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EFFICIENCY OF THE VENTURE CAPITAL AND PRIVATE EQUITY BACKED IPO ON THE WARSAW STOCK EXCHANGE

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Purpose: The main goal of this paper is to examine 42 VC and PE backed IPOs and their return on equity indicator before and after IPO in the period of 2013-2023 on the Warsaw Stock Exchanges.
Design/methodology/approach: To confirm the statistical significance of the results regarding the behavior of the return on equity before and after the IPO process, a paired sample Student's t-test was conducted. For this purpose, a comparison was made between the ROE values obtained in the period between year n_{-1} and year n_{+1} for VC and PE backed IPOs.
Findings: Analyzing the results, it can be concluded that the differences in the return on equity levels within the examined group of companies are statistically significant. The ROE levels in the analyzed firms are higher before their introduction to the public market compared to the period following their stock market debut.
Research limitations/implications: Venture capital and private equity firms have played a vital role in the creation of public corporations. Its Initial Public Offerings (IPO) offers on the stock markets are well documented in literature. IPOs emerge when companies decide to enter the equity market by selling their stock to the public. It is widely acknowledged that IPO are subjected to many different research analyses. One of them is indicator of return on equity. This paper analyses the long run performance of Initial Public Offerings that are backed by venture capital or private equity sponsor in terms of return on equity indicator. Despite the large increase in investments and the concomitant increase in academic and practitioner literature, the historical performance of both segments remains controversial. This is due to the uneven disclosure of private equity returns and questions about the quality of the available private equity data. However, despite the extensive literature attempting to explain many different anomalies, there still has been no satisfactory answer to the causes of VC and PE backed IPO performance.
Originality/value: There is no such research conducted on WSE on VC/PE backed IPOs.
Keywords: VC and PE backed IPO, ROE performance, Venture capital investments.
Category of the paper: Choose one or two of the possibilities.

1. Introduction

The concept of private equity (PE) and venture capital (VC) represents a relatively new term for high-risk investments that have historically been carried out by various entities. Many authors describe these as medium or long-term investments in high-risk ventures, which are combined with managerial support. The term "venture capital" is sometimes replaced with "risk capital" and is considered one of the instruments of the capital market. Literally translated, it refers to equity capital invested in a risky venture. Venture capital is capital invested in companies that are in the early stages of development or are just beginning to enter the market. All actions taken by the fund and the entrepreneur aim to achieve above-average company value growth within a set time frame. The increase in enterprise value serves as a crucial source of capital for newly established small businesses, where the risk is significantly higher than in other types of private equity investments, which are typically directed at companies in more advanced stages of development. The core function of private equity and venture capital funds involves identifying, financing, and actively supporting young and innovative projects that demonstrate rapid value growth potential. The role of these funds also includes acting as intermediaries between capital investors and portfolio companies, in which the funds invest the capital raised from investors after conducting thorough analyses. Another important responsibility of fund managers is to ensure professional selection of promising investment projects. Private equity and venture capital represent medium- to long-term capital engaged in equity stakes of enterprises, jointly managed with a professional financial intermediary – the funds themselves. These companies are undergoing radical changes driven by rapid development, which is expected to result in above-average returns, although these investments also carry risks borne by the investor.

The most important characteristics of PE/VC funds include:

- Seeking non-public equity companies with high potential for market value growth.
- Investing capital and actively participating in company management to enable effective business development.
- Selling owned shares or equity interests to achieve specified capital gains.

There are numerous other definitions describing the nature and characteristics of venture capital and private equity fund operations. In the United States, such funds are represented by the National Venture Capital Association (NVCA), which defines venture capital as high-risk capital that transforms innovative ideas and basic research into products and services that change the world. It is about building high-growth companies from the ground up. Venture capital is a unique asset class for institutional investors. Venture capitalists form partnerships with pension funds, endowments, foundations, and other entities to make risky, long-term capital investments in innovative young companies. According to *Invest Europe*, the organization that brings together European PE funds, private equity is a form of professional

investing that involves acquiring an ownership stake in a company and keeping it private—as opposed to trading on public stock markets. PE and VC are generally medium or long-term investments in which fund managers actively participate in the company's operations over a relatively extended period. Fund managers raise investment capital from various sources, including institutional investors such as pension funds, insurance groups, sovereign wealth funds, as well as private investors. When the time comes to realize returns and exit investments, the fund managers sell their stakes in portfolio companies and return the invested funds to their investors. Venture capital as equity provided for a limited time by external investors to small and medium-sized enterprises with an innovative product, production method, or service that has not yet been validated by the market, thus posing a high investment failure risk. However, if market success is achieved, it offers significant capital appreciation.

Generally, fund management can be divided into three phases: capital acquisition, investment, and divestment. The goal of this article is to analyze the performance of portfolio companies in terms of return on equity, which achieved sufficiently high economic results to allow for an initial public offering on the Warsaw Stock Exchange. The introductory part outlines shortly the objectives and motivation for writing the paper. The introduction should provide a theoretical context for the discussion in the body of the paper and point explicitly the purpose of the article.

Divestment refers to the actions taken by an investor to exit an investment, meaning the sale of equity stakes in a portfolio company—either on the private or public market—to one or more entities. Divestment marks the final stage of cooperation between a company and the investment fund. Investors finance fast-growing enterprises with the intention of selling their stakes after a few years. When a fund exits one company, it often quickly reinvests in another. Many funds admit that they consider the divestment strategy even before signing the investment agreement and start preparing the company for it from the first day of financial involvement. Typically, the investor plans to exit at the end of the company's dynamic growth phase. The fund's participation in managing the portfolio company and its involvement in developing or modifying the company's strategy is aimed at ensuring planned development and achieving performance levels that make a timely divestment possible. The most common methods used by venture capital and private equity funds to exit an investment include:

1. Initial Public Offering.
2. Sale of shares to a strategic investor – trade sale.
3. Sale of shares to remaining company owners – buyback.
4. Sale of shares to another fund or financial investor.
5. Management buyout by the company's own managers.
6. Buyout by external managers.
7. Management-employee buyout by both company managers and regular employees.
8. Company acquisition by another investor in exchange for the investor's shares.
9. Company liquidation and redemption of shares.

An IPO is not solely a method of exiting an investment, but rather the first stage of divestment. The actual exit occurs through the sale of shares on the stock exchange. This is considered the most desirable and model form of divestment for companies financed by funds. Across all markets where venture capital funds operate, going public is often the preferred exit route, enabling the sale of shares on the exchange. However, this process is time-consuming and relatively expensive, meaning that the portfolio company often requires extensive support from the fund to complete it successfully.

For a well-performing company, the benefits of going public can far outweigh the costs of preparing for the listing. An IPO can lead to significant profits, but it is a path reserved for large companies with high profitability, transparent organizational structures, and clearly defined financial flows. Key factors influencing the IPO process include the competence of the management team, the quality of corporate governance, and the shareholder structure. The risk associated with exiting via an IPO is particularly significant during a market downturn. A fund is not always able to sell all of its shares immediately after the company goes public, as this is regulated by existing laws. The decision to exit via IPO heavily depends on stock market conditions. In times of economic prosperity, such transactions can be highly profitable, while during downturns, they may end in failure. Performance itself of portfolio companies can also influence IPOs transactions. This study is one of the first at the Polish market and the first one that take into the study such a long period of time (2013-2023).

2. Literature review

Academic literature reveals that venture capital funded companies show superior and much advanced performance to regular companies that does not have venture capital support. Those firms contribute in many ways to the development of economies through boost of the turnovers, innovations, the creation of jobs as well as an exceptional growth rate. Their high level of investments and returns also influences many different areas of the economy. However in general, in the macro economy the proportion of companies that receive venture capital funding is limited and very small. Despite that, there has been a rapid growth in the availability of VC/PE funds over the years in the different branches and economies. One can observe that there is still lack of this kind of investors in many sectors. Researchers conclusions have indicated that significant variance in performance between companies that are supported by VC/PE and regular firms can be attributed to the VC/PE investors. This outcome should then led us to the important question - what capabilities of VC/PEs contribute to the performance variation of the supported companies. There has been high number of research evidence to indicate that managerial and value addition capabilities of venture capital dominate the selection capabilities in explaining the performance variation. The relationship between entrepreneur and

investor is a broad area for VC/PE value added research. Most important might be acceptance of the investment manager (in most cases its and current owner of the company) through the management of the venture. Cable and Shane conclude that a cooperative relationship between entrepreneur and investor is even more important for the positive development of a company than a provision of money itself. This relation is characterized by as a socially complex inter-organizational relationship. They argue that the relationship between two parties increases in its social complexity and therefore becomes more and more difficult to imitate (Cable et al., 1997). This in turn led to an improvement in the company's performance. At the certain period in the investment time span venture capital funds should conduct an effective divestment process. IPO as desirable exit for the funds is the outcome of that process. When a venture capital or private equity sponsor conducts an IPO of a portfolio firm, it not often sells significant stake of its investment, usually remaining a large block holder in the newly listed firm for a longer and much extended period. This practice is consistent with the recognition that retention of shares in an IPO is a signalling device that mitigates adverse selection intrinsic to equity issuance (Leland, Pyle, 1977). There were clearly benefits of a healthy IPO market. Research suggests that IPOs finance growth and stimulate innovation, productivity and job creation. After an IPO, venture capital funds generally block and hold its governance rights, maintains board representation, monitor managers, influences corporate decisions and sometimes is bound by regulations that restrict its share trading. Because a sponsor influences a firm's operations until its ownership is sold (typically some years after an IPO), venture capitalist is the type of block holder that researchers (Demsetz, 1986) viewed as an effective corporate monitor. At the same time, the limited horizon intrinsic to VC/PE's business model, creates pressure for sponsor divestment after an IPO, including the fact that a sponsor's limited partners pay high fees for managing. Venture capital and private equity contracts govern long-term relations between entrepreneurs and their investors in a way that establishes path for capital gain growth, cash flow, control rights and exit horizon. The long-term nature of VC/PE–entrepreneur relationships leave entrepreneurs open to exploitation by VC/PE funds (Fried, Ganor, 2006; Atanasov et al., 2006), and VC/PE funds open to expropriation by entrepreneurs (Gompers, 1998; Casamatta, 2003; Schmidt, 2003; Kaplan, Strömberg, 2003). It is therefore natural for relation and its contracts to depend on the bargaining power of the VC/PE funds and the entrepreneurs. Further, as high-tech start-up entrepreneurial firms do not have sufficient cash flows to pay interest on debt or dividends on equity, contracts are established in a way that control rights are allocated over divestment decisions (Sahlman, 1990; Black, Gilson, 1998; for related theoretical work, see Aghion, Bolton, 1992; Berglöf, 1994; Trester, 1998; Garmaise, 2000; Bascha, Walz, 2001; Schwienbacher, 2007; Neus, Walz, 2005). A successful divestment may involve an IPO, or an merger or acquisition (often referred to as a "trade sale"). There is limited number of research that covers ROE analysis for VC backed IPOs. However there are some studies that show that PE/VC backed IPOs comapnies have a lower leverage ratio in the first 5 years after the IPO, in comparison with those not financed by PE/VC. These companies,

in addition to having more capital options, must return to the PE/VC funds the investments made by them. (Carvalho et al., 2013) show that 25% of the exit from investment of PE/VC funds between 2004 and 2009 were through IPO. In this sense, companies invested by PE/VC are more likely to issue shares instead of debt. Further studies also found evidence that companies financed by PE/VC have a higher level of profitability - as measured by ROE - in the short term, i.e., in the first three years after the IPO. In the same direction, companies financed by PE/VC show a higher level of sales growth in the first 3 years after the IPO. With regard to the ROE variable, (Morsfield, Tan, 2006) argue that companies invested by PE/VC funds tend to have on average, better performance in their investments when compared to those not invested by PE/VC. Caselli (Caselli, 2009) analyzed 804 investments made by 87 channels of Investments of 58 PE/VC Management Organizations in Italy in the period of 1999-2005 and divested not before 2007. The author also concluded that the high IRR return is driven by sales growth, return on assets (ROA) and return on equity (ROE). In terms of profitability, the results indicated that these companies perform better, as measured by ROA, in the first 3 years after the IPO. These companies also presented a superior result when considering sales growth as a variable of operational performance. Analyzing Polish data from the 2013–2023 period it shows some picture of divestment market situation. IPOs account for 13.7% of number and 13.16% of value of all divestments of VC/PE portfolio companies.

Table 1.
Number and Value of VC/PE Fund Divestments in the Polish Market (2000-2023)

Divestment	Number of divestments 2013-2023	Share in %	Value 2013-2023	Shate in %
Sale to trade buyers	146	35,10%	2 236,03	43,95%
Divestment by public offering	57	13,70%	669,40633	13,16%
Write off	12	2,88%	189	3,71%
Repayment of preference shares/ loans or mezzanine	27	6,49%	122	2,40%
Sale to another private equity firm	42	10,10%	938	18,43%
Sale to financial institutions	36	8,65%	640	12,58%
Management/Owner buy-back	73	17,55%	256	5,04%
Divestment by other means	23	5,53%	37	0,73%
Total	416	100,00%	5 088,05	100,00%

Source: Own calculations based on EVCA data.

The most common method of exiting investments in the period 2013-2023 was the sale of shares by funds to strategic investors, accounting for over 35% of all transactions. Initial Public Offerings (IPOs), totalling 57 transactions, represented nearly 13.7% of all exits, and 13.6% in terms of value. This indicates a significant share within the overall structure of divestment transactions. The number of divestments through IPOs on the Warsaw Stock Exchange are illustrated in Figure 1.

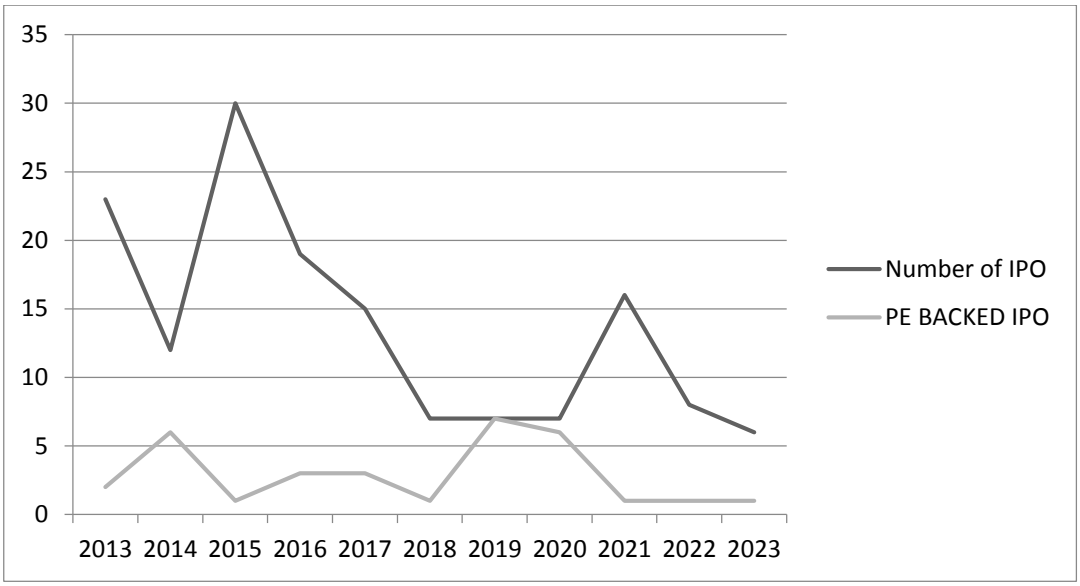

Figure 1. Number of IPO transactions on the Polish market carried out by PE/VC funds in the period 2013-2023.

Source: Own calculations based on EVCA and InvestEurope data.

When analyzing IPO transaction data on the Warsaw Stock Exchange carried out by companies backed by VC or PE capital, it can be concluded that they account for approximately 10% of the total value and number of all transactions. This is a relatively high share, providing grounds to assert that VC and PE funds are active participants in the capital market.

3. Methods

There are many classic and specific indicators that can be used to measure the return rates on VC and PE-type investments. Common financial metrics such as the Internal Rate of Return (IRR) and the Time-Weighted Rate of Return (TWR) yield different results when applied to VC investments and may not fully capture the effectiveness of fund managers. Various forms of internal rate of return can be found in the literature. In the context of venture capital and private equity investments, IRR can be calculated at multiple levels.

The basic classification used by EVCA includes:

- Gross IRR on realized investments.
- Gross IRR on all investments.
- Net IRR for investors.

Another approach to evaluating funds and comparing them with the returns of public market companies is the Public Market Equivalent (PME or index method). This is a return metric based on a market index, adjusted to reflect the irregular cash flows typical of VC funds. It is related to a money-weighted return (similar to IRR) in such a way that the PME rate is the

return an investor would achieve by investing in a public index during the periods when the VC fund calls capital, and selling the index when the fund distributes proceeds. This strategy is designed to replicate the irregular investment and divestment patterns of a venture capital fund as closely as possible in order to compare the achieved returns more accurately. The indicator answers a simple question: how much (in net present value terms) would an investor need to invest in a public market index to generate one monetary unit of return equivalent to that received from a VC or PE fund investment. This measure allows for a direct comparison of returns from public market investments and those from VC or PE funds. In this way, we can obtain a comprehensive comparison of investment performance against an appropriate benchmark.

Mathematically, the model is represented as follows:

$$PME = \frac{\sum_{t=1}^{T} cf_t \prod_{i=t+1}^{T}(1 + R_{Ii})}{\prod_{t=1}^{T}(1 + R_{It})}$$

where:

R_{It} – net return from the public market index over the period t,

cf_t – normalized positive cash flow of the VC fund over the period t.

As can be observed, public index return rates are gross returns that include management fees. An alternative definition of the PME indicator model, presented by S. Kaplan and Scholar, states that the PME ratio is the quotient of the discounted fund distributions from realized investments to the discounted fund inflows (investor contributions), where the discounting is based on the return rate of the chosen benchmark investment. Mathematically, the formula is as follows:

$$PME_i = \frac{\sum_{t=1}^{T}(CFO_{ti} \prod_{n=0}^{t}(1 + r_{Bn})^{-1}}{\sum_{t=1}^{T}(CFI_{ti} \prod_{n=0}^{t}(1 + r_{Bn})^{-1}}$$

where:

CFO_{ti} – fund distributions from investment i in period t.

CFI_{ti} – fund inflows for investment i in period t.

r_{Bn} – total return rate of the benchmark index B in period t.

If the PME ratio exceeds 1, it indicates that investments in VC or PE funds outperform the benchmark and provide higher returns than the public market. Conversely, if the PME is below 1, then public market investments are more effective than VC and PE investments. From the investor's perspective, it is important to determine whether investing in venture capital funds offers higher efficiency compared to public market investments.

Apart from IRR, other indicators are also used to measure fund performance. Multiples used by NVCA and EVCA include:

- DPI (Distributions to Paid-In Capital): the ratio of profits distributed to fund participants (net of fees) over a given period, relative to committed capital.
- RVPI (Residual Value to Paid-In Capital): the ratio of the residual value of the fund (the remaining capital held by the fund, net of fees and interest) to the committed capital.
- TVPI (Total Value to Paid-In Capital): the sum of DPI and RVPI, representing the total value generated relative to committed capital, net of costs and interest.

An additional indicator is PIC (Paid-In Capital to Committed Capital), which shows the portion of committed capital that has been actually paid into the fund by investors.

When assessing the performance of individual companies, various capital market indicators can be compared. During investments in enterprises, funds often rely on valuation multiples based on the assumption that the market reflects the company's value most accurately. In the case of young companies, however, the full set of valuation multiples may not be applicable. The most commonly used multiples are based on earnings categories.

Frequently applied valuation multiples include:

- Revenue multiples (P/Sales).
- Operational multiples (e.g., number of customers, area, number of operations).
- Book value multiples (P/Book Value).
- Earnings multiples (EBITDA, EBIT, gross profit, net profit).

Other important indicators include profitability ratios such as return on equity (ROE), return on assets (ROA), and return on sales (ROS)—which are part of the financial analysis applied to all types of companies, both private and public. Analysis was conducted of the ROE of companies that carried out IPO transactions on the Warsaw Stock Exchange and were also backed by venture capital or private equity funding. ROE was selected for this analysis as it is the most critical metric for equity holders and occupies a prominent position among financial indicators, for example, at the top of the DuPont Analysis model.

Empirical research on the effects of divestment processes carried out by private equity and venture capital funds is conducted at various levels and presents diversified results, especially when different exit strategies of the funds are considered. For companies in which a fund executed an IPO transaction, three primary areas of research can be identified:

- Underpricing of the returns on shares offered in IPOs by private equity or venture capital funds.
- Costs of the IPO process for the analyzed companies.
- Return on equity of the portfolio companies owned by private equity or venture capital funds.

These issues are considered key for assessing the effectiveness of investments in portfolio companies and may distinguish such firms from other companies conducting IPOs without the support of high-risk capital funds. The capital and stock markets allow for a comprehensive evaluation of companies in terms of valuation, divestment costs, and return on equity performance compared to other companies going public. During an IPO, the fund partially disposes of its shares in the portfolio company and eventually exits the company entirely. Funds are generally not interested in remaining shareholders of companies whose stock value has stabilized and no longer delivers above-average returns. This provides an opportunity to study the performance of portfolio companies after the fund exits their shareholder structure at the point when they lose financial, personnel, and managerial capital support. This represents a kind of "test" for the companies and is a situation that significantly affects their ability to maintain operational efficiency and stabilize their share price on the stock exchange after the fund's withdrawal. The exit of the fund means the company begins to operate independently, without the support typically provided by venture capital or private equity funds. This introduces new conditions for the company, which should already be mature enough to continue generating positive financial results, especially as a publicly listed firm. Studies conducted on portfolio companies of foreign funds and the effects of fund divestments indicate that after IPOs are completed, a deterioration in the financial condition of portfolio companies is often observed specifically, those whose shares have been floated publicly.

To assess the scale and durability of changes in the financial condition of portfolio companies of venture capital and private equity funds, the **return on equity** indicator was used. In the context of evaluating efficiency and enterprise value, ROE is a key variable in the formulation, implementation, and monitoring of financial strategies aimed at providing shareholders with capital gains, dividends, and increased market value. ROE is considered the most important measure of economic performance of a business and its management tools, as changes in ROE reflect the enterprise's activity in both financial and non-financial spheres such as marketing. Empirical studies conducted to verify the research hypothesis—namely that venture capital and private equity portfolio companies experience a temporary decline in financial performance following their stock market debut—confirm this effect. In particular, a decline in ROE was observed for almost entire companies, whose IPOs on the Warsaw Stock Exchange took place between 2013 and 2023. This research period was chosen to allow for a comprehensive review of VC- and PE-backed companies that carried out IPOs on the WSE, and to include the longest possible timeframe to track their medium- and long-term performance post-IPO. During the indicated period, 46 companies debuted on the WSE, with venture capital and private equity funds listed as shareholders immediately prior to their IPOs.

To verify the research hypothesis, the traditional formula for calculating ROE was applied, where the net income generated by the company in a given period is related to the arithmetic average of the book value of shareholders' equity. ROE serves as a synthetic measure of how effectively a company utilizes its owners' assets and resources. Its value and changes depend

on many factors and operational conditions of the enterprise. For the purpose of causal analysis, **pyramidal decomposition** was used, breaking ROE down into three components and presenting it as follows:

$$ROE_n = \frac{EAT_n}{\bar{E}_n} = ROS_n x AU_n x EM_n.$$

$$ROE_n = \frac{EAT_n}{S_n} x \frac{S_n}{\overline{TA}_n} x \frac{\overline{TA}_n}{E_n}.$$

where:

ROE_n – return on equity (ROE) in year n,

EAT_n – net income in the financial year n,

EM_n – equity multiplier in year n,

ROS_n – return on sales om year n,

AU_n – asset productivity ratio in year n,

S_n – sales revenue in year n,

$\bar{E}_n$ – average equity in year n,

$\overline{TA}_n$ – average total assets in year n.

To numerically determine the impact of changes in the net profit margin**,** equity multiplier**,** **a**nd asset productivity ratio on variations in the return on equity (ROE)**,** the method of successive substitutions will be applied. The use of this method requires adherence to the following research discipline:

- Determining the **total deviation** between the value of the return on equity achieved in a given year and its value in the preceding year, i.e.:

$$O_{ROE_n} = ROE_n - ROE_{n-1},$$

where:

O_{ROE_n} – total deviation of the return on equity coefficient in year n,

ROE_{n-1} – return on equity in the previous year, serving as the reference base,

other notations as above.

- Identification of factors influencing the total deviation and the causal relationship between these variables:

$$f(ROE_n) = ROS_n x AU_n x EM_n,$$

- Performing subsequent substitutions with respect to individual factors and determining the magnitude of the corresponding deviations:

$$O_{ROE_n} = O_{ROS_n} + O_{AU_n} + O_{EM_n},$$

$$O_{ROS_n} = ROS_n + AU_{n-1} x EM_{n-1} - ROS_{n-1} x AU_{n-1} x EM_{n-1} = (ROS_n - ROS_{n-1}) x AU_{n-1} x EM_{n-1},$$

$$O_{AU_n} = ROS_n + AU_n x EM_{n-1} - ROS_n x AU_{n-1} x EM_{n-1} = (AU_n - AU_{n-1}) x ROS_n x EM_{n-1},$$

$$O_{EM_n} = ROS_n + AU_n x EM_n - ROS_n x AU_n x EM_{n-1} = (EM_n - EM_{n-1}) x ROS_n x AU_n,$$

where:
O_{ROS_n} – partial deviation resulting from changes in the sales profitability ratio,
O_{AU_n} – partial deviations resulting from changes in the asset productivity ratio,
O_{EM_n} – partial deviation resulting from changes in the equity multiplier,

Other notations remain as previously defined. A summary of partial deviations was compiled, and conclusions were drawn based on a deterministic approach. The data were collected using the prospectuses of companies undergoing the IPO process and from financial statements prepared after the IPO transaction.

Research Strengths

- Methodological clarity - The study applies a well-established DuPont decomposition (pyramidal model of ROE), which is a standard and theoretically grounded approach for analyzing the determinants of return on equity.
- Deterministic framework - The method of successive substitutions allows for precise, numerical determination of the impact of individual factors (profitability, asset efficiency, leverage) on ROE. This makes causal inference more transparent than simple correlation analysis.
- Data reliability - using IPO prospectuses and post-IPO financial statements ensures that the data come from verified and publicly available sources, which enhances transparency and replicability.

Limitations and Weaknesses

- Methodological Limitations - lack of statistical validation, the deterministic method assumes linear and proportional relationships between the components of ROE. It does not test statistical significance, multicollinearity, or non-linear effects. Therefore, causal inferences may be mechanical rather than empirical.
- Static framework - the pyramidal decomposition provides a snapshot rather than capturing dynamic interactions over time. It does not model feedback effects or lagged relationships between profitability, asset use, and leverage.
- No control for external variables - factors such as market conditions, industry differences, macroeconomic trends, or firm-specific risks are not incorporated. This omission limits the explanatory power of the model.

Data-Related Weaknesses

- Small and selective sample - focusing solely on companies during and after the IPO process restricts the generalizability of findings. IPO firms are typically in a transitional phase (e.g., restructuring capital, rapid growth), making them non-representative of mature firms.
- Potential inconsistencies in reporting standards - prospectuses and post-IPO reports may differ in accounting methods or assumptions (e.g., fair value adjustments, goodwill recognition), which could distort comparability of financial data.
- Short observation window - If the analysis covers only a few years post-IPO, it fails to capture long-term profitability trends and structural changes in performance.

Conceptual Weaknesses

- Overreliance on accounting measures - ROE and its components are accounting-based, and thus susceptible to earnings management, valuation choices, and timing effects. They may not accurately reflect economic performance or shareholder value creation.
- Simplified causal structure - The decomposition assumes a unidirectional influence from profitability, assets, and leverage to ROE. In reality, these relationships are interdependent and may involve reverse causality (e.g., higher ROE enabling higher leverage).

4. Results

The analysis of changes in this indicator covered a period of two years prior to the IPO debut on the Warsaw Stock Exchange, the year of the initial listing (n_0), and three subsequent years following the IPO. During the course of the analysis, periods were excluded in which calculating the coefficient based on the adopted research methodology and the availability of empirical data was not feasible. In cases where negative equity was reported during selected periods, the ROE was not calculated. When analyzing the return on equity of portfolio companies backed by investment funds, it should be noted that most of the examined companies generated positive financial results during the analyzed period.

Table 2.
Number and share of VC/PE backed IPO

		Analyzed period					
		n_{-2}	n_{-1}	n_0	n_{+1}	n_{+2}	n_{+3}
Profitable companies	number	36	44	40	34	34	30
	share [%]	94,74	95,65	86,96	73,91	77,27	73,43
Deficit companies	number	2	2	6	12	10	12
	share [%]	5,26	4,35	13,04	26,09	22,73	26,57

Source: Own calculations.

Analyzing the data presented in Table 2, it should be noted that in the years preceding the IPO on the Warsaw Stock Exchange, only two companies reported operating losses. In the year of the IPO, this number increased to six companies, and in the following periods, the number of loss-making companies rose to twelve. With this data, it is also possible to examine the average ROE values achieved by the analyzed companies. In the two years prior to the initial public offering of shares issued by portfolio companies of private equity and venture capital funds, the average return on equity amounted to 25.32%. In the year directly preceding the IPO transaction, the ROE increased slightly to 26.18%. However, in the year of the IPO, it dropped significantly to 15.23%, and in the following years after the debut, the average ROE declined further to 7.29%, 7.98%, and 3.05%, respectively. This indicates that VC and PE backed companies follow a similar pattern to other firms conducting IPOs: in the pre-IPO period, they report very strong return on equity results, which then systematically deteriorate in the years following the IPO. Notably, only two companies showed an increase in ROE between year n_{-1} and year n_{+1}.

Table 3.
Results of the ROE changes in VC/PE backed IPO

Specification	Analyzed period					
Arithmetic mean	n_{-2},32	n_{-1},18	n_0 5,23	n_{+1},29	n_{+2},98	n_{+3},05
Median	19,56	21,62	14,51	5,56	7,23	4,05
Standard deviation	23,41	20,49	12,61	10,18	11,89	26,21
Lower quartile	11,62	14,73	7,28	0,01	0,34	3,31
Upper quartile	37,88	38,05	24,29	14,28	17,43	16,59
Interquartile range	26,26	23,32	17,01	14,27	17,09	13,28
Minimum	-10,39	-16,51	-11,73	-7,51	-18,78	-72,21
Maximum	92,55	72,94	36,55	33,21	23,98	27,01
Number of companies	36	40	46	46	42	42

Source: Own calculations.

To confirm the statistical significance of the results regarding the behavior of the return on equity before and after the IPO process, a paired sample Student's t-test was conducted. For this purpose, a comparison was made between the ROE values obtained in the period between year n_{-1} and year n_{+1}.

Assuming a normal distribution of the variables under study, the following null hypothesis (H_0) was formulated: there is no difference between the means, i.e., the means are equal:

$$H_0 : u_{n-1} = u_{n+1}$$

In contrast, the alternative hypothesis H_1 stated that:

$$H_1 : u_{n-1} > u_{n+1}$$

The results of the study indicate that there are grounds to reject the null hypothesis in favor of the alternative hypothesis**.**

Table 4.
Results of the Paired Sample Student's t-Test for mean ROE values

Specification	$\boldsymbol{ROE_{n-1}}$	$\boldsymbol{ROE_{n+1}}$
Mean	0,2653	0,0721
Variance	0,0419	0,0105
Obsevations	42	42
tStat	4,6528	
P(T<=t) one sided	0,0001	
one sided T Test	1,7192	
P(T<+=t) two-tiled	0,0001	
Two-tiled T Test	2,0539	

Source: Own calculations.

Analyzing the results presented in table 4. it can be concluded that the differences in the return on equity levels within the examined group of companies are statistically significant. The ROE levels in the analyzed firms are higher before their introduction to the public market compared to the period following their stock market debut. It should be noted that numerous diverse factors influence the ROE, such as asset utilization efficiency, asset structure, and profit margins. Analyzing these individual components that affect ROE is the next stage of the research, which will complement the assessment of the effectiveness of companies that conduct IPO transactions on the Warsaw Stock Exchange. The subsequent stage of the study should include a comparison with companies that have conducted IPOs without the support of VC or PE funds.

5. Discussions

It can be concluded that the differences in the return on equity (ROE) levels within the examined group of companies are statistically significant. The ROE levels in the analyzed firms are higher before their introduction to the public market compared to the period following their stock market debut. It should be noted that numerous diverse factors influence the ROE, such as asset utilization efficiency, asset structure, and profit margins. Analyzing these individual components that affect ROE is the next stage of the research, which will complement the assessment of the effectiveness of companies that conduct IPO transactions on the Warsaw

Stock Exchange. The subsequent stage of the study should include a comparison with companies that have conducted IPOs without the support of VC or PE funds.

6. Conclusions

Venture capital and private equity investments are important part of financial markets across the globe. Economies with high stake of those investments are among leading ones. Crucial factor for the activity of those funds is well working stock market and possibility of IPO transactions. In this paper only performance in terms of return on capital was examined, and it gave the outcome that this indicator vary before the IPO and afterwards. It show statistical significance. Very similar situations happen among non VC backed IPOs. Future research can examine further indicators such as return on assets and return on sales, costs of IPO and underpricing. It can also can possibly explain the comparison of performance of CEE region IPOs or European IPOs in general, and European VC-backed IPOs in particular, with their counterparts. Central Eastern European countries and other European markets possess a set of distinct characteristics, including culture, institutional factors, legal environments, political systems, and corporate governance regimes. In addition, important divergence in two corporate governance models, Continental European version Anglo Saxon, may lead to differences in the VC participation as well as VC-back IPOs' performance. These factors can explain divergence in performance of VC-backed IPOs in different regions, and worth future research efforts.

The research provides **a** systematic and quantitative assessment of ROE**,** breaking it down into profitability, asset efficiency, and leverage components. This decomposition allows stakeholders—investors, analysts, and managers—to pinpoint the key drivers of financial performance rather than relying on aggregate indicators alone. By analyzing data from IPO prospectuses and post-IPO financial statements, the study offers insights into how newly public firms manage equity and generate returns. This is crucial for investors and underwriters seeking to assess post-IPO performance risk and make informed investment decisions.

The research is important because it moves beyond aggregate measures of profitability to reveal the underlying drivers of ROE, particularly for IPO firms. Its impact spans investment analysis, corporate strategy, academic research, and regulatory oversight**,** and the information obtained can serve as a foundation for predictive modeling, benchmarking, and further sectoral or cross-country studies.

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