expected rate of return of Astralis Group in every trading day by using the constants (α_0) and variable coefficients (β and α) obtained by the first-step

regression. The daily abnormal rate of returns can be obtained by taking the difference between the expected rate of returns and the actual rate of returns. OLS regression test was performed using the abnormal rate of returns and the dummy variables of Astralis Group's wins and losses in each playoff and championship game of CS:GO E-sports leagues and tournaments in the sample time period (December 8, 2019-April 9, 2022).

$$AR_t = \beta_0 + \beta_{CW}D_{CW} + \beta_{CL}D_{CL} + \beta_{PW}D_{PW} + \beta_{PL}D_{PL} + u_t \quad (2)$$

where, D_{CW} is the dummy variable of winning the championship match, and the value is 1 when winning the championship final, or 0 otherwise. D_{CL} is the dummy variable of losing in the championship match, the value of losing is 1, otherwise it is 0. The current study also examines the impact of Astralis Group's on-stage performance on stock price returns in the playoff stage by adding dummy variables of winning and losing in the playoffs through this model, D_{PW} and D_{PL} are the dummy variables of winning and losing in the playoffs respectively. When winning the playoff match, D_{PW} is 1, otherwise it is 0. When losing the playoff match, D_{PL} is 1, otherwise it is 0. The model is used to test the hypothesis that, if the regression coefficients (β_{CW} and β_{PW}) of the dummy variables (D_{CW} and D_{PW}) are significantly positive, it indicates that investors believe Astralis Group's E-sports club winning major E-sports events will have a positive impact on the company's future profitability, which is reflected in the stock prices and abnormal rate of returns.

5. Data

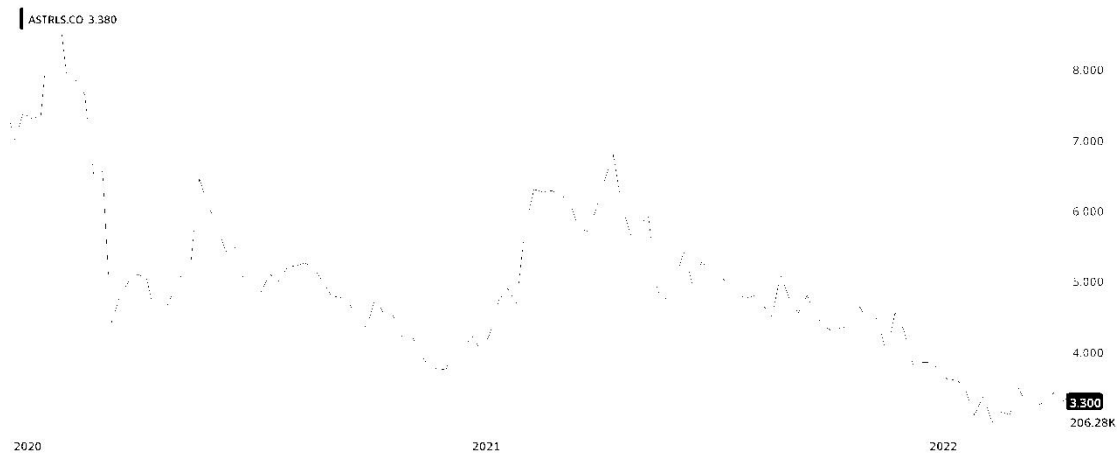
According to Astralis Group's annual report, the majority of revenue comes from its CS:GO club (80% in 2020 and 71% in 2021), therefore the current study mainly focuses on the on-stage performance of Astralis Group's CS:GO club as the target for empirical research, its LOL, FIFA, R6 and Fortnite clubs' matches were not included. Meanwhile, Since the formats and the ranking methods of CS:GO E-sports leagues and tournaments are different from regions, for instance, the competitive system in Europe is different (though not totally) from the system in China or North America, the study refers to the systems of several main CS: GO tournaments and has been clear about that the bonuses and rankings are based on playoff matches. In other words, playoff stage is equal to a benchmark, only teams joining in the playoff stage are eligible to participate in the distribution of prize pool money and league ranking points. Therefore, the current study mainly makes use of the results of championship and playoff games to examine the regression models above.

According to statistics, Astralis Group has participated in 38 different E-sports leagues in one and a half years since its IPO to April 2022 (preseason matches, regular season matches and playoff matches of the same series are counted separately), promoting to playoff stages 63 times, winning 33 matches and losing 30 matches. Furthermore, Astralis Group has been to league finals 8 times, winning championship titles 5 times and losing 3 times.

Based on the first step of regression model (Equation 1), the study collected the daily stock price data of Astralis Group from Yahoo.finance.com for total 583 trading days from its IPO (December 9, 2019) to the most current (April 8, 2022). Daily data of the OMX COPENHAGEN 25

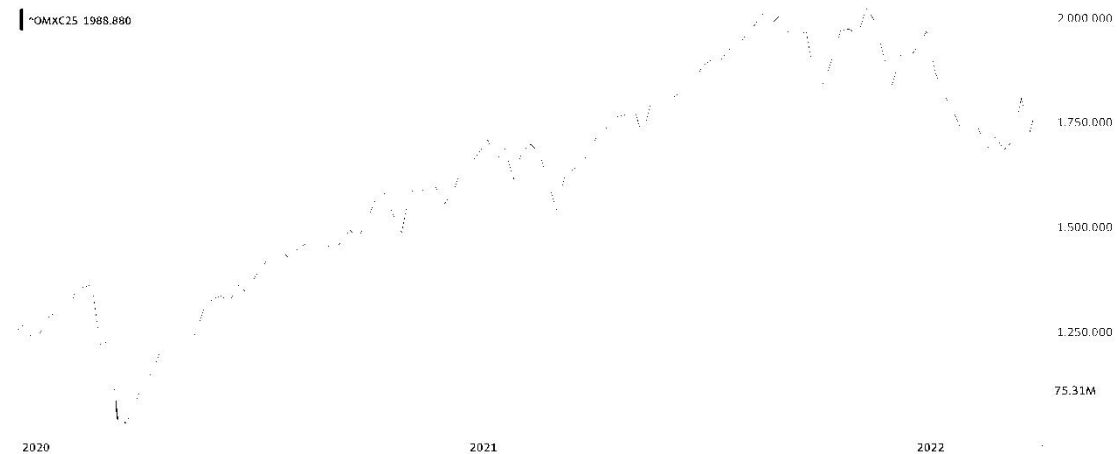
market index (OMXC25) were collected from NasdaqOMxNordic.com. Chart 6 and Chart 7 provide the trends of stock prices of Astralis Group and OMXC25 market index respectively.

Chart 6. Astralis Group’s stock price movements: December 8, 2019–April 9, 2022.



Source: <https://yhoo.it/3zRRagh>

Chart 7. OMXC25 market index movements: December 8, 2019–April 9, 2022.



Source: <https://yhoo.it/39DPyMD>

After calculating Astralis Group’s abnormal rate of returns, the study endows them with dummy variables according to the win and loss match results obtained from the above real-time E-sports data websites, and makes use of them to carry out regression test.

At the same time, considering the situation that some of the E-sports competitions are held on weekends, the study compares the test results of two groups of time series. The first group of time series still calculates the relative rate of returns of Astralis Group's stock price according to the "Friday closing price to Monday closing price" of weekday mode, while the second group calculates the relative rate of returns based on the "Friday closing price to Monday opening price" of weekend mode. The second set of data is based on the assumption that news of wins and losses during weekends will be reflected in Monday's opening stock prices.

In the process of dealing with statistics and regression tests, the study makes use of the identical method and formula to perform repeated calculation for the two groups of different time series mentioned above. In addition, there also are cases where Astralis Group plays multiple matches on a same trading day or a same weekend. In this case, considering that the playoff stage matches are basically equal to knockout matches (if you lose, you are eliminated), the study subjectively selects the results of matches with higher importance or the results of later matches to assign dummy variables.

Table 4 provides a summary of the descriptive statistics for both of the raw Astralis Group's daily stock price returns under two separate time series. As shown in the table, the descriptive statistics data in the "Friday closing price to Monday closing price" time series is qualitatively similar with the counterparts under "Friday closing price to Monday opening price".

Table 4. Descriptive statistics for raw Astralis Group daily stock price log relative returns (%):

December 9, 2019–April 8, 2021.

	Mean	Median	SD	Maximum	Minimum	Observations
Friday closing price to Monday closing price	-0.002	0	0.037	0.177	-0.212	583
Friday closing price to Monday opening price	-0.002	-0.001	0.037	0.165	-0.285	583

6. Empirical Results

Table 5 provides the regression results of the first step (Equation 1), and respectively lists the correlation coefficients between the lagged stock price rate of return and the daily stock price rate of return, as well as the correlation coefficients between the lagged market index rate of returns and the daily stock price rate of returns under the two groups of time series mentioned above. The lagged stock price rate of returns under “Friday closing price to Monday closing price” time series, as well as the market index rate of returns under the calculation of the two time series groups, are significantly correlated with the daily stock price rate of returns.

Based on the results in Table 5, the abnormal rate of returns can be obtained by taking difference between R_t and R_{t-1} . And the regression test can be conducted by referring to the formula in the second step (Equation 2), as well as the dummy variables of the match results. After excluding the noise effect of multiple matches in a same trading day or a same weekend, Table 6 provides the correlation coefficients between abnormal rate of return and all dummy variables, as well as significance test results.

According to previous studies on traditional sports, except for the matches played on weekends, it is assumed that stock prices on trading days will immediately reflect the win or loss of the day’s match results. In the process of collecting data, however, the current study found that some of the matches were held at night local time. Therefore, the impact of the match results should be reflected in the next trading day’s stock prices. In this case, on the basis of the two time series, the study calculates and provides the test results of the abnormal rate of returns on the match day and the

next trading day respectively, namely, the abnormal return (AR) and the normalized abnormal return (NAR).

According to the data shown in Table 6, the study found that except for the normalized abnormal returns as dependent variable under “Friday closing price to Monday closing price” time series, championship wins in other time series are significantly positively correlated with abnormal returns (or normalized abnormal returns). It shows that investors prefer to regard the wins of championship titles as a key factor for the future profitability of Astralis Group. Winning championship titles can not only directly gain the largest proportion of prize pool money, but also accumulate E-sports club fans, as well as acquire more potential business opportunities such as E-sports product endorsements, sponsorship and advertisements in the future. According to Astralis Group’s 2020 annual report, around 27% of the Group’s revenue came from prize pool money and other league revenues, while its 2021 annual report showed that prize pool money and other league revenues increased to 42%, ranking only second to commercial endorsements’ 51%.

Table 5. Results of mean Equation (1): December 9, 2019 to April 8, 2022.

	Friday Closing Price to Monday Closing Price	Friday Closing Price to Monday Opening Price
α_0 (constant)	-0.0023(0.1295)	-0.0022(0.150)
$R_{t-\gamma}$ (lagged return)	-0.0814(0.0495*)	-0.0324(0.427)
$R_{Mt-\gamma}$ (lagged market return)	0.1117(0.3409)	0.0732(0.527)
R_{Mt} (market return)	0.5647(1.07e-06***)	-0.5714(9.07e-07***)

observations	583	583
		<i>p</i> -value in parenthesis

Table 6. Win and loss regression results of Equation (2): December 9, 2019 to April 8, 2022.

	Close to Close Weekend Returns		Close to Open Weekend Returns	
	AR	NAR	AR	NAR
constant	0.0091(0.0203*)	0.0123(0.0033**)	-0.0038(0.2561)	-0.0055(0.0814.)
championship win	0.0451(0.0352*)	0.0304(0.1826)	0.0583(0.0017**)	0.0482(0.0055**)
championship loss	-0.0118(0.6980)	-0.0062(0.8463)	0.0031(0.9066)	0.0063(0.7971)
playoff win	-0.0196(0.0855.)	-0.0092(0.4465)	-0.0151(0.1224)	-0.0038(0.6813)
playoff loss	-0.0119(0.1978)	-0.0205(0.0395*)	-0.0020(0.8060)	-0.0028(0.7073)
adjusted R ²	0.0192	0.0168	0.0386	0.0325
observations	583	583	583	583

Note: AR (abnormal return), NAR (normalized abnormal return), *p*-value in parenthesis

In order to examine if the similar results can be obtained with subsamples, the study repeats the regression tests with the data from December 9, 2019 to March 29, 2021. Same as Table 5, Table 7 provides the regression results in the first step with subsamples. Except for the lagged return and lagged market return in the “Friday closing price to Monday closing price” time series, other variables are significantly correlated with the daily stock price rate of return. And same as Table 6, Table 8 employing subsamples provides the the correlation coefficients between abnormal rate of

return and all dummy variables, as well as significance test results.

Table 7. Results of mean Equation (1): December 9, 2019 to March 29, 2021.

	Friday Closing Price to Monday Closing Price	Friday Closing Price to Monday Opening Price
α_0 (constant)	-0.0021(0.335)	-0.0023(0.315)
$R_{t-\gamma}$ (lagged return)	-0.0044(0.937)	-0.1103(0.045*)
$R_{Mt-\gamma}$ (lagged market return)	0.0583(0.725)	0.4758(0.004**)
R_{Mt} (market return)	0.8414(2.05e-07***)	0.4660(0.005**)
observations	321	321

p-value in parenthesis

Table 8. Win and loss regression results of Equation (2): December 9, 2019 to March 29, 2021.

	Close to Close Weekend Returns		Close to Open Weekend Returns	
	AR	NAR	AR	NAR
constant	0.0140(0.0199*)	0.0191(0.0041**)	0.0091(0.0717.)	-0.0106(0.0266*)
championship win	0.0436(0.0913)	0.03567(0.2071)	0.0556(0.0113*)	0.0533(0.0102*)
championship loss	-0.0074(0.8340)	-0.0074(0.8490)	0.0175(0.5591)	0.0062(0.8273)
playoff win	-0.02296(0.1638)	-0.0213(0.2368)	-0.0176(0.2032)	-0.0139(0.2873)
playoff loss	-0.0212(0.1780)	-0.0261(0.1315)	-0.0178(0.1803)	-0.0078(0.5320)

adjusted R ²	0.0168	0.0084	0.0527	0.0412
observations	321	321	321	321

Note: AR (abnormal return), NAR (normalized abnormal return), *p*-value in parenthesis

As the results shown in Table 8, the regression test results of playoff wins and losses with subsamples are not statistically significant, which indicates that investors did not attach great importance to the performance of a single playoff match. However, as the results shown in Table 6, the study finds that, in the “Friday closing price to Monday closing price” time series, there is a significantly negative correlation between the normalized abnormal return and playoff loss. In contrast to the results shown in Table 6 that playoff losses were not significantly correlated with stock price, the current study considers that, as E-sports companies have developed over time, the number of CS:GO E-sports teams have increased, and the CS:GO matches have become more and more competitive, investors found it more and more difficult for Astralis Group to win championship titles and began to attach more importance on its playoff match performance. Therefore, the negative correlation between playoff loss and normalized abnormal return is reasonable since playoff loss directly means that Astralis Group might not gain more bonuses from prize pool or commercial endorsements. As for the significantly negative correlation between playoff win and abnormal return under “Friday closing price to Monday closing price” time series shown in Table 6, the study checked all of the match results from Astralis Group’s pre-IPO to now, and argues that the reasonable explanation is possibly because, after its IPO, many of the playoff matches Astralis Group won were not so much impressive and overwhelming than in the past (pre-IPO period), even against much weaker opponents. Therefore, investors would be concerned

about that such performance would not attract many E-sports club fans' attentions, which, again, represent a large source of revenue.

In general, the positive correlation between the dummy variable of championship win and abnormal rate of return, as well as the statistical significance degrees of the dummy variables of championship win and loss are much higher than the counterparts of playoff win and loss, indicating that investors perceive that championship matches are more important and influential than playoff matches, and championship wins as a key element contributing to Astralis Group's future profitability. Meanwhile, as Astralis Group's revenue gained from prize pool money and other league revenues has increased from 27% of the total operating revenue in 2020 to around 42% in 2021, the playoff match results, which could directly determine the amount of prize pool money and other league revenues, have become more and more important data for investors to evaluate and refer to Astralis Group's operating conditions. In addition, while Brown and Hartzell (2001) argue that on-field losses have a greater impact on stock prices of traditional listed sports clubs, the current study is consistent with the research made by Palomino *et al.* (2009) in that they found that wins have a dominating effect on stock price returns.

7. Conclusions

Based on an event study tested by two-step regression models, the current research provides empirical evidence that the on-stage performance of championship wins of Astralis Group have a statistically significantly positive impact on its stock returns, which partly supports the study's hypothesis. Besides, some of the dummy variables of playoff match results are not statistically significant, indicating that not all of match wins are equally important to investors. Especially, the regression results of the current research are in accordance with the previous study about traditional sports made by Palomino, Frederic and Renneboog in 2009. The current research elaborates the prior studies about the relationship between on-field performance results and stock returns of traditional sports clubs, finding that the relationship holds for E-sports clubs as well, which means that investors also regard powerful E-sports clubs as promising and profitable.

In addition to the relationship between on-stage performance of CS:GO matches and stock returns of Astralis Group, there are also many other interesting points and directions worthy of scholars' attentions. Firstly, for instance, from its IPO (December 8, 2019) to now, it's only two and a half years. And the current research exclusively focuses on its CS:GO club. But Astralis Group actually owns five E-sports clubs (Astralis in CS:GO, Origen in LOL, Future FC in FIFA, as well as two start-up clubs in Rainbow Six: Siege and Fortnite). As time goes on, the other clubs would also get more opportunities to play on stage, providing more match results, accumulating more club fans and generating more revenues. Therefore, future researches could extend time span, obtaining more comprehensive data of match results of Astralis Group together with more data of its stock prices and OMXC25 market index to do regression test, investigating if qualitatively similar results or

more statistically significant results could be obtained. What's more, as shown in the literature review part above, in addition to on-field performance, there are also many other events that could impact traditional sports clubs' stock returns, such as product endorsements, sponsorship announcements, the transfers of famous players, the appointments of eminent coaches and so on. For now, listed E-sports companies and related events are comparatively rare, but as the number of listed E-sports companies increase, more and more related events could be captured. In that case, future research could have opportunities to examine the correlations between stock prices of owning E-sports companies and such events, leading investors to make rational decisions.

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