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Where is the missing value? Evidence from the game industry IPOs underpricing in Poland

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Abstract: The underpricing phenomenon on financial markets has long been the research subject in many financial areas – from neoclassical to behavioral finance. Once confirmed as a persistent pattern, it has begun an ongoing discussion as to its possible causes. Our study examined the phenomenon of IPO underpricing for companies from the game sector in Poland from 2016 to 2020. Many IPOs in Poland have attracted both international companies and investors, making the Warsaw Stock Exchange a kind of financial hub for game companies. Analyzing the whole IPO market in Poland, we however found substantial IPO underpricing, which is statistically higher in the game sector than in the no-game group of debuting companies. Our research argues that the issuer's industry may influence the size of the IPO's first-day return. We also noticed that the way the IPO was carried out influenced the underpricing. Greater underpricing characterized private offers compared to public offers.

Keywords: behavioral biases, game industry, IPO underpricing
JEL Classification: G41, G11, G12

1 Introduction

The Polish game sector is a phenomenon on a global scale. With around 470 active game producers and publishers, over 600 new releases annually, and € 969 million in revenues in 2020, it joined an exclusive club of only several countries where more games are exported than imported [Marszałkowski et al., 2021]. Considering the number of employees, the Polish game industry is second only to Great Britain in Europe. The position in the Top200 Steam wishlists also showed the strength of the Polish gaming sector. According to *GameAnalitycs.info*, in August 2021, 38 games from Poland were on this list, which made it the leader. Polish companies were ahead of those from the USA (35 titles), Canada (16), Great Britain (15), and Sweden (12).[1]

1 Considering: Top100 Steam wishlists Poland ranks second after the US, and as regards Top20 Steam wishlists, only the US and Sweden outperform Poland.

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The increase in revenues and profits in the game industry attracts investors and game companies conducting IPOs. In 2020, only Tokyo Stock Exchange listed more game companies than Warsaw Stock Exchange (WSE). With more debuts in 2021, Warsaw took the lead, becoming the financial hub for game companies.[2] What attracts companies is the possibility of raising capital through an IPO. High rates of return attract investors. They can result from the phenomenon of IPO underpricing, defined as the difference between the closing price of the company's first trading session and the price of the shares offered through an IPO.

There are many theories about underestimating prices in IPOs. They focus on information asymmetry [Akerlof, 1970; Spence, 1973; Rothschild and Stiglitz, 1976] and ownership and control of the company [Williamson, 1963; Jensen and Meckling, 1976; Fama and Jensen, 1983]. There is also a group of studies emphasizing assumptions from behavioral finance, primarily regarding the disposition effect [Shefrin and Statman, 1985]. However, the relative contribution of these theories to the explanation of the empirical data on the undervaluation of public offering prices is far from conclusive. Therefore, no single theory has yet been identified as the one to best explain this phenomenon.

The article aims to investigate the influence of: (i) the industry from which the issuer originates and (ii) the way the offer is conducted (private or public[3]), on the underpricing phenomenon. For this, we examined the changes in rates of return and share turnovers on IPOs for companies from the game sector at their debuts and thereafter, and then compared them with rates of return and volumes on IPOs for companies from outside this sector. The increasing role of companies belonging to the gaming sector on the WSE dictated the choice of this group of companies for our analysis; in 2016–2020, they were the largest group of companies debuting in the Polish capital market. Based on the analysis of a research group comprising 99 companies, covering all of the IPOs on WSE during 2016–2020, a cross-sectional research was presented in the article that allowed for verification of the research hypotheses used in this study; these hypotheses concern the phenomenon of underpricing in the IPO offers of the game sector, and are further described as follows:

(i) The first hypothesis concerns the statistical significance of IPO's first-day return for game companies.
(ii) We compared IPO underpricing of the game sector with overall market IPO's first-day return assuming that underpricing may be higher in the game sector because of the investors' expectations resulting from the behavior of game indices, which grew relatively more compared to other WSE indices.
(iii) In the short term after the debut, we assume behavioral factors remain the major factors responsible for changes in the company's capitalization, in contrast to the longer period in which fundamental factors play a greater role. Searching for the causes of underpricing in the game sector, the behaviors of prices and share turnover after a short (1 month) and long (1 year) period from the debut were also analyzed.
(iv) The last hypothesis assumes that there is a relationship between the type of offer (private or public) and the IPO's first returns.

Our contribution to the extensive literature devoted to the occurrence of the phenomenon of underpricing results from our focus on a regional study on IPO underpricing in the game industry in Poland. We assume that the specificity of the industry can affect the size of IPO underpricing. Here, an important factor influencing its appearance in game companies' IPOs is the behavioral factor related to the expectations of high rates of return on the IPO by investors. It is due, in most cases, to the private nature of IPOs addressed only to selected investors, and with public offerings, it is associated with large reductions in submitted subscriptions for the shares. Therefore, our results may contribute to the broader scientific international literature on IPO's underpricing in three different areas: (i) behavioral biases observed among IPO investors, (ii) market specific IPO patterns for private and public offers, and (iii) IPO underpricing factors' identification.

2 International game company Huuuge Games debuted on the Warsaw Stock Exchange after conducting the largest mobile game IPO in European history (US$ 445 million) in February 2021. Huuuge Games is registered in the US. and has offices in eight countries.

3 As there is no formal definition of private offering under Polish law, the concept of private placement is basically a colloquial term. In practice, with reference to the EU Directive 2017/1129/EC ("Prospectus Law"), it has become common to label an offer as a private offer if securities are not addressed to more than 149 investors within the last 12 months.

The remainder of the article is structured as follows. The second part presents an overview of the theoretical and empirical literature on undervaluing the issue price of the shares in IPO processes. Part three presents and describes the data used to verify the research hypotheses, while part four presents the method used for conducting the research and the results obtained from the same. The final part of the article presents the conclusions.

2 Literature review

The theoretical and empirical literature on IPO underpricing is broad. One of the earliest explanations of this phenomenon is the study of Miller [1977]. Miller hypothesized that the underestimation of IPO price is because IPO price is determined based on the average opinion of investors, while the post-IPO price is determined by the valuation of the most optimistic investors. This is because the prices of listed stocks are determined by marginal transactions. Miller's hypothesis is based on three intuitive assumptions: differences of opinion, limitations related to short selling, and that a minority of potential investors can absorb the entire supply of new shares issued in the IPO.

Underestimating prices in IPOs can also be analyzed from different perspectives. Rock [1986] models underpricing as compensation, i.e. a discount for uninformed investors for participating in an IPO. Many studies [e.g., Chen et al., 2014; Chaplinsky et al., 2017] show that the phenomenon of underpricing increases with information asymmetry in line with this assumption. Also, Hanley and Hoberg [2012] drew up consistent evidence on this phenomenon by analyzing the content of prospectuses related to IPOs.

In turn, Tinic [1988] and Hughes and Thakor [1992] argue that issuers use underpricing to reduce their legal liability. Bartling and Park [2010] underline that the underwriters specifically lower the issue price because they want to avoid financial and reputational costs related to the possibility of an offer not closing if it meets with insufficient demand from investors. Boeh and Dunbar [2016] found that there is a dependence on the level of underpricing and the engagement of the underwriter.

According to Habib and Ljungqvist [2001], underpricing can also be the result of costly marketing expenses associated with the entire process, while recent studies by Borello et al. [2019] and Ma et al. [2017] have shown that increased pre-IPO marketing reduces the scale of this phenomenon.

Aggarwal et al. [2002] examined underpricing as a strategic decision aimed at maximizing the profits of management by selling shares after the expiration of lock-ups. Similar behavior can be observed in cases wherein the vast majority of shares from IPOs go to institutional investors, who are the main beneficiaries of underpricing in public offerings [Ljungqvist and Wilhelm, 2002]. These results find a continuation in the observations of Chemmanur et al. [2010], who proved that more than 70% of institutional investors receiving their shares in an IPO sold them within 1 year, generating a gain from underpricing. It is worth mentioning that similar studies were carried out for investment certificates, where the premium and discount were linked to the presence of institutional investors [Levis and Thomas, 1995]. Additionally, it was found that their share in closed-end funds fell to only 5% after three quarters from the fund's opening [Welch, 1989].

Another part of the literature tries to connect the fact of underpricing with the assumptions underlying behavioral finance. Szyszka and Zielonka's study [2007] can be mentioned as an example for this mode of inference; their study focused on the rates of return on IPOs and the volume of transactions on the debut date on the Central Eastern Europe (CEE) stock exchanges, both in the immediate aftermath of the IPO and thereafter. The explanation of IPO underpricing was mainly related to the occurrence of utility functions that differ among investors and to the anomaly described in behavioral finance literature as the disposition effect.

There is also a well-established literature dealing with the cyclical nature of IPO markets. Changes in the IPO volume over time cause cycles or "waves." Their highs are referred to as "hot" markets and their lows as "cold." Some studies claim that hot markets are temporary windows of opportunity, during which investors are more optimistic and willing to invest, and the cost of equity is low [e.g. Pagano et al., 1998; Helwege and Liang, 2004].

3 Data

The research group covered all debuts of companies from 2016 to 2020 on the WSE Main Market and the NewConnect market. Ninety-nine companies that debuted on the WSE in 2016–2020 raised polish zloty (PLN) 18.7 billion. Out of them, 32 companies represented the game sector. Especially from 2018 to 2020, the number of companies from this sector increased on the WSE. In the first 2 years of this period, they accounted, respectively, for 39% and 53% of all debuts, but in 2020, 10 game companies entered the trading floor, which accounted for almost two-thirds of all debuts on the WSE occurring during that year. Statistics of debuts in the game sector in relation to all debuts are presented in Figure 1, and Table 1 presents the number of companies listed in those years on the WSE main market and in the alternative trading system NewConnect, where smaller companies from the small and medium enterprises (SME) sector are listed. The data source is WSE yearbooks, 2016–2020.

Twenty-five game companies made their debut on the NewConnect market, raising PLN 77.9 million. Most of the offers preceding the NewConnect debut were purely private, while nine of them were partially or entirely public offers, which raised PLN 26.9 million. Seven game companies had their debut on the main market of the WSE, acquiring PLN 539.9 million in public offerings.

Game companies are heavily represented in the Polish stock exchange. At the end of 2020, these were 52 companies (after Q3 2021, this number increased to 75), which puts the Polish stock exchange in the first place in the world in terms of the number of representatives of this sector in trading, just ahead of Japan (47), which until 2020 was the leader in this area. Thirty-eight of them are listed on the NewConnect market, and the remaining 14 are on the main trading floor of the WSE.

Great interest in the game sector among investors resulted in the creation of the stock exchange index for the game producers, Warszawski indeks giełdowy (WIG) Games. Since its publication on September 21, 2018 it increased by 116.71% on December 31, 2020, while the broad market index, WIG, decreased by 2.1%, and the NewConnect index, NC INDEX, rose by 118.5%, as shown in Figure 2.

To test the research hypotheses, the differences between the offering price and the first trading day closing price were subjects of the study both for public and private offers before stock exchange debuts. Because of the nature of the study, the rates of return on IPOs in 1-month and 1-year periods were also

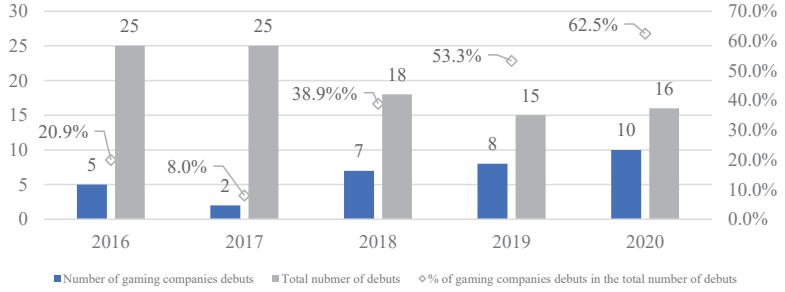


Figure 1. Number of game companies debuting on the WSE and NewConnect in 2016–2020.
Source: Own research based on WSE data. WSE, Warsaw Stock Exchange.

Table 1. Basic statistics of NewConnect and WSE issuers in 2016–2020*

		2016	2017	2018	2019	2020
NewConnect	Listed companies	406	408	387	375	377
	Debuting companies	16	19	15	15	14
WSE Main Market	Listed companies	487	482	465	449	436
	Debuting companies	19	15	7	7	7

*The table does not include withdrawals of companies from the stock market.
WSE, Warsaw Stock Exchange.

calculated. The statistics comprising the rates of return on initial offers in the game sector for the first day (D1), the first month (M1), and the first year from the start of trading (Y1) are presented in Table 2. We also analyzed the volume of transactions that took place on the debut days and a month and a year after the debut in relation to the number of issued shares.

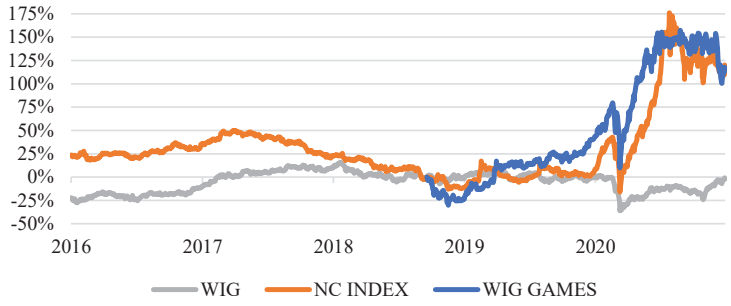


Figure 2. NC INDEX, WIG 20, and WIG Games indices in 2016–2020. Although the WIG Games sector index was launched on March 18, 2019, its values were presented starting from September 21, 2018.
Source: WSE data. WSE, Warsaw Stock Exchange.

Table 2. Characteristics of the first offers rate of returns from the game and all sectors

		D1	M1	Y1
Game IPOs (All: 32)	Min-Max (%)	−69.5 to 250.5	−80.2 to 379.7	−81.0 to 657.8
	Median (%)	32.7	49.8	57.1
	Mean (%)	55.0	57.5	86.8
	SD (%)	79.6	91.3	151.5
Game IPOs (NewConnect: 25)	Min-Max (%)	−69.5 to 250.5	−80.2 to 379.7	−81.0 to 657.8
	Median (%)	34.5	48.6	66.8
	Mean (%)	58.9	64.3	101.9
	SD (%)	87.2	101.0	161.6
Game IPOs (Main Market: 7)	Min-Max (%)	−6.9 to 101.9	−14.4 to 67.6	−56.4 to 179.1
	Median (%)	30.9	57.0	1.7
	Mean	41.2	32.8	26.6
	SD	45.2	37.3	90.1
No-game IPOs (All: 67)	Min-Max (%)	−44.0 to 620.0	−72.0 to 485.1	−88.5 to 1,186.7
	Median (%)	13.6	9.4	−15.1
	Mean (%)	48.5	39.3	57.2
	SD (%)	105.5	95.5	206.6
No-game IPOs (NewConnect: 44)	Min-Max (%)	−44.0 to 620.0	−72.0 to 485.1	−88.5 to 1,186.7
	Median (%)	37.4	15.8	−1.9
	Mean (%)	71.3	55.8	90.2
	SD (%)	122.3	114.4	246.2
No-game IPOs (Main Market: 23)	Min-Max (%)	−29.3 to 62.8	−32.0 to 84.9	−79.7 to 179.1
	Median (%)	3.8	5.4	−19.6
	Mean (%)	5.1	8.5	−4.0
	SD (%)	15.7	21.3	68.3

Source: Own study based on WSE yearbooks 2016–2020.
WSE, Warsaw Stock Exchange.

4 Research

4.1 IPO underpricing in case of the game companies in relation to no-game companies debuting on the WSE

In the first part of the study, the average IPO first-day returns rates and their statistical significance were computed for the game and no-game companies (Table 3). The results show that the underpricing phenomenon occurred in both game and no-game sectors in 2016–2020. The analysis of the average values and the median of the IPO discount shows that the level of underpricing was higher in the game sector compared to companies from other industries (55.0% vs. 48.5% for means and 32.7% vs. 13.6% for medians). In case of debutants in the game sector, 25 out of 32 of them (78.1%) made their debut above the IPO price. In the no-game sector, the proportions were similar. Underpricing occurred in 76.1% of cases (51 out of 67 companies).[4]

Table 3. Characteristics of the first offers rates of returns from the game and no-game sectors in the period 2016–2020

	All game sector	Game sector: private offers	Game sector: public offers	Game sector: NewConnect	Game sector: Main Market
Mean (%)	55.0	87.7	22.3	58.9	41.2
SD	0.795664964	0.936708	0.450111	0.871573	0.451503
t-Statistics	3.911173637	3.746282	1.981368	3.377911	2.413904
Statistical significance	***	***	*	***	*
N	32	16	16	25	7
	No-game sector	**No-game: private offers**	**No-game: public offers**	**No-game: NewConnect**	**No-game: Main Market**
Mean (%)	48.5	44.3	36.3	71.3	5.1
SD	1.0550432	0.561801	1.202298	1.24181	0.157155
t-Statistics	3.7656406	4.800103	1.596541	3.805891	1.551933
Statistical significance	***	***		***	
n	67	37	28	44	23

The statistical significances are given as 10%, 5%, and 1%, respectively, corresponding to *, **, and ***.
The second and third columns do not include combined offers, i.e., when some shares were sold in a private placement and some in a public one.
Source: Own study based on WSE yearbooks 2016–2020.
WSE, Warsaw Stock Exchange.

Comparing the phenomenon of IPO underpricing in both game and no-game sectors, we can state that greater underpricing characterized private offers than public ones. The same applies to the IPOs of companies aiming at NewConnect as compared to larger companies to be listed on the WSE's prime market. This difference may result from the fact that private placements are addressed to a limited group of investors. Here, investors who were not invited to take part in an IPO but would like to become shareholders of given companies are forced to buy shares during the stock exchange listing. We can also assume that investors who took part in a private placement are aware of their privileged position. They do not accept premiums that are lower than in case of the public offers. A majority of them are professional investors, known to and

4 The assumption that underpricing is higher in the game sector in comparison with other groups of companies was also verified by examining the difference in rates of return on debuts between game and non-game companies and its statistical significance (H_0: $u_1 - u_2 \leq 0$).

Table 4. Characteristics of the first offer rate of returns from the game and no-game sectors for subsequent years in the period of 2016–2020

		2016	2017	2018	2019	2020	2016–2020
Game sector	Debuts	5	2	7	8	10	32
	Underpricing	3	1	6	7	8	25
	Overpricing	2	1	1	1	2	7
	Mean (%)	25.7	–16.3	20.9*	73.6*	93.0**	55.0***
	Median (%)	22.0	–16.3	23.3	39.1	84.9	32.7
No-game sector	Debuts	20	23	11	7	6	67
	Underpricing	16	16	9	4	6	51
	No change	0	2	1	1	0	4
	Overpricing	4	5	1	2	0	12
	Mean (%)	24.1**	27.6***	45.5*	47.1	217.3	48.5***
	Median (%)	12.7	8.7	17.4	28.0	67.8	13.6

Source: Own study based on WSE yearbooks 2016–2020.
WSE, Warsaw Stock Exchange.

chosen by the entity offering shares. Private issues are also smaller and addressed to non-impulse investors who have more experience in stock exchange investments.

Private issues prevail on NewConnect because of their much lower values compared to the IPOs in the WSE main market. In the period 2016–2020, the average value of the IPO preceding the debut on NewConnect was € 0.96 million (median € 0.46 million), compared to the WSE, where the average value of the IPO was € 138.0 million (median € 17.5 million). Another reason why underpricing on NewConnect was higher compared to the WSE's main market is the structure of investors in both markets. Individual investors who dominate NewConnect[5] are aware of the limited possibilities of participating in an IPO because of their private nature and low value. Also, high expectations regarding the potential development of these companies, which start from a low revenue and income base, cause great interest in debuts on NewConnect, regardless of the industries they represent. Institutional investors cover IPOs on the Main Market to a much greater extent, investing more selectively. This may additionally limit the occurrence of certain emotional elements in IPOs.

The dynamics of the occurrence of the phenomenon of IPO underpricing in individual years also deserve attention (Table 4). In 2016–2017, four out of seven debutants from the game industry made their debut above the IPO price. In the following years, however, underpricing became a common phenomenon. In 2019, as in 2018, in the group of game companies IPOs, there was only one case where the share price at the end of the first day of quoting was lower than during the IPO, and in 2020, among 10 companies that debuted on the stock exchange, underpricing can be observed in eight cases. The scale of underpricing also increased in subsequent years, with the increased number of debuts that appeared along with the growing WIG Games index. In 2018, the average underpricing was 20.9% (with a median of 23.3%), in 2019 it increased to 73.6% (median 39.1%), and in 2020 it was 93.0% (median 84.9%).

Comparing the underpricing in the game and non-game sectors in individual years, we can see greater underpricing in the no-game sector in 2017–2018, which also coincides with a much larger number of debuts from companies outside the game sector. The increased importance of the game sector, as evidenced by the establishment of the stock exchange index for this sector in 2019 and its rally thereafter, resulted in increased interest in this industry among investors, and consequently affected the number of game IPOs. Along with usually relatively small amounts of money raised privately to selected investors before the stock exchange debut, we can see an increase in the underpricing scale in the group of game companies in relation to underpricing for debutants from other industries.

5 In the first half of 2020, individual investors generated 22% of the turnover on the Main Market and 93% on the NewConnect market (WSE 2020)

4.2 Determinants of IPO underpricing in case of the game and no-game sectors

The model for testing the potential determinants of IPO underpricing level is based on univariate linear regressions measuring the relationship between a dependent variable that stands for IPO underpricing and one independent variable (chosen from a set of potential explanatory variables), which were selected based on the hypotheses formulated in the paper and literature. The independent variables concern underpricing in the following groups of companies debuting in Warsaw: (i) all companies (all IPOs), (ii) game companies (game IPOs), and (iii) no-game companies (no-game IPOs). As Table 4 shows, a method of conducting an offer (public or private) is an especially important determinant of the IPO underpricing among game and no-game companies; and the regressions were also done for following sub-groups of companies: (iv) game companies with private offer IPOs, (v) game companies with public offer IPOs, (vi) no-game companies with private offer IPOs, and (vii) no-game companies with public offer IPOs. Given the dataset of dependent variables y_i and the explanatory variables x_i the models we applied were simple linear regressions, as indicated in Eq. (1).

$$y_j = \alpha + \beta_{xi} + \varepsilon_i \tag{1}$$

where ε_i is the random component of the regression and x_i represents for each model one of the following variables regarding the following potential IPO underpricing determinants: (i) belonging to a game or no-game group (zero-one variable), (ii) private or public offering (zero-one variable), (iii) debut on the NewConnect market or on the WSE main market (zero-one variable), (iv) year of IPO, (v) behavior of indices (variables related to changes in WIG, WIG_GAMES, and NCINDEX indices for four periods: change in the index price on the debut day [D1], the closing price on the debut day compared to the previous day close [D–1], change in the closing price on the debut day compared to the close from the week before [W–1], and change in the closing price on the debut day compared to the previous month's price [M–1]), (vi) the size (capitalization) of the company, and (vii) the variables relating to the size of the offer and the value of shares introduced to trading (offer value, value of instruments introduced, and value of free float). We used ordinary least squares (OLS) to estimate the parameters α (a constant term) and β (the coefficient term).

The regression results are set out in Tables 5 and 6.[6] First, the estimated coefficients are depicted; second, *t*-statistic is used to test if a coefficient is statistically equal to zero (values in parentheses); and third, *P*-values that serve as evidence in rejecting the hypothesis of a zero coefficient are marked with asterisks depending on the significance level (* indicates $P < 0.10$, ** $P < 0.05$, and *** $P < 0.01$).

The regressions results for all companies show that underpricing can vary among different industries. The significance of the game variable implies higher potential underpricing compared to no-game companies. The variables for private offers and NewConnect debuts are highly significant at 1%. These results support the observations discussed in Section 4.1, showing that the way the offer is done has a huge impact on the underpricing level. NewConnect market, where offers are smaller and in majority addressed to a limited number of investors, favors IPO underpricing as well. The third most significant variable is the year of the issue. Along with an increase in market sentiment, accompanied by an increase in indices and a higher number of IPOs, higher rates of return on debuts were observed. The role of these four factors: (i) belonging to the game sector, (ii) the way the issue was conducted, (iii) the selection of the quotation market, and (iv) the choice of the IPO period, was decisive in terms of the influence of the analyzed factors on the level of underpricing. Other factors, such as the size of the issuer, the value of IPO, free float, or the

6 A total of 97 out of 99 IPOs were analyzed in the econometric study. Two companies were excluded: genXone and Spyrosoft, which represented outliers. GenXone had a 523.2% return rate on the debut (the company doing COVID-19 tests), whereas in the case of Spyrosoft, the figure was 620.0% (following underpricing resulting from a specific IPO carried out at non-market prices and offered only to employees for the amount of PLN 100,000).

Table 5. Regression results (1)

	All IPOs	Game IPOs	No-game IPOs
Game [1]\no-game [0]	0.225698 (1.691601)*	-	-
Private [1]\public [0]	0.386802 (3.183515)***	0.654334 (2.518507)**	0.276035 (2.230298)**
NewConnect [1]\WSE [0]	0.381886 (2.893440)***	0.176881 (0.513660)	0.423386 (3.470867)***
Year of IPO	0.137598 (3.141277)***	0.216724 (2.296288)**	0.067208 (1.261736)
WIG [D1]	1.047926 (0.118864)	−2.592949 (−0.130189)	2.148557 (0.244202)*
WIG [D−1]	−5.629779 (−0.966431)	0.462730 (0.043916)	−10.58843 (−1.558410)
WIG [T−1]	−1.333989 (−0.437430)	3.440564 (0.496711)	−3.639609 (−1.213683)
WIG [M−1]	−1.685412 (−1.147583)	−1.495686 (−0.555861)	−1.976673 (−1.168461)
WIG.GAMES [D1]	−8.883673 (−1.346062)	−12.16628 (−1.467447)	9.211253 (0.848898)
WIG.GAMES [D−1]	9.098525 (1.673614)	13.13837 (1.610657)	−1.203189 (−0.198984)
WIG.GAMES [W−1]	4.423977 (1.613811)	6.805883 (1.572765)	−0.256893 (−0.090821)
WIG.GAMES [M−1]	0.292906 (0.219987)	0.852879 (0.355876)	−0451682 (−0.398930)
NCINDEX [D1]	1.235625 (0.221317)	6.259028 (0.717509)	−9.900088 (−1.255147)
NCINDEX [D−1]	−5.852847 (−1.740861)*	−6.749160 (−1.486992)	4.135325 (0.505896)
NCINDEX [W−1]	0.719481 (0.309206)	0.313350 (0.080819)	2.081392 (0.687925)
NCINDEX M−1 [M−1]	1.740658 (1.842382)*	1.666198 (1.198618)	1.170435 (0.702659)
The value of the offer	−1.18E−11 (−0.191373)	−2.16E−09 (−0.627552)	1.42E−12 (0.028054)
The capitalization of the company	8.80E−13 (0.062622)	−2.56E−10 (−0.471025)	3.43E−12 (0.296494)
The value of the shares introduced to the trading	1.16E−12 (0.082512)	−2.23E−10 (−0.409770)	3.62E−12 (0.313099)
The value of free float	7.45E−12 (0.145098)	−5.65E−10 (−0.295387)	1.73E−11 (0.448894)
N	97	32	65
Underpricing – mean	39.89%	55.01%	32.44%
Underpricing – SD	62.02%	78.31%	50.53%
Number of private IPOs	53	16	37
Number of public IPOs	44	16	28

Source: Own study.
WSE, Warsaw Stock Exchange.

stock market situation on the day and in the period immediately preceding the debut, turned out to be insignificant.

The analysis of the underpricing phenomenon in the game sector showed that there are only two statistically significant regressors ($P < 0.05$): (i) the way of conducting the offer (private placement or public offer) and (ii) the time of debuting. In case of the no-game, only the following factors were, again, discovered to be statistically significant: (i) whether the offer was private or public, and (ii) on which market the stock exchange debut took place.

Interesting conclusions emerge when analyzing the factors influencing the scale of underpricing depending on the method of conducting an IPO offer. An in-depth analysis of the issues of private IPOs of the game companies shows that the lower the free float the greater the underpricing. Other factors were not statistically significant. This is because of the potentially lower supply of shares during the debut, which is below the demand from investors who were not invited to take part in an IPO, but would like to become company shareholders. With public issues of the game companies, there are more determinants of underpricing, with the most important factor being the stock market situation on the day and in the period preceding the stock exchange debut.

Table 6. Regression results (2)

	GIPOS – Private offers	GIPOs – Public offers	No-GIPOS – Private offers	No-GIPOS – Public offers
NewConnect [1]\WSE [0]	-	−0.335962 (−1.548574)	-	0.652091 (4.470154)***
Year of IPO	0.247473 (1.563250)	0.162970 (2.227296)**	−0.043191 (−0.454099)	0.153701 (3.497488)***
WIG [D1]	5.228206 (0.124626)	−11.72320 (−0.857939)	25.61639 (1.964242)*	−21.73320 (−2.529616)**
WIG [D−1]	5.216321 (0.395991)	−30.11302 (−1.575983)	−3.482968 (−0.343858)	−19.48325 (−2.715175)**
WIG [T−1]	10.66208 (0.943780)	0.936019 (0.158950)	−1.985592 (−0.449925)	−4.191893 (−1.180513)
WIG [M−1]	−8.617495 (−1.548601)	3.686187 (2.234503)**	−1.604716 (−0.654016)	−2.029404 (−1.005749)
WIG.GAMES [D1]	−13.23927 (−1.332557)	3.092303 (0.172944)	−22.57897 (−1.367175)	−1.712193 (−0.092173)
WIG.GAMES [D−1]	14.88058 (1.463901)	−7.880833 (−0.656460)	−3.949185 (−0.903998)	−21.54909 (−1.469102)
WIG.GAMES [W−1]	7.684992 (1.046982)	2.511047 (0.716086)	−2.865255 (−1.256690)	−0.094838 (−0.019052)
WIG.GAMES [M−1]	−3.197250 (−0.390122)	1.291315 (1.056550)	−1.339054 (−2.357194)*	3.829869 (1.525959)
NCINDEX [D1]	2.871421 (0.263108)	45.90438 (3.135237)***	−14.64240 (−1.052499)	0.257850 (0.031096)
NCINDEX [D−1]	−6.640788 (−1.175878)	21.46843 (2.240100)**	17.47464 (1.490351)	−16.05207 (−1.776898)*
NCINDEX [W−1]	−1.692563 (−0.326314)	7.159107 (1.562447)	2.872322 (0.648556)	3.690085 (1.025435)
NCINDEX M−1 [M−1]	1.003331 (0.328602)	2.316720 (3.002314)***	3.256832 (1.314066)	−0.277059 (−0.145136)
The value of the offer	−3.22E−08 (−0.310808)	1.16E−09 (0.540782)	−2.80E−08 (−2.407204)**	3.11E−11 (0.784123)
The capitalization of the company	−9.77E−09 (−0.891123)	2.05E−10 (0.622635)	−4.37E−09 (−2.296425)**	9.14E−12 (1.029754)
The value of the shares introduced to the trading	−2.06E−08 (−0.919658)	2.37E−10 (0.723325)	−5.15E−09 (−1.791981)*	9.19E−12 (1.036916)
The value of free float	−1.48E−07 (−2.022439)*	8.69E−10 (0.770001)	−1.72E−08 (−1.967373)*	3.19E−11 (0.921920)
n	16	16	37	28
Underpricing – mean (%)	87.73	22.30	44.53	16.73
Underpricing – SD (%)	90.70	43.58	55.43	37.89
Number of private IPOs	16	0	0	28
Number of public IPOs	0	16	37	0

Source: Own study.

WSE, Warsaw Stock Exchange; GIPOS, Game Initial Public Offering; IPO, Initial Public Offering; NC, NewConnect.

Underpricing that occurs in no-game companies where private placements were conducted, the size of the offer, the size of the company, and the related number of admitted shares are statistically significant. With public offerings, the statistically significant regressors are related to the market quotation and the year of issue. Interestingly, the level of underpricing with public issues is negatively correlated with the behavior of stock exchange indices on the debut day, which may suggest a shift in the demand from shares of other companies to shares of debutants on that day.

4.3 Evolution of prices and volume after the debuts on the WSE in case of the game and no-game sectors

The next stage of the analysis was to examine the price and volume behavior after the debuts in both groups of companies. The analysis of the rate of return and volume after the debut was carried out for two periods: 1 month (1M) and 1 year from the debut (1Y), and then it was compared with the IPO rate of return and the volume at the first day of listings. The purpose of this study was to search for the causes of underpricing, which are related to the activity of investors on the first trading day compared to later periods.

As far as the comparison of returns between D1, M1, and Y1 is concerned, we assume that if the stock exchange price fell in a short period (1M) after the debut, it could mean that the causes of underpricing should be sought, among others, in behavioral factors. The behavioral effect is related to the desire to have shares in the investment portfolio that could not be purchased in the IPO (because of the private nature of the issue or in case of the significant reduction of subscriptions for shares in public offerings). In such situations, IPO prices were inflated, first as a result of IPO investors' lack of willingness to sell shares in the absence of satisfactory premiums, and second by the high demand from investors who wanted to have these shares in their portfolios. The assumption that there is a relationship between underpricing and the price development in the short term after the debut (1M) arises from the fact that, as a rule, little time passes from an IPO to a debut and a month later, and there is usually no change in the fundamentals of the company during this time that would justify a change in capitalization. Thus, behavioral factors remain the main factors responsible for changes in the company's capitalization in the short term, in contrast to the longer period (1Y) in which fundamental factors play a greater role. This is because of investors' greater knowledge of financial results or implementing the strategy described in the offer documents.

Table 7 shows the average rates of return in 1 month and 1 year from the IPO for companies from the game sector and other companies with their statistical significance, while in Figure 3 we compare the average rates of return in the periods D1, M1, and Y1.[7]

In the group of all game companies, the average rate of return 1 month after the debut slightly increased, resulting in an underpricing rise from 55.0% to 57.5%. A similar slight increase can be observed in the group of game companies that conducted private offers that dominate on NewConnect (from 58.9% to 64.3%). With public offerings, which had much less underpricing than private offers (25.7% vs. 87.7%), average prices 1 month after the debut increased by 7.6%. In the longer term, except for shares sold in offerings preceding the Main Market debut, prices were also rising as measured by the behavior of their mean. A similar pattern of behavior characterized no-game companies, with the difference that the IPO underpricing was smaller in their case. A greater difference is visible with public offerings (and IPOs on the Main Market, where such offers dominate). However, it is difficult to arrive at a definite conclusion as regards these groups of companies, because of the lack of statistical significance of the average rates of return, which is mainly the result of the large diversification of price behavior in these groups of companies.

7 Taking into consideration the risk factor, there is a huge difference in standard deviations between the average rates of return in the periods D1, M1, and Y1 in two markets operated by the WSE (NewConnect vs. the Main Market) and under two offerings regimes (private vs. public placement) in both groups of companies, i.e. from the game and non-game sectors. The problem of risk related to IPOs, including the relations between the rates of returns and accompanying risk for IPOs carried out on different markets and under various legal regimes in Poland, will be the subject of our further research.

Table 7. Characteristics of the IPO rates of returns from the game and no-game sectors after 1M and 1Y from their debuts

	All game companies	Game companies: private offers	Game companies: public offers	Game companies: NewConnect	Game companies: Main Market
M1					
Mean (%)	57.5	82.8	32.1	64.3	32.8
SD	0.9129986	1.12129	0.57303	1.009563	0.373363
t-Statistics	3.5599357	2.953819	2.24144	3.186955	2.327168
Statistical significance	***	***	**	***	*
N	32	16	16	25	7
Y1					
Mean (%)	86.8	124.9	45.6	101.9	26.6
SD	1.5153339	1.813899	1.031422	1.615579	0.901035
t-Statistics	2.8656941	2.483026	1.531832	2.821211	0.659583
Statistical significance	***	**		**	
n	25	13	12	20	5
	No-game companies	**No-game companies: private offers**	**No-game companies: public offers**	**No-game companies: NewConnect**	**No-game companies: Main Market**
M1					
Mean (%)	39.3	34.6	29.2	55.8	8.5
SD	0.95514002	0.745913	0.851727	1.143894	0.213319
t-Statistics	3.34354364	2.782819	1.816058	3.196773	1.921225
Statistical significance	***	***	*	***	*
n	66	36	28	43	23
Y1					
Mean (%)	57.2	87.0	23.7	90.2	−4.0
SD	2.0659316	2.496368	1.1270009	2.462339	0.682876
t-Statistics	2.1450145	2.09152	1.0307249	2.286424	−0.26624
Statistical significance	**	**		**	
n	60	36	24	39	21

The statistical significances of 10%, 5%, and 1%, respectively, are indicated by *, **, and ***.

The second and third columns do not include combined offers, i.e., when some shares were sold in a private placement and some in a public one.

1M: 1 month; 1Y: 1 year.

The average volumes of debutants in trading were next examined for the first day, 1 month, and 1 year after debuts (Table 8). The trading volumes were higher on the first trading day than after a month and a year for the game and no-game debutants regardless of whether they were private or public issues, as well as whether they were debuts on NewConnect or the Main Market of the WSE. The behavior of investors taking part in the IPO, who sell shares at the debuts, is often associated with their privileged position in relation to those investors who could not take part in the IPOs because of their private nature or a large reduction during subscription in the process of public offerings. It confirms the disposition effect, i.e., relatively quick profit-taking [Shefrin and Statman, 1985], as a natural consequence of the utility function from the prospect theory [Kahnemann and Tversky, 1979].

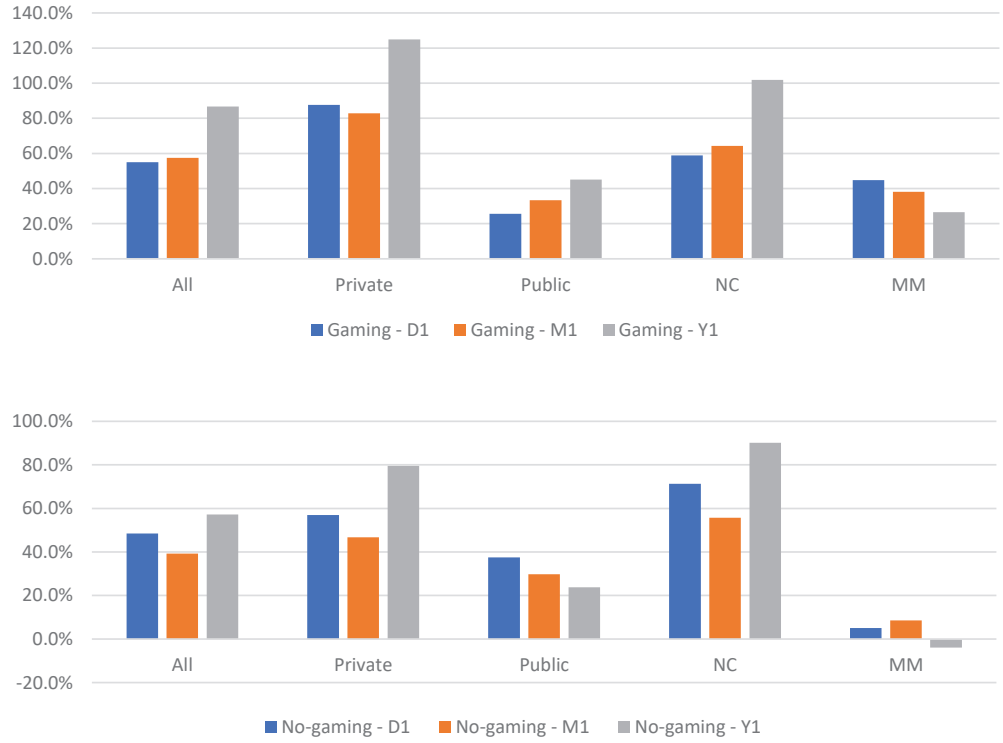


Figure 3. Comparison of the IPO rates of returns from the game and no-game sectors on the first day of quotation and after 1M and 1Y from their debuts. D1: day of the debut; M1: 1 month after the debut; Y1: 1 year after the debut.

Table 8. Trading volumes for IPOs in the game and non-game sectors at D1, M1, and Y1

	All game companies	Game companies: private offers	Game companies: public offers	Game companies: NewConnect	Game companies: Main Market
D1					
Mean	301,399	392,770.13	210,028.38	302,120.24	298,824.29
SD	324,138.2165	383,423.80	228,716.65	340,636.188	280,529.67
t-Statistics	5.26001422	4.097503876	3.6731629	4.43464685	2.818293
Statistical significance	***	***	***	***	**
n	32	16	16	25	7
M1					
Median	47,356.26	49,809.42	25,252.60	34,647.57	65,907.36
Mean	46,110	65,481.96	38,200.14	50,551.74	56,445.72
SD	64,024.69073	70,470.72	35,322.09479	61,516.64934	36,850.69
t-Statistics	4.074008224	3.716832367	4.325920183	4.108785612	4.052607
Statistical significance	***	***	***	***	***
n	32	16	16	25	7
Y1					
Mean	21,799	32,078.55	10,088.99	22,219.54	18,739.66
SD	24,961.54411	26,106.18	13,673.27731	24,969.7522	18,422.20
t-Statistics	4.366518793	4.430402103	2.556028617	3.97956683	2.274601

Continued

Table 8. Continued

	All game companies	Game companies: private offers	Game companies: public offers	Game companies: NewConnect	Game companies: Main Market
Statistical significance	***	***	**	***	*
n	25	13	12	20	5
	No-game companies	**No-game companies: private offers**	**No-game companies: public offers**	**No-game companies:**	**No-game companies: Main Market**
D1					
Mean	1,682,788.53	264,882.69	3,616,701.90	242,531	4,375,444.09
SD	7,967,161.488	687,115.736	12,060,749.3	633,481	13,234,094.7
t-Statistics	1.728873927	2.34490122	1.58678263	2.53956804	1.58559337
Statistical significance	*	**		**	
n	67	37	28	44	23
M1					
Mean	273,144.88	125,825.75	479,961.58	108,894	580,222.98
SD	1,153,059.543	435,097.9301	1,696,355.2	399,257	1,863,483.4
t-Statistics	1.924479554	1.73513692	1.4971616	1.78848255	1.4932528
Statistical significance	*	*		*	
n	66	36	28	43	23
Y1					
Mean	41,138.96	25,143.03	65,132.87	23,364	74,150.33
SD	104,656.6287	71,163.42	139,245.0352	68,584	147,016.8
t-Statistics	3.044824247	2.119884	2.291532867	2.12741262	2.311296
Statistical significance	***	**	**	**	**
n	60	36	24	39	21

Source: Own study.
1D: day of the debut; 1M: 1 month after debut; 1Y: 1 year after debut.
The statistical significances are given as 10%, 5%, and 1%, respectively, corresponding to *, **, and ***.

5 Conclusions

This study examined the phenomenon of IPO underpricing for companies from the game sector in Poland. The most important findings are as follows.

First, we found substantial underpricing while studying IPOs, which is statistically higher in the game sector (55.0%) than in the no-game group of debuting companies in Poland (48.5%). Our research argues that the specific issuer's industry may influence the size of the IPO underpricing. This finding is consistent with the results of several studies in the literature, including Atkinson and LeBruto [1995] who studied IPOs in the game sector, and Canina et al. [2008] and Borghesi et al. [2015] who analyzed IPO issuances in the hospitality sector. This may result from higher expectations regarding future quotations resulting from, among others, relatively greater increases in the WIG-game index compared to indices for the entire market.

Second, we noticed that the way the IPO was carried out influenced the underpricing. Private offers were characterized by greater underpricing than public ones. Since private offers dominate on the NewConnect market and public offers on the WSE main market, the IPO underpricing was also greater on the market that is tailored for innovative SMEs compared with the WSE main market, which is largely dedicated to

larger companies. Greater underpricing with private placement may result from the privileged position of investors in relation to those who could not buy shares in the IPO. It means that investors who were not invited to take part in an IPO but would like to become shareholders of given companies were forced to buy shares during the stock exchange listing.

Third, the analysis of price and volume behavior during and after the debuts showed that there may exist behavioral causes of IPO underpricing in the game IPOs. From the perspective of the demand side, the behavioral effect is related to the desire to have shares in the investment portfolio that could not be purchased during the IPO. The large supply of shares at the first trading session confirms the disposition effect, i.e., relatively quick profit-taking as a natural consequence of the utility function from the prospect theory.

Although our findings address only the Polish case, the paper contributes to the broader international literature on the IPO underpricing and also may apply to the investment practice not only for managing the investments and trading strategies but also in preparing the IPOs, including setting the issue prices. Knowledge of the scale and reasons for the occurrence of an IPO underpricing can be used in practice to increase the effectiveness of the financial market in the IPO segment.

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