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Factors Influencing IPO Underpricing in Poland

Abstract: We review the theory and evidence on IPO activity and underpricing focusing on the Warsaw Stock Exchange. Although the topic has been under investigation in the past, we believe that the recent decade of low interest rates deserves inquiry. We research the extent of underpricing during this period and further conclude that three factors had a statistically significant influence on initial public offering underpricing during this period: the year of IPO, risk-free rate and WIG close value.

Keywords: IPO, underpricing, Poland, behavioural finance

JEL: G11, G15, G24

1. Introduction

Companies that sell shares on the stock exchange for the first time (Initial Public Offering) advertise and offer incentives to new shareholders. To attract investors, shares are usually offered at a price which is lower than that resulting from valuations. The procedure is called "underpricing". The size of the incentives and pre-IPO valuations are confidential and as such difficult to research. To assess underpricing, an indicator of Initial Return (IR) is calculated based on the price at the end of the first day of trading and the price at which shares were sold to new investors.

Data gathered by Jay Ritter (2018) indicate that IPO underpricing in the United States fluctuates substantially, averaging 21.2 in the 1960s, 7.1% in 1970s, 6.9% in the 1980s, 21% in the 1990s, and 21.1% in the years 2001–2017[1]. Ritter further indicates that underpricing depends upon the size of the company issuing shares and prior financing sources. Initial return decreases with the size of the company (measured in revenues). Underpricing is also higher for venture capital backed companies than it is for growth and buy-out funds financed companies.

Underpricing on the Warsaw Stock Exchange also varied. Earlier research was conducted by Aussenegg (2000: 69–99), Lyn and Zychowicz (2003: 181–195), Jewartowski and Lizińska (2012: 59–75), Sieradzki (2013), Lizińska and Czapiewski (2015: 112–125). Higher underpricing in the 1990s is attributed to privatisation processes in the Polish economy. After the year 2000, underpricing decreased. Czapiewski et al. (2014) indicate underpricing of 34.1% in the period 1991–2000 and 13.5% in the period 2001–2011. Pomykalski and Domagalski (2015) reported 11.89% in the period 2005–2013. Going a step further, Wołoszyn and Zarzecki (2013: 121–135) researched the impact of "the January effect" on IPO underpricing in Poland.

Similar research has been conducted in other countries by Chowdhry and Sherman (1996: 359–381), Habib and Ljungqvist (2001: 433–458), Banerjee, Dai and Shrestha (2011: 1289–1305), Chan, Wang and Wei (2004: 409–430) in China, Cassia et al. (2004: 179–194) in Italy, Chambers and Dimson in the UK (2009: 1407–1443), Mezhoud and Boubaker in France (2011: 166–180), Ganesamoorthy and Shankar in India (2013: 36–38).

In this study, we investigate underpricing in IPOs on the Warsaw Stock Exchange (WSE) between 2005 and 2016. Since there is sufficient scientific evidence to assume that IPO underpricing existed in this period and that it is likely to exist in the future, these results are used as a background for further analysis of factors

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1   Based on data available on Jay Ritter's website: https://site.warrington.ufl.edu/ritter/ipo-data/ [accessed: 1.04.2018].

influencing the extent of underpricing in this period. We analysed three groups of potential factors and focused on the impact of three: the year of IPO, risk-free rate and WIG close value.

We admit that findings of this study are limited to the WSE and one economic cycle.

We believe that the results of this study may be interesting for analysts, investors, consultants and managers involved in IPOs. The researched period was characterised by low interest rates and we believe that this factor makes our research and its results worth considering.

2. Dataset and methodology

In this paper, we investigate IPOs of 349 companies quoted on the Main Market of the Warsaw Stock Exchange that took place between 2005 and 2016. Only companies which offered their shares to the public for the first time were taken into consideration. Firms previously quoted on the WSE or another market were excluded from the sample.

Table 1. Number of IPOs in the years 2005–2016 (adjusted for companies previously quoted)

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
No of IPOs included	35	37	81	33	13	26	29	15	16	25	25	14

Source: own elaboration

Data for the WIG – Warszawski Indeks Giełdowy (Warsaw Stock Exchange Index) – are published by the Warsaw Stock Exchange. During the researched period, the number of IPOs and WIG closing values were loosely correlated. The number of public offerings dropped after 2008 and remained lower than in prior years even though the stock market recovered and reached higher valuations. The reasons for that may vary but the primary reason may be that better access to debt financing combined with low interest rates seem to decrease the attractiveness of public equity financing.

Our research results indicate that average underpricing on the WSE in the years 2005–2016 was 12.35%. Further analysis indicates that underpricing changes over time, with the size of the offer, and due to other factors.

To assess underpricing, we used two methods. Using the first method, we compared the first day closing price to the offering price. Using the second method, we subtracted broad market index change.
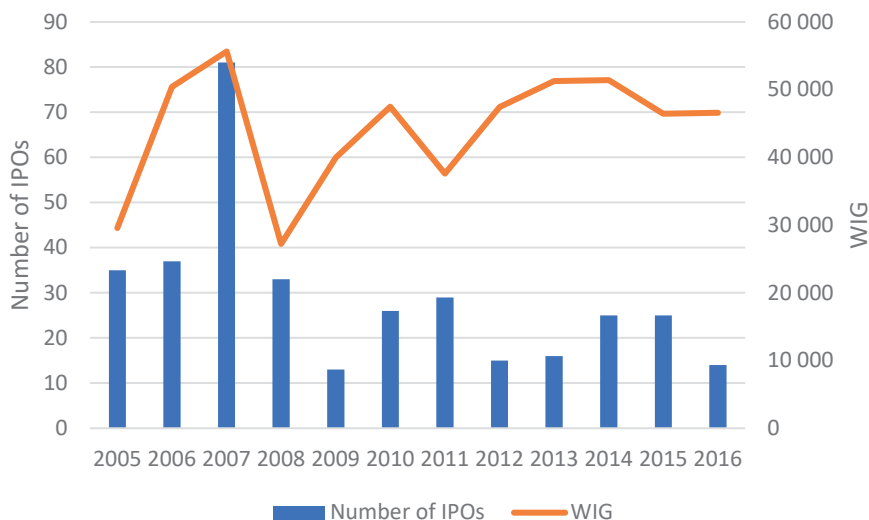
Figure 1. WIG and number of IPOs
Source: own elaboration

To assess underpricing, a ratio of initial return (IR) is calculated (Saunders, 1990: 3–12; Fijałkowska, Muszyński, Pauka, 2013: 415–426).

$$IR_{i,t} = \frac{PC_{i,t} - PO_i}{PC_{i,t}} \cdot 100\%, \tag{1}$$

where:
$IR_{i,t}$ – initial return (return on the first day (t) the company (i) was traded),
$PC_{i,t}$ – first day (t) closing price of company (i) shares,
PO_i – offering price of the company (i).

In the second step, the broad market index change is subtracted from the initial return. In this paper, we used Warszawski Indeks Giełdowy (WIG), the main index of the Warsaw Stock Exchange. This method is less popular than the first one but, according to Hunger (2003), Sieradzki (2013: 1–37) and Czapiewski et al. (2014: 571–590), it provides more reliable results, as stock market (index) changes may impact first day closing prices.

$$IAR_{i,t} = IR_{i,t} - IR_t^{WIG}, \tag{2}$$

where:
IAR – initial adjusted return on the day (t) that the company (i) debuted,
$IR^{WIG}_{i,t}$ – return of broad market index on the day (t) that the company (i) debuted.

Any list of factors influencing underpricing is subjective. The list of factors used in this research was created from most commonly used statistics in publications of the WSE.

Table 2. Factors affecting underpricing

Factor	Description
Year	The year of IPO.
Offering Price	Initial price of one share.
New issue [%]	Part of the company that was offered to the public in percentage.
IR [%]	Initial rate of return (underpricing).
WIG change [%]	Percentage change of WIG on the day that the company was offered.
WIG close	Value of broad market index in base points.
Offering value	Total offering value of the company in PLN.
Risk-free rate	Risk free rate on the day that the company was offered.
Number of IPOs	Number of IPOs in the year that the company was offered.

Source: own elaboration

As a risk-free rate, we have taken the reference rate of the National Bank of Poland.

Table 3. Reference rate (on 31 December)

Year	2005	2006	2007	2008	2009	2010
Reference rate	6.00%	4.00%	4.00%	5.70%	3.81%	3.50%
Year	2011	2012	2013	2014	2015	2016
Reference rate	4.15%	4.55%	2.73%	2.34%	1.54%	1.50%

Source: National Bank of Poland data

We have chosen ordinary least squares methodology to look for correlations between underpricing and factors. This methodology was previously used in underpricing examination of IPOs on New Connect by Fijałkowska, Muszyński and Pauka (2013: 415–426).

We used Gretl open source statistical package to perform the analysis. IR was the dependent variable. Factors listed in Table 2 were used as regressors.

3. Results

3.1. Underpricing

Average underpricing (initial return) of the 349 companies which debuted on the Warsaw Stock Exchange from 2005 to 2016 was 12.35%. In comparison to 2005–2013 (Pomykalski, Domagalski, 2015: 117–131), the average rate of return on the first day increased by 0.46%.

The average adjusted IR (IAR) underpricing of IPOs is 11.84%, which is smaller than IR. Decreasing change of the adjusted IR is expected. It means that IPOs were increasing their value more when there was a positive change of WIG. According to the calculation performed, the average influence of WIG change on the closing price is 0.51%.

Table 4. Analysis of Initial Return (IR) and corrected Initial Return (IAR)

	IR	IAR
Average	12.35%	11.84%
Median	4.71%	4.15%
Minimum	–74.07%	–72.20%
Maximum	481.33%	480.07%
Standard deviation	36.71%	36.32%
Skewness	7.34	7.42
Curtosis	81.52	82.83
IPOs with negative initial returns	94.00	100.00
IPOs with positive initial returns	238.00	249.00
IPOs with initial returns equal to 0	17.00	0.00

Source: own elaboration

The median for IR is 4.71% and it is a lot lower than the average which is 12.35%. The same situation is for the corrected IAR – 4.15% compared to 11.84%.

The distribution is far from normal (curtosis of 81.52 for IR and 82.23 for IAR). Skewness is positive (7.34 for IR and 7.42% for IAR), which means there are more results above the average than below the average values.

Almost 27% of the offers were overpriced (29% if IAR is used). 238 companies brought a positive initial return while considering IR, which is 68% of all IPOs (249 companies or 71% if IAR is used). The majority of IPOs are underpriced and results indicate the existence of underpricing on the Warsaw Stock Exchange.

The level of underpricing varies. In 27% of the cases, initial return was negative and in one case it amounted to –74.07%. This means that investing in IPOs on the WSE in hope of exploiting underpricing is associated with risk and may bring disappointing results.
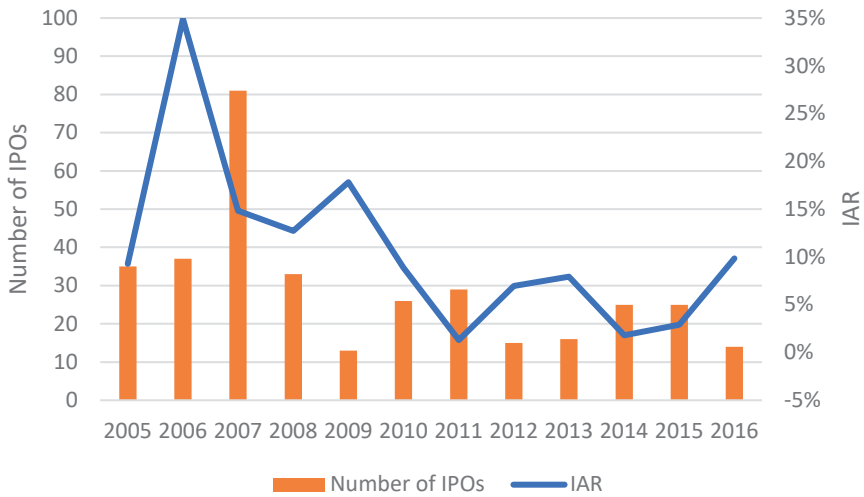
Figure 2. Number of IPOs and IAR in the years: 2005 to 2016

Source: own elaboration

During the researched period, IAR was inversely proportional to the number of IPOs in individual years (Figure 2). This confirms similar conclusions by Henricson (2012: 1–45) on the Swedish market and Chi and Padgett (2005: 71–93) on the Chinese market.

3.2. Analysis of independent variables

Table 5. Summary statistics

	Offering price	New issue	WIG change	WIG close	Offering value	Risk free rate	Number of IPOs
Average	28.759	0.750	3.378e−05	47351,000	2.539e+08	0.039	40.728
Median	13.330	1.000	0.001	47872,000	4.240e+07	0.040	33.000
Minimum	0.510	0.000	−0.043	24333,000	0.000	0.015	13.000
Maximum	539.500	5.500	0.043	67289,000	1.072e+10	0.060	81.000
Standard deviation	57.629	0.457	0.010	10209,000	9.760e+08	0.013	23.174
Skewness	5.436	3.247	−0.451	−0.353	7.310	−0.159	0.958
Curtosis	35.119	37.975	2.375	−0.322	60.633	−0.462	−0.608

Source: own elaboration

Table 6. Correlations between independent variables

		Year	Offering Price	New issue [%]	IR [%]	WIG change [%]	WIG close	Offering value	Risk free rate	Number of IPOs	WIG log
Year	Pearson correlation	1.000	0.002	–0.059	–0.157**	0.072	0.179**	–0.001	–0.766**	–0.498**	0.243**
	significance		0.970	0.310	0.007	0.216	0.002	0.991	0.000	0.000	0.000
Offering Price	Pearson correlation	0.002	1.000	–0.128*	0.039	0.017	0.128*	0.260**	–0.065	0.053	0.120*
	significance	0.970		0.028	0.510	0.777	0.028	0.000	0.264	0.364	0.040
New issue [%]	Pearson correlation	–0.059	–0.128*	1.000	0.014	–0.076	0.016	–0.157**	0.045	0.055	0.017
	significance	0.310	0.028		0.813	0.193	0.788	0.007	0.439	0.346	0.772
IR [%]	Pearson correlation	–0.157**	0.039	0.014	1.000	0.048	0.073	–0.021	–0.014	0.101	0.073
	significance	0.007	0.510	0.813		0.413	0.210	0.723	0.809	0.085	0.213
WIG change [%]	Pearson correlation	0.072	0.017	–0.076	0.048	1.000	0.038	–0.009	–0.066	0.007	0.043
	significance	0.216	0.777	0.193	0.413		0.510	0.873	0.262	0.908	0.458
WIG close	Pearson correlation	0.179**	0.128*	0.016	0.073	0.038	1.000	0.008	–0.470**	0.624**	0.990**
	significance	0.002	0.028	0.788	0.210	0.510		0.897	0.000	0.000	0.000
Offering value	Pearson correlation	–0.001	0.260**	–0.157**	–0.021	–0.009	0.008	1.000	0.022	–0.024	0.009
	significance	0.991	0.000	0.007	0.723	0.873	0.897		0.712	0.686	0.873
Risk free rate	Pearson correlation	–0.766**	–0.065	0.045	–0.014	–0.066	–0.470**	0.022	1.000	0.136*	–0.514**
	significance	0.000	0.264	0.439	0.809	0.262	0.000	0.712		0.020	0.000
Number of IPOs	Pearson correlation	–0.498**	0.053	0.055	0.101	0.007	0.624**	–0.024	0.136*	1.000	0.546**
	significance	0.000	0.364	0.346	0.085	0.908	0.000	0.686	0.020		0.000
WIG log	Pearson correlation	0.243**	0.120*	0.017	0.073	0.043	0.990**	0.009	–0.514**	0.546**	1.000
	significance	0.000	0.040	0.772	0.213	0.458	0.000	0.873	0.000	0.000	

** Correlation is significant at the 0.01 level. * Correlation is significant at the 0.05 level.

Source: own elaboration

There are statistically significant correlations between independent variables at a level of 0.01 and 0.05. In order to meet ordinary least squares requirements, we have performed Variance Inflation Factors statistics to examine a collinearity problem. Since all of the values are below 10, collinearity problem does not exist.

Table 7. Variance Inflation Statistics

Year	4.423
OfferingPrice	1.114
NewIssue	1.238
WIGchange	1.017
l_WIGclose	3.280
l_OfferingValue	1.338
RiskFreeRate	3.361
NumberofIPOs	3.634

Source: own elaboration

Two of the independent variables have much higher values than the rest: WIGclose and OfferingValue. In order to have a similar scale, natural logarithms of these variables were used in the model.

Four OLS models were built. The first model consists of all variables listed in Table 7. P-value was the highest for the variable NewIssue which was rejected from the second model. The second model R-squared was higher than the first model R-squared. In the second model, p-value was the highest for the variable OfferingPrice which was rejected from the third model. The third model R-squared was higher than the second model R-squared. Since rejections from the third model would lower the R-squared, the third model was the final one.

Two of the variables have a statistically significant impact on IR at a level of 0.01: the year and risk-free rate. One variable has a statistically significant impact on IR at a level of 0.05: the number of IPOs. Considering significance at the 0.1 level, one variable has an impact on IR: WIGclose.

Table 8. Ordinary least squares analysis

Dependent variable = IR			
	coefficient	std. error	t-ratio	p-value
Const	126.2360	25.9428	4.8660	1.8800e-06***
Year	−0.06375	0.0131	−4.8710	1.8400e-06***
WIGchange	2.0631	1.9385	1.0640	0.2881
l_WIGclose	0.2658	0.1504	1.7670	0.0783*
l_OfferingValue	−0.0202	0.0126	−1.6070	0.1092
RiskFreeRate	−9.4979	2.9669	−3.2010	0.0015***
NumberofIPOs	−0.0037	0.0017	−2.2300	0.0265**

Dependent variable = IR			
	coefficient	std. error	t-ratio	p-value
Mean dependent var	0.1175	S. D. dependent var	0.3581
Sum squared resid	34.1815	S.E. of regression	0.3445
R-squared	0.0936	Adjusted R-squared	0.0747
F(8, 286)	4.9570	P-value (F)	0.0001
Log-likelihood	−100.6813	Akaike criterion	215.3625
Schwarz criterion	241.1714	Hannan-Quinn	225.6970

Source: own elaboration

The factor with the most significance is the year of the IPO (Figure 3). The coefficient of the year variable was –0.06, which means that the higher the year value, the lower the underpricing level. In developing markets, this can be explained by efficient market hypothesis (EMH). Fama (1965: 34–105) described an efficient market as "a market where prices at every point in time represent best estimates of intrinsic value. This implies in turn that, when an intrinsic value changes, the actual price will adjust "instantaneously", where instantaneously means, among other things, that the actual price will initially overshoot the new intrinsic values as often as it will undershoot it". Significance of *year* variable means that the WSE is more efficient now than it was in the past. This explanation is controversial. Adams, Thornton and Hall (2008: 67–74) in their study of IPO pricing argue against associating EMH with IPOs.

Figure 3. IAR

Source: own elaboration

Results of this and other studies conducted in Poland using data starting after the year 2000 (Czapiewski et al., 2014: 571–590; Pomykalski, Domagalski,

2015: 117–132) indicate that the level of underpricing was below 21.1% observed by Ritter in the US markets. Assuming that US markets are more developed, the conclusion that underpricing is higher in less developed countries does not hold.

The second most significant factor is the risk-free rate (Figure 4). The coefficient is –9.49. It means that the higher is the risk-free rate, the lower is the IPO initial rate of return. The sign of the coefficient is also expected. When interest rates are high, investors usually save their money because profits from bank deposits are satisfactory. Conversely, if interest rates are low, investors are looking for different investment opportunities because they cannot earn as much as they wish on a bank deposit. For that reason, more people are likely to buy shares when interest rates are low. High interest rates increase demand for shares and consequently first day closing prices.
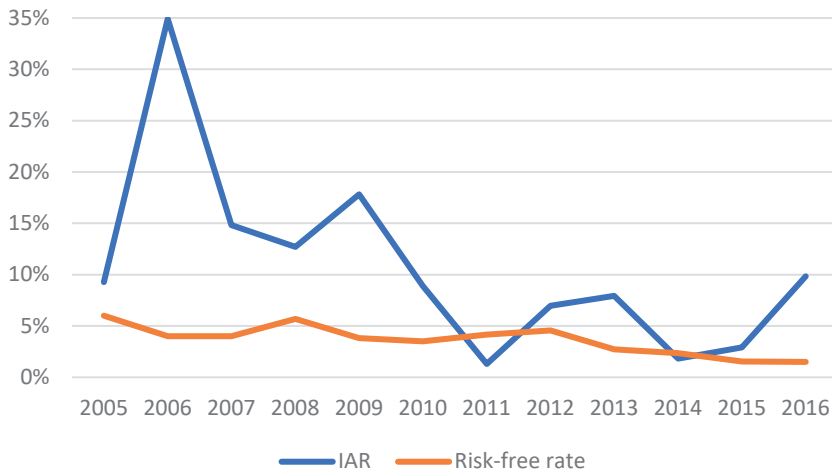
Figure 4. Risk-free rates and IAR
Source: own elaboration

The third most significant factor influencing IPO underpricing is the number of IPOs that took place in a given year (Figure 2). The coefficient is –0.0037 and it is negative, which means that when more IPOs took place in a given year, the underpricing level was lower. One possible explanation is the law of supply and demand. When there are more IPO offers on the market, people are not willing to pay as much as if there were fewer offers.

The least important but also significant factor is the WIG closing level. The WIG (Warszawski Indeks Giełdowy) is a cumulated value of all securities quoted on the Warsaw Stock Exchange. In this case, the WIG close is the level measured at the end of IPO day. The WIG coefficient is positive, which means that the higher the broad market index, the higher the IPO initial return. There is no clear explanation of this phenomenon in the literature. One possible reason of this de-

pendency is stock exchange attractiveness. If the value of broad market index is at a high level, the stock exchange seems to be more attractive to investors who are more likely to invest in IPOs. That causes higher initial returns of IPOs. Adjusted R-squared of the final model is 7.47%. Since the goal of this paper was not to develop a model describing underpricing but to identify factors influencing initial return, the value is rewarding.
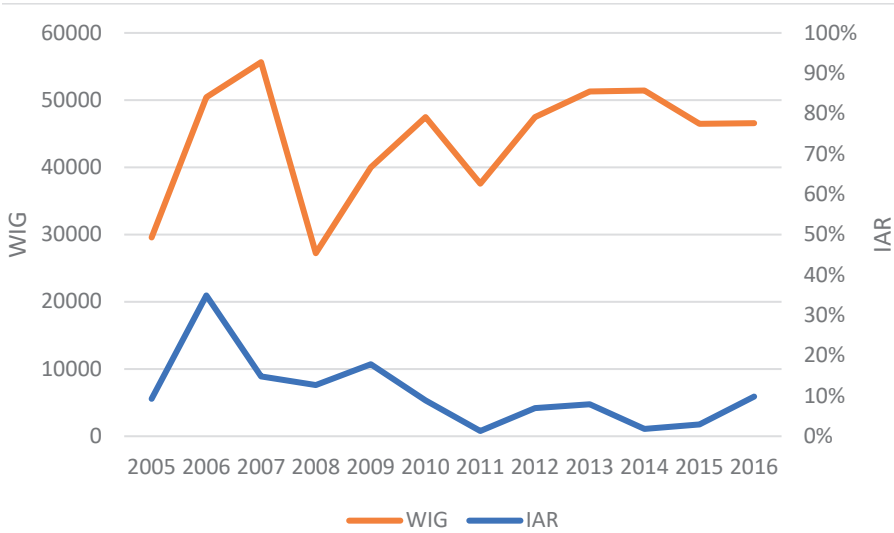
Figure 5. Comparison of WIG and IAR
Source: own elaboration

The impact of WIG on IAR was stronger in the period 2005–2008. This indicates that lower interest rates and the number of IPOs in the later years impacted underpricing to a larger extent than the broad stock market index. This conclusion is based on a short period of analysis and requires further research.

3.3. Limitations of this study

This study is limited to the WSE and one economic cycle. Results may be different in both more mature and less mature markets. We researched the impact of factors from a list of statistics used by the WSE. There may be other factors influencing underpricing as shown by Wołoszyn and Zarzecki (2013: 121–135).

Further research can concentrate on factors such as underwriters' reputation, free float of shares, market segment affiliation and oversubscription.

4. Conclusions

We have examined 349 companies which went public in 2005–2016. We have calculated the initial return and adjusted initial return and obtained results of 12.35% and 11.84% respectively. We have confirmed that underpricing existed during the researched period.

We have also examined the influence of selected factors on underpricing and can conclude that during the researched period three of the examined factors had a statistically significant influence on initial public offering underpricing. The year of IPO (negatively), risk-free rate (negatively) and WIG close value (positively) influenced underpricing during the researched period.

Due to a limited scope of our research (a short period and one market), our results should be treated with caution and used in further inquiries into a possible impact of interest rates and stock market indexes on underpricing.

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Czynniki wpływające na niedoszacowanie cen emisyjnych pierwszych ofert publicznych akcji w Polsce

Streszczenie: W artykule analizujemy teorię oraz dowody występowania zjawiska niedoszacowania cen emisyjnych pierwszych ofert publicznych akcji na Giełdzie Papierów Wartościowych w Warszawie. Mimo że temat był już w przeszłości badany, uważamy, że ostatnia dekada niskich stóp procentowych zasługuje na szczególną uwagę. Zbadaliśmy zjawisko niedoszacowania cen emisyjnych w tym okresie, a także wykazaliśmy, że trzy czynniki miały istotnie statystyczny wpływ na wielkość zjawiska: rok emisji, stopa procentowa wolna od ryzyka oraz poziom zamknięcia indeksu szerokiego rynku w dniu emisji.

Słowa kluczowe: IPO, niedoszacowanie cen emisyjnych, Polska, finanse behawioralne

JEL: G11, G15, G24

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