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What Determines the Success of an IPO? Analysis of IPO Underpricing on the Warsaw Stock Exchange

Abstract

This article aimed to analyse the factors that influence the level of underpricing of an initial public offering (IPO) on the Warsaw Stock Exchange (WSE), based on the example of 101 companies debuting on the main market between 2010 and 2019. We discuss the theories that explain IPO underpricing and the research conducted so far on the Polish market. In the main part of the article, we present the results of our study aimed at identifying and characterising the hitherto-unrecognised factors determining IPO underpricing, which is a contribution to the current research on WSE trends. Our findings point to three variables that influence the level of underpricing: the involvement of private equity or venture capital funds in the transaction, the rate of return of the WSE Index in the 6 months before the IPO, and the amount of capital offered during the debut.

Keywords

IPO underpricing | stock exchange debut | initial rate of return

JEL Codes

G12, G14, G32

1 Introduction

Offering the company's shares to the public in a stock exchange issuance for the first time is known as an initial public offering (IPO). It requires an estimate of the share issue price, which—from the moment of the first listing—is confronted with investors' expectations and assessments. The subsequent stock exchange valuation of the company's shares depends on many market factors that influence the demand and supply on the trading floor, both dependent on and independent of it. For a company, the purpose of going public is to obtain capital, the amount of which depends on both the issue price and the number of shares offered. There are many cases of IPO underpricing worldwide. This practice involves a negative difference between the offer price and the closing price of the first trading day and is measured by the initial rate of return.

Many researchers globally are trying to answer the question of what causes underpricing. Among the first researchers to deal with this topic were Reilly and Hatfield (1969), who studied the US public stock market and found that IPO underpricing is common and laid the foundations for further analysis. Loughran, Ritter, and Rydqvist (1994) documented underpricing ranging from 3.3% to 270.1% across 54 countries. A number of theories have been developed to explain this phenomenon, including theories of information asymmetry; theories of behavioural finance, used by Ljungqvist and Wilhelm (2008), among others, to analyse IPO allocations in Germany, Great Britain, France, and the United States; theories of ownership and control of enterprises; as well as institutional theories verified, e.g. with data from Japan (Beller, Tsunemasa, & Levine, 1992) or Sweden (Rydqvist, 1997). Underpricing has been extensively studied internationally and very

well described in the literature; however, as it is heterogeneous depending on time and latitude, this research problem has still not been fully explained with regard to the Polish capital market. More than a decade has passed since the publication of many of the studies, and the characteristics of the market have significantly changed during this time. Data availability, market size, market mechanisms, analytical tools and investor awareness have considerably improved. In addition, in most cases, researchers only look at underpricing from the point of view of the issuer who sets the price, while disregarding the perspective of investors on the secondary market whose decisions shape the share prices.

This article aimed to analyse the factors that influence the level of underpricing of the IPO on the Warsaw Stock Exchange (WSE) based on 101 companies debuting on the main market between 2010 and 2019. By using econometric tools, we will verify both the supply and the demand factors: those influenced by the issuer and the investors, respectively. We draw on an analysis of offers, fundamental analyses of companies and the market factors of the stock exchange.

The article contains a description of an IPO; it defines the phenomenon of underpricing and refers to the previously developed theories that laid the groundwork for scientific research to date. Then, we analyse the scientific knowledge on underpricing in the Polish capital market. The key parts of this study are the identification and an attempt at defining hitherto-unexplored determinants and a detailed analysis of these factors and variables based on the example of the WSE, using econometric tools.

2 IPO: theoretical considerations

The most frequently cited goal of any enterprise is to maximise the owners' (shareholders') profits and revenues. This is true for any type of company, both the largest ones listed on the New York Stock Exchange and the smallest ones, such as neighbourhood grocery stores. However, in order for a company to develop and meet its goals, it needs capital, and thus, an appropriate financing method. There are many sources for raising capital. One of them, intended primarily for those firms that are no longer in the early stages of development, is to have their shares listed for trade on the stock exchange, i.e. a stock exchange debut.

An IPO is a process that leads to the sale of company shares on the public market through the stock exchange. There are many reasons why companies opt for an IPO. Primarily, the goal is to obtain additional capital to ensure the further development of the business, including expanding the scale of operations, implementing investment projects, achieving faster growth, expanding on the market and, over time, increasing the company's value. An IPO also enhances the company's credibility, increases the prospects of obtaining financing from banks and facilitates access to extra capital through subsequent issues.

However, in addition to a number of advantages, an IPO also has disadvantages. One of them is the obligation to disclose information about the financial situation not only during the IPO itself but also on a regular basis throughout the period when the company is listed on the stock exchange. In addition, selling a company's stock dilutes the owner's control. The high cost of the operation is also important. The large number of IPOs that we observe every year on stock exchanges around the world indicates that the advantages of this form of raising capital must outweigh the disadvantages, and one of the key issues is to determine the opening price in the initial offering.

3 Setting the Issue Price of Shares

Setting the issue price in the initial offering requires the correct valuation of the company and the search for a balance in the game of interests between the company (issuer) making its public debut and the investors. The issuer aims to obtain the highest possible price to raise as much capital as possible, and investors count on the lowest possible price to achieve the highest possible rate of return on investment. The share price set during the IPO determines the level of underpricing or overpricing of the issue.

There are two methods of determining the stock price in the primary market, namely book building and auctions. The former method is the most popular in Poland and around the world. It is preceded by 'investor education', which consists of preparing an investment teaser, i.e. a document containing information about the company, the industry, the company's situation, financial forecasts and its strategy development prospects. Based on this document, discussions are held with potential investors, and the price range

within which investors may consider purchasing the issuer's shares is determined.

In the next stage, the 'roadshow' begins, i.e. meetings of the issuer's management board with investors, and simultaneously, book building, based on which the underwriter determines the issue price and the size of the issue, i.e. the number of shares offered during the debut. The purpose of these meetings is for the management team to make a sales pitch in a series of presentations and persuade potential investors to participate in the transaction. During this time, the brokerage house conducting the IPO gathers offers from prospective institutional investors and determines the number of shares that would potentially sell at a given opening price. After the meetings, based on the prospectus that they have created, the advisors and the management board set the final price and the volume of the IPO.

4 IPO Underpricing

The main goal of an IPO is to obtain as much capital as possible through the issue of stocks. Nevertheless, we can observe stock underpricing during IPOs. This is the situation in which the issue price of a share is lower than the closing price of the share on the first public market day. The extent of this practice can be measured by the initial rate of return, which is calculated as follows (Saunders, 1990):

$$IR = \frac{P_1 - P_0}{P_0}$$

where IR (initial return) is the initial rate of return; P_0 (Price 0) is the issue price of the shares; and P_1 (Price 1) is the closing price on the debut day.

IPO underpricing is an important event for companies that go public. The scale of underpricing in relation to the size of the issue is referred to in the literature as 'money left on the table' (Perera, 2015). For the issuer, this constitutes indirect costs, i.e. funds that could potentially be obtained by setting a higher issue price. In many cases, the money left on the table is much more than just the cost of going public (Woloszyn, 2013).

IPO underpricing, although ubiquitous around the world, is not evenly spread across time or space. Many studies are trying to explain this phenomenon

and determine the factors that influence its scale. The main theories that appear in the literature are discussed in Section 5.

5 Theories of Stock Underpricing During IPO

Ljungqvist (2004) outlines four basic categories of factors that influence shares' underpricing during a market debut: information asymmetry, behavioural or institutional factors and the theory of control of the company.

5.1 Information asymmetry theories

In the group of factors related to information asymmetry, we can distinguish three reasons for IPO underpricing. The first one is the asymmetry of information among the different types of investors to whom the shares are offered (Rock, 1986). Rock posits that institutional investors are better informed than individual investors. As a result, individual investors will decide to buy shares regardless of their quality, while large financial institutions will decide only to invest their funds in an offer with prospects for high profitability. Here, the underpricing effect is a sort of immediate reward for utilising capital resources. An attractive offer results in a larger group of interested parties, allowing more shares to be issued and potentially more funds to be raised.

Baron (1982) presents a theory on the asymmetry of information between the issuer and the underwriter. As the more experienced and the better-informed party, the entity responsible for conducting the IPO is better able to assess the demand on the capital market and thus more accurately evaluate the value of the issuer's shares. The decision on the final issue price lies with the underwriter. Baron's concept assumes a positive correlation between the issuer's uncertainty and the potential demand for the shares offered.

Another theory proposes that the issuer signals the quality of the company to investors. Welch (1989) and Grinblatt and Hwang (1989) have investigated the relationship of information asymmetry between the issuer and the investors. This concept implies that the issuing company is better informed about the true firm value than are the investors willing to buy the

shares. The company, seeking to build good relations with shareholders, offers its shares at a discounted price, which in the future may lead to further issues at much more favourable prices, from the issuer's perspective.

5.2 Behavioural finance theories

Behavioural finance theories presuppose market inefficiency and the irrationality of investor decisions. Ljungqvist and Wilhelm (2008) provide an example of a clearly high level of underpricing during the Internet bubble in 2000, when the irrational optimism of investors led to a re-evaluation of companies from the information technology (IT) industry and related sectors.

Ljungqvist, Sigh, and Nanda (2006) have confirmed the hypothesis that there is a correlation between general optimism on capital markets and demand for securities. During a long-term boom on the stock market, investors do not pay as much attention to the analysis of their investments as during market decline and stagnation. Positive sentiments of investors lead to a noticeable increase in the initial rates of return of newly listed companies. Furthermore, issuers are more likely to conduct an IPO during long-term increases in stock prices to obtain an advantageous valuation of the company by an optimistic market (Szyszka, 2014).

5.3 Theories of company ownership and control

The theories of ownership and control of an enterprise refer to the most important cost of introducing the company's shares to stock exchange trading: the transfer of control over the company. The two theories presented by researchers at the end of the 1990s, although demonstrating opposite effects, document the intentional lowering of shares' issue price.

Brennan (1997) proves that the deliberate underpricing of IPO stocks allows the company owners to retain control. The reason for this is the positive correlation between the level of underpricing and demand from investors. Owing to the low offer price, small shareholdings can be allocated to a wide group of investors to prevent the purchase of a significant number of shares by one entity. Thus, dispersed

shareholding is a tool for the company managers to stay in control.

Stoughton (1998) puts forward a different theory. In his opinion, underpricing reduces agency costs. A lower issue price may allow one investor to acquire a large block of shares and consequently help increase supervision over the firm and positively affect the implementation of the company's long-term plans for development.

5.4 Institutional theories

Ljungqvist (2004) cites three institutional theories that have appeared in the literature: litigation, stabilisation and taxation theories. The first theory has been formulated by Ibbotson (1975). Issuers sometimes choose to set a lower opening price to avoid potential lawsuits arising from significant drops in prices in the early stages of company listing. However, this practice is mainly confined to the US market, where IPO-related litigation is much more common compared to other regions of the world. The risk of a lawsuit is insignificant, e.g. in Germany (Ljungqvist, 1997), Japan (Beller et al., 1992) and Great Britain (Jenkinson, 1990).

Ruud (1993) has proposed a stock price stabilisation theory based on the risk of the market price falling below the offer price within weeks or months of the debut. This phenomenon damages the company's reputation and the investors' confidence. The issuer decides to underprice the issue to minimise the risk resulting from the need to stabilise the prices of IPOs.

The last institutional explanation of IPO underpricing is based on a study carried out by Rydqvist (1997). Having analysed the Swedish market, he shows that, before 1990, when income taxation was much higher than capital gains tax, companies underpriced their IPOs and then offered to remunerate their employees with shares in the company. Thus, the tax benefits far outweighed the cost of stock underpricing.

Although underpricing has been researched all over the world for years, not all the theories are reflected in the Polish market. In Section 6, we discuss the results of the studies conducted so far on companies listed on the WSE.

Tab. 1. Results of the analysis of the determinants of IPO underpricing on the WSE

Variable	Description of variable	Impact
PEVC backed	Use of private equity/venture capital funds in the transaction	-
New shares issued	New shares issued in the total number of shares offered during the IPO	-
PEV	The quotient of the maximum price and the minimum price on the first day of listing	+
Turnover	The quotient of the trading volume on the first trading day and the number of shares sold during the IPO	-
Issued max	Offering the maximum issue price within the range established during the book building	-
Market return	Rates of return of the WIG within 6 months before the IPO	+

IPO, initial public offering; PEV, Parkinson's extreme value; PEVC, private equity or venture capital; WSE, Warsaw Stock Exchange.

Source: Based on the paper by Kavalenka (2018).

6 Underpricing: A Review of Research on the Polish Market

The level of IPO underpricing, although a common phenomenon and noticeable on all stock exchanges around the world, significantly differs depending on the latitude and the time of research (Ljungqvist, 1997).

One of the first studies on the Polish market was carried out by Aussenegg (2000). He examined companies debuting on the WSE between 1991 and 1999. This study showed that at that time, public sector companies (controlled by the treasury) had much higher initial rates of return than private companies. Lyn and Zychowicz (2003) conducted a later study and concluded that there is a positive relationship between the level of underpricing and the average rate of return of the WSE Index (Warszawski Indeks Gieldowy or WIG) over the month before the debut.

Sukacz (2005) analysed 185 companies debuting on the Polish stock exchange between 1991 and 2002. His research identified three factors that influence initial return. He found a positive correlation between the rate of return of the WIG during subscriptions for the purchase of the issuer's shares and the number of days of the subscription and a negative correlation between the rate of return of the WIG and the values of the financial price-to-book (P/B) and price-to-equity (P/E) ratios.

Sieradzki (2013) investigated 314 IPOs that took place between 2003 and 2011. He noted that higher underpricing could be observed among private domestic companies and enterprises migrating from

foreign markets, which contradicts the theory of information asymmetry.

The latest study on the difference between the issue price and the market price at the end of the first trading day was published by Kavalenka (2018). The analysis covered 281 stock exchange debuts from 2005 to 2015. Her findings are illustrated in Table 1.

7 Research Design of the Empirical Study

The purpose of this study is to analyse the factors affecting the level of underpricing for a specifically defined group of debuting companies. Based on the current scientific knowledge, we have attempted to define new factors related to a company's operations that may affect investors' decisions during an IPO and to find the factors affecting the initial rate of return of a company during its IPO. We have verified the hypotheses concerning the determinants of underpricing already investigated in theory and research; however, we have focused on a group of companies that have not yet been analysed in previous studies, in terms of both time and quality. Based on the econometric model, we have tried to answer the question of what motivates investors when making investment decisions during the IPO. The analysis uses basic financial ratios for the company's qualitative valuation in the fundamental analysis.

7.1 Dataset

The empirical research was based on 101 stock exchange debuts on the main market of the WSE between 2010 and 2019. The type of enterprises and the period under analysis are not random. The NewConnect market, which is characterised by lower liquidity, was deliberately omitted in this analysis. Moreover, the companies that make their debut operate on a smaller scale and face higher market uncertainty. Including both markets in one group could distort a study based on fundamental analysis. Transfers from the alternative market to the main market were also omitted due to the asymmetry of information affecting companies that are starting the sale of their shares to the public. The period of the study was selected in such a way as to avoid significant anomalies on the capital market, such as the crisis in 2008. This will better explain the general market trends.

As mentioned in previous studies (Kavalenka, 2018; Sieradzki, 2013), the explained variable is the initial rate of return, i.e. the percentage change between the closing price on the first trading day and the issue price of the shares. The data was obtained from the WSE website.

The source of the explanatory variables was the prospectus of the debuting companies. This is the basic document when carrying out the IPO and the main source of information about the company, which investors use to decide whether to invest their capital.

7.2. Research hypotheses

A total of 14 explanatory variables were analysed in the study, both those that have already been researched in Poland and those whose importance has not yet been proven. Table 2 summarises these variables.

Tab. 2. Research hypotheses verified in the study

Offered capital (log(OfferSize))	
Hypothesis	The amount of capital offered has a negative impact on the level of IPO underpricing.
Substantiation	The amount of capital offered can be treated as a measure of issuance risk. A large amount of capital offered may suggest less risk, leading to a higher issue price and less underpricing.
Metric	The number of shares offered during the IPO multiplied by the issue price, logarithmised in order to keep the correct functional form, in line with the principles of the classical linear regression model.
New shares issued	
Hypothesis	New shares issued have a negative impact on the level of IPO underpricing.
Substantiation	A company that offers more new shares during an IPO is expected to send a signal to the investors that it is confident in the IPO success and reduces the level of information asymmetry.
Metric	The ratio of the number of new shares issued to the total number of shares offered during the IPO.
Involvement of private equity or venture capital funds (PEVC)	
Hypothesis	The involvement of private equity or venture capital funds has a negative impact on the level of IPO underpricing.
Substantiation	It is assumed that investment funds, due to their experience, are able to better estimate market behaviour and more accurately value a debuting company, which reduces the level of underpricing.
Metric	Binary variable, '1' equals involvement of fund, '0' indicates no involvement of the fund.
Market volatility	
Hypothesis	Market volatility in the 6 months prior to the IPO has a positive impact on the level of IPO underpricing.
Substantiation	A market characterised by high volatility indicates high investment risk. Thus, the chance of an IPO succeeding in a highly fluctuating market is much smaller, so a lower issue price is expected (Menyah, 1994).
Metric	The standard deviation of the daily rates of return of the WIG within 6 months before the IPO date.

Continued **Tab. 2.** Research hypotheses verified in the study

Market return	
Hypothesis	Market return in the 6 months prior to the IPO has a positive influence on the level of IPO underpricing.
Substantiation	Investors operating in the so-called 'hot market' are much more inclined to make sudden, often-irrational decisions, which may lead to a higher share price at the close of the first day of trading.
Metric	Rates of return of the WIG within 6 months before the IPO date.
New technologies sector (TECH)	
Hypothesis	Being in the technology industry has a positive impact on the level of IPO underpricing.
Substantiation	New tech companies enjoy great popularity on the stock exchange. Based on the theory of behavioural finance, we can conclude that the stocks of a new tech company will immediately rise.
Metric	Binary variable, '1' - a company in the new technology sector, '0' - other.
Company age (AGE)	
Hypothesis	Company age has a positive impact on the level of IPO underpricing.
Substantiation	Companies that have been operating on the market for a long time have a lower risk of no profitability and are considered a more secure investment. In addition, they are more recognisable, which may positively affect the company's share price.
Metric	Discrete variable, the difference between the year of debut and the year in which the company was established
Company debt-to-equity ratio (DE)	
Hypothesis	Company debt-to-equity ratio affects the level of IPO underpricing.
Substantiation	The debt-to-equity ratio is the basic indicator of the fundamental analysis of a company. The ratio of debt to equity is also a key element of the most popular method of business valuation: the discounted cash flow method (Damodaran, 1996).
Metric	The quotient of the company's debt to equity in the last full financial year as detailed in the prospectus.
Country of origin (PL)	
Hypothesis	The company's country of origin affects the level of IPO underpricing.
Substantiation	Investors are often sceptical about foreign companies and are reluctant to invest their capital on the first day of debut. This relationship was proved by Alnodel (2018) using the example of the Saudi Arabian market.
Metric	Binary variable, '1' - a company based in Poland, '0' - other
Return on equity (ROE)	
Hypothesis	Return on equity has a positive impact on the level of IPO underpricing.
Substantiation	The value of the ratio shows the company's profitability and ability to use capital. A higher value of the ratio is positively perceived by investors and may positively affect the valuation of a listed company. It is a basic indicator in the fundamental analysis of a company (Zaręba, 2014).
Metric	The quotient of the company's net profit and equity in the last full financial year as detailed in the prospectus.
Return on assets (ROA)	
Hypothesis	Return on assets has a positive impact on the level of IPO underpricing.
Substantiation	The value of the ratio shows the company's profitability and ability to use the capital. A higher value of the ratio is positively perceived by investors and may positively affect the valuation of a listed company. It is a basic indicator in the fundamental analysis of a company (Zaręba, 2014).
Metric	The quotient of the company's net profit and equity in the last full financial year as detailed in the prospectus.

Continued **Tab. 2.** Research hypotheses verified in the study

Earnings per share (EPS)	
Hypothesis	Earnings per share have a positive impact on the level of IPO underpricing.
Substantiation	A basic indicator of fundamental analysis showing how much profit is attributable to one share. The higher the value of the ratio, the higher the potential dividend in the future. A high value of this ratio should translate to investors' optimism.
Metric	Earnings per share in the last full financial year as detailed in the prospectus.
Price/Earnings ratio (PE)	
Hypothesis	The price/earnings ratio affects the level of IPO underpricing.
Substantiation	A basic indicator used in the valuation of an enterprise; its low value may indicate that the company is not very attractive to investors.
Metric	The price/earnings ratio in the last full financial year as detailed in the prospectus.
Price/Book value ratio (PBV)	
Hypothesis	The price/book value affects the level of IPO underpricing.
Substantiation	The indicator shows the relationship between market valuation and book valuation and is a kind of investors' speculation about the company's future prospects.
Metric	The price/book ratio in the last full financial year as detailed in the prospectus.

IPO, initial public offering; WIG, Warsaw Stock Exchange Index.

Source: Authors' analysis.

8 Description of the Study and Results

In the analysed period, from 2010 to 2019, the average level of the initial rate of return and, thus, the IPO's underpricing was 5%, and the median was 2.1%. There were also significant deviations of the underpricing level from the average. The highest recorded value was 66.3% and the lowest was -24.7%. Basic statistics of all variables used in the study are presented in Table 3.

The correlation matrix presented in Table 4 does not show a strong relationship (>0.6) between the explanatory variables. This suggests that there is no problem with the collinearity of variables.

We will use the classical linear regression model to answer the research questions. The basic model is as follows:

$$IR = \beta_1 * OfferSize + \beta_2 * NewSharesIssued + \beta_3 * PEVC + \beta_4 * MarketVolatility + \beta_5 * MarketReturn + \beta_6 * TECH + \beta_7 * AGE + \beta_8 * DE + \beta_9 * PL + \beta_{10} * ROE + \beta_{11} * ROA + \beta_{12} * EPS + \beta_{13} * PE + \beta_{14} * PB$$

The research was carried out in the R package according to the 'from general to particular' concept.

Starting from the basic form of the model, we sequentially rejected the variables with the largest *p*-value and checked the statistical validity of such a procedure each time. In this way, 12 models were created. Four of them (the first, final, and two intermediate ones that introduced significant changes) are shown in Table 5.

The last model includes three significant explanatory variables, and (based on the *F*-statistic), all variables are jointly significant. Based on the diagnostic tests performed, it can be concluded that the last model has the correct functional form; homoscedasticity of the random component and random error autocorrelation do not occur. However, the Jarque–Bera test shows that the distribution of deviations is not normal. This may be caused by atypical observations, such as, for instance, the debut of Czerwona Torebka SA, whose initial rate of return reached the level of 66%. However, both this and the remaining outliers are not erroneous, and it is important to keep them in the model. The coefficient of determination is 21.6%, which means that the variables that have been incorporated into the final model describe the studied phenomenon in >20% cases.

Tab. 3. Descriptive statistics of the variables described in the model

Statistic	N	Mean	SD	Minimum	Percentile(25)	Percentile(75)	Maximum
IR	101	0.050	0.117	-0.247	0.000	0.082	0.663
New shares issued	101	0.570	0.440	0.000	0.000	1.000	1.000
PEVC	101	0.267	0.445	0	0	1	1
Market volatility	101	0.914	0.233	0.650	0.710	1.050	1.860
Market return	101	1.811	10.592	-21.690	-4.620	8.290	24.170
TECH	101	0.139	0.347	0	0	0	1
AGE	101	16.525	16.930	1	7	21	137
DE	101	1.974	2.518	0.100	0.670	2.070	12.920
PL	101	0.861	0.347	0	1	1	1
ROE	101	0.308	0.478	-0.380	0.110	0.380	4.380
ROA	101	0.127	0.150	-0.320	0.040	0.180	0.690
EPS	101	2.259	3.492	-3.650	0.600	2.600	20.309
PE	101	22.482	73.955	-139.600	6.740	19.020	686.120
PBV	101	5.226	9.052	0.090	1.180	4.940	67.910
Offer size	101	17.483	3.827	0.000	17.189	18.865	22.404

AGE, company age; DE, debt-to-equity ratio; EPS, earnings per share; IPO, initial public offering; IR, initial return; PEVC, private equity or venture capital; PBV, price/book value; PE, price/earnings ratio; PL, country of origin; ROE, return on equity; ROA, return on assets; SD, standard deviation; TECH, technology industry; WSE, Warsaw Stock Exchange.

The study outcomes indicate three significant variables and confirm the assumed direction of their impact on the dependent variable. We have noted a positive relationship with the variable describing the rate of return of the WIG over 6 months before the IPO. This supports the hypothesis about investors' irrationality during the so-called 'hot market' period, where an optimistic economic situation boosts enterprise valuation. This finding also substantiates the previous research conducted on the Polish market by Kavalenka (2018).

A statistically significant variable with a negative impact is the involvement of PE or VC funds in the stock exchange debut. This confirms the hypothesis about the ownership structure and may be caused by two factors: on the one hand, due to the high qualifications of investment fund employees, they are able to better predict market behaviour and more accurately evaluate the company, and on the other hand, when the fund introduces the company to the stock exchange in order to sell it, their priority is to get the best return on their investment.

Contrary to Kavalenka's study (2018), our results indicate the significance of the offer size variable, which denotes the amount of capital offered by the issuer. The negative relationship can be explained within the framework of two theories. On the one hand, more capital offered may suggest the company's confidence in the success of the IPO, which prevents the issue price from dropping. On the other hand, based on the theory of the balance of supply and demand, it can be concluded that the more shares are offered, the more people can buy them at the issue price, which reduces the activity of investors on the first trading day.

We have failed to confirm Kavalenka's hypothesis (2018) on the share of the issue of new stocks in the IPO process. This may be due to a different time frame of our study or the omission of companies from the NewConnect alternative market. There was also no statistical significance of the fundamental financial indicators: PE, PBV, ROE, ROA, EPS, and DE. This could suggest that investors do not make rational decisions based on the analysis of companies' financial

Tab. 4. Correlation matrix of the variables described in the model

Variable	IR	Offer size	New shares Issued	PEVC	Market volatility	Market return	TECH	AGE	DE	PL	ROE	ROA	EPS	PE	PBV
IR	1	-0.063	0.044	-0.310	-0.030	0.285	-0.002	0.078	-0.029	0.048	-0.028	0.115	0.036	-0.009	0.015
Offer size	-0.063	1	-0.320	-0.103	-0.079	0.245	0.055	-0.003	0.180	0.073	0.001	-0.065	0.247	-0.031	-0.050
New shares issued	0.044	-0.320	1	-0.179	-0.163	-0.021	-0.049	-0.137	-0.029	-0.106	0.055	-0.099	-0.144	0.008	-0.100
PEVC	-0.310	-0.103	-0.179	1	-0.012	-0.002	0.146	0.060	-0.095	-0.017	-0.068	-0.045	0.098	-0.082	0.093
Market volatility	-0.030	-0.079	-0.163	-0.012	1	-0.481	-0.136	0.063	0.014	0.099	-0.120	-0.125	-0.127	-0.089	-0.093
Market return	0.285	0.245	-0.021	-0.002	-0.481	1	-0.027	0.049	0.115	-0.017	-0.027	0.054	0.099	0.042	-0.0001
TECH	-0.002	0.055	-0.049	0.146	-0.136	-0.027	1	-0.142	-0.128	0.078	-0.045	0.048	-0.072	0.015	0.407
AGE	0.078	-0.003	-0.137	0.060	0.063	0.049	-0.142	1	-0.042	0.205	-0.074	-0.103	0.251	0.017	-0.137
DE	-0.029	0.180	-0.029	-0.095	0.014	0.115	-0.128	-0.042	1	-0.198	0.286	-0.187	-0.046	0.029	-0.056
PL	0.048	0.073	-0.106	-0.017	0.099	-0.017	0.078	0.205	-0.198	1	-0.351	-0.113	-0.040	0.073	-0.020
ROE	-0.028	0.001	0.055	-0.068	-0.120	-0.027	-0.045	-0.074	0.286	-0.351	1	0.578	0.117	-0.048	0.398
ROA	0.115	-0.065	-0.099	-0.045	-0.125	0.054	0.048	-0.103	-0.187	-0.113	0.578	1	0.220	0.011	0.524
EPS	0.036	0.247	-0.144	0.098	-0.127	0.099	-0.072	0.251	-0.046	-0.040	0.117	0.220	1	-0.102	-0.118
PE	-0.009	-0.031	0.008	-0.082	-0.089	0.042	0.015	0.017	0.029	0.073	-0.048	0.011	-0.102	1	0.114
PBV	0.015	-0.050	-0.100	0.093	-0.093	-0.0001	0.407	-0.137	-0.056	-0.020	0.398	0.524	-0.118	0.114	1

AGE, company age; DE, debt-to-equity ratio; EPS, earnings per share; IR, initial return; PEVC, private equity or venture capital; PBV, price/book value; PE, price/earnings ratio; PL, country of origin; ROE, return on equity; ROA, return on assets; TECH, technology industry.

statements; however, the theory of the heterogeneity of enterprises seems to provide a more likely explanation. It says that firms cannot be compared solely based on indicators without us knowing their activities and the macro- and microeconomic circumstances. The application of the indicators could improve the division of companies into business sectors. The hypotheses about the age and country of origin of the company have also been invalidated. In the latter case, the reason may be the small number of foreign companies in the sample, while the lack of impact of age may be attributable to the diversity of companies listed on the WSE.

9 Conclusion

The study presented in this article was intended to investigate the factors affecting the level of underpricing

of IPOs based on a sample of companies debuting on the WSE. The aim was to explore this phenomenon on theoretical grounds, to outline the research on this topic and to attempt to verify the previously proven hypotheses for a specific group of companies, as well as to define and analyse new determinants of the undervaluation of IPOs. We drew on the analysis of offers, fundamental analyses of companies and market factors of the stock exchange.

The empirical study carried out using the classical linear regression model confirmed the importance of the two previously identified determinants of underpricing on the Polish stock exchange. The first factor, which is based on the theory of ownership and has a negative impact, is the introduction of private equity or venture capital funds into the transaction. On the other hand, the second factor with a positive influence, referring to the theory of behavioural

Tab. 5. Results of selected linear regression models

Variable	Dependent variable			
	IR			
	(1)	(2)	(3)	(4)
log(OfferSize)	-0.007** (0.003)	-0.007** (0.003)	-0.007** (0.003)	-0.006** (0.003)
New shares issued	0.019 (0.027)	0.020 (0.026)		
PEVC	-0.078*** (0.026)	-0.077*** (0.025)	-0.078*** (0.024)	-0.075*** (0.024)
Market volatility	0.052 (0.058)	0.051 (0.056)		
Market return	0.004*** (0.001)	0.004*** (0.001)	0.004*** (0.001)	0.004*** (0.001)
TECH	0.027 (0.036)	0.029 (0.032)	0.026 (0.031)	
AGE	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	
DE	-0.001 (0.005)			
PL	0.007 (0.035)			
ROE	-0.020 (0.035)	-0.025 (0.028)		
ROA	0.129 (0.115)	0.150* (0.089)	0.090 (0.071)	
EPS	0.001 (0.004)			
PE	-0.0001 (0.0002)	-0.0001 (0.0001)		
PBV	0.0002 (0.002)			
Constant	0.090 (0.092)	0.092 (0.086)	0.162*** (0.051)	0.176*** (0.051)
Observations	101	101	101	101
R ²	0.267	0.265	0.246	0.216
Adjusted R ²	0.147	0.184	0.198	0.192
Residual standard error	0.108 (df = 86)	0.105 (df = 90)	0.104 (df = 94)	0.105 (df = 97)
F-statistic	2.232** (df = 14; 86)	3.252** (df = 10; 90)	5.120** (df = 6; 94)	8.927** (df = 3; 97)

AGE, company age; DE, debt-to-equity ratio; EPS, earnings per share; IR, initial return; PEVC, private equity or venture capital; PBV, price/book value; PE, price/earnings ratio; PL, country of origin; ROE, return on equity; ROA, return on assets; TECH, technology industry.

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$; values in parentheses, residual standard deviation.

finance, is the rate of return of the WIG over a 6-month period before the IPO. This confirms the assumption that investors are irrational and that they are more inclined to invest in the so-called 'hot market.' A new hypothesis that we have verified is the negative impact of the value of the offered capital during the debut.

However, it was not possible to prove the statistical significance of the other explanatory variables, such as the factors of the company's fundamental analysis, which included the basic financial indicators. This may be due to the high heterogeneity of public companies. Analysing them on the exclusive basis of financial values, without either micro- or macroeconomic background, may be significantly difficult.

In the final version of the model, we obtained a higher coefficient of determination than in the previous studies (Kavalenka, 2018). Although it was possible to identify only one new factor influencing the level of undervaluation of the IPO, this research advances the understanding of the Polish capital market and may constitute a starting point for further analyses. It is worth noting that more accurate results could be obtained by expanding the study to include companies debuting on an alternative market or categorising companies by industry, which would allow for a more accurate and reliable analysis of the impact of fundamental financial indicators.

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