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Analyzing The Factors Influencing Venture Capital-Backed IPOs In India: A Regression and Multicollinearity Approach

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Abstract: This study examines the factors influencing venture capital-backed Initial Public Offerings (IPOs) in India, focusing on variables such as Face Value (FV), Listing Days (LD), Size, Subscribed Times (SubT), Volume (Vol), Value (Val), Age, and Issue Price (IP). A multiple regression analysis was performed to determine the relationship between these predictors and IPO performance (Under-pricing). The results reveal that Vol and Val are the most significant predictors, with p-values less than 0.01. Multicollinearity issues were identified, particularly between Vol, Val, and Trades, which may affect the stability of the regression model. The model explains about 50% of the variance in IPO performance, with moderate explanatory power. Tests for heteroscedasticity, autocorrelation, and normality suggest no severe issues, but the model's predictive power could be improved with further refinement. This study contributes to understanding the dynamics of venture capital-backed IPOs and provides guidance for future research.

Index Terms **- Venture Capital, IPOs, Subscribed Times, Under-pricing.**

I. INTRODUCTION

The rise of venture capital (VC) as a significant source of funding for start-ups and high-growth companies has led to an increasing interest in its role in the performance of Initial Public Offerings (IPOs). Venture capital-backed IPOs have become a crucial segment of the global financial market, especially in emerging economies like India, where the VC ecosystem has expanded rapidly in recent years. Venture capital plays a pivotal role in providing the necessary capital for innovative firms that may not have access to traditional financing sources like banks. By supporting stratus with high growth potential, VC funding enables them to scale operations, develop competitive products, and enter the market in a way that can make them attractive IPO candidates.

In India, the VC ecosystem has grown significantly, driven by government initiatives, an increasing number of institutional investors, and a vibrant entrepreneurial landscape. The country's start-ups culture has seen a dramatic transformation, with a sharp increase in venture capital-backed companies going public in recent years. The IPO market in India, fuelled by the growing number of tech start-ups and other high-growth companies, represents a dynamic area of study, especially concerning the factors influencing their pricing behavior and post-IPO performance.

A crucial aspect of studying venture capital-backed IPOs is understanding the factors that influence the performance of these companies once they go public. IPO performance is influenced by various factors, including firm characteristics such as size, age, leverage, and market conditions like volatility and investor sentiment. However, understanding the specific impact of each factor, particularly in the context of venture capital-backed IPOs, has not been extensively researched in the Indian market. This gap in research is significant given the growing importance of VC funding and the potential long-term effects it has on the success or failure of IPOs.

The primary objective of this study is to analyse the factors affecting the performance of venture capital-backed IPOs in India. This study uses multiple regression models to examine the relationship between various independent variables—such as Face Value (FV), Listing Days (LD), Size, Subscribed Times (SubT), Volume (Vol), Value (Val), Age, and Issue Price (IP)—and the dependent variable, IPO performance (UP). The analysis investigates how these factors influence IPO performance, focusing on the effect of volume and value as key determinants of stock performance post-IPO.

One of the key challenges in analyzing IPO performance is dealing with multicollinearity, a phenomenon where independent variables are highly correlated with each other. This can lead to issues with model stability and the interpretability of regression coefficients. In this study, we perform a multicollinearity check to identify potential issues arising from the correlation between variables. The correlation matrix reveals some interesting insights, such as the strong positive correlation between Volume and Value (Vol and Val), as well as their strong influence on trading behaviour and market sentiment.

The study also addresses the presence of heteroscedasticity, autocorrelation, and the normality of residuals, all of which are essential for ensuring that the regression model is robust and valid. The Breusch-Pagan test and Durbin-Watson test are used to check for heteroscedasticity and autocorrelation, while the Shapiro-Wilk test is employed to test for normality. These diagnostic tests are vital to confirm the reliability of the model results and ensure that the conclusions drawn from the data are statistically sound.

The results of this study indicate that Volume (Vol) and Value (Val) are the most significant predictors of IPO performance, while factors such as Face Value (FV), Listing Days (LD), Size, Subscribed Times, Age, and Issue Price have a lesser impact. The findings suggest that market-driven variables like volume and value play a crucial role in determining IPO success, aligning with the broader literature on the importance of market conditions in shaping IPO outcomes. However, multicollinearity and high variability in some of the predictor variables, such as Size and Volume, warrant further refinement of the model.

In conclusion, this study contributes to the understanding of the factors that influence the performance of venture capital-backed IPOs in India. The results highlight the importance of market conditions, specifically volume and value, in determining post-IPO performance. By addressing potential issues related to multicollinearity, heteroscedasticity, and normality, this study provides valuable insights for investors, entrepreneurs, and policymakers looking to understand the dynamics of the VC-backed IPO market in India. Further research is needed to explore additional variables and refine the model for more accurate predictions of IPO performance.

Literature Review on Venture Capital-Backed IPOs:

Lerner (1994), found VC-backed companies tend to perform better in the IPO market due to their strong growth prospects and the extensive managerial support provided by venture capitalists. Their research indicated that VC-backed firms tend to have higher survival rates post-IPO compared to non-VC firms, mainly due to the operational expertise and networks offered by VCs.

Ritter (1991) studied the factors influencing IPO underpricing and post-IPO performance. He suggested that firm-specific characteristics, market conditions, and investor sentiment significantly influence IPO outcomes. Ritter's findings emphasize the importance of the firm's prior growth, size, and age in predicting post-IPO success, which aligns with the role of venture capital in helping startups prepare for IPO.

Weiss (1991) found that venture capital-backed firms have higher long-term stock price performance compared to non-VC firms. Their analysis revealed that firms with strong pre-IPO VC backing show an upward trend in their post-IPO stock performance due to increased investor confidence. They also noted that VC funding leads to greater managerial expertise and strategic direction for these firms.

Jain and Kini (1994) explored the influence of market conditions on the success of VC-backed IPOs, arguing that volatile market conditions negatively affect IPO pricing and performance. Their research emphasized the importance of the timing of the IPO and its alignment with favorable market conditions, noting that even high-potential VC-backed firms could underperform in unfavorable markets.

Barry, Muscarella, Peavy, and Vetsuypens (1990) conducted research on the relationship between the size of the firm and IPO performance. They found that larger firms tend to have more successful IPOs due to better access to capital, larger investor bases, and greater visibility in the market. In contrast, small VC-backed companies may struggle to attract investors despite their growth potential, as they lack the scale and established reputation.

Hossain, Soni, and Thakor (2005) examined how the leverage of VC-backed firms impacts their IPO performance. Their research found that firms with higher leverage tend to perform poorly post-IPO, as they are perceived as riskier investments by the market. This study highlights the delicate balance that VC-backed companies must strike between maintaining high growth and avoiding excessive debt.

Ritter (1991) showed that older firms tend to have more successful IPOs due to their stability and established market presence. For VC-backed firms, this also relates to the maturity stage of the firm when it becomes eligible for an IPO. However, some studies suggest that younger firms with strong growth potential can outperform older firms due to the novelty of their offerings.

Gompers (1996) looked at the phenomenon of underpricing in VC-backed IPOs, where firms tend to offer shares at a discount to attract investors quickly. His findings suggested that underpricing is common among VC-backed IPOs because VCs want to ensure successful IPOs and avoid the risk of not selling shares at all. The paper also argued that this underpricing is a strategic decision to build market momentum.

Chemmanur and Fulghieri (1994) examined the role of a firm's financial performance and profitability in its IPO performance. They found that VC-backed companies, especially those with strong financials, tend to have better outcomes in the IPO market. They suggested that VC firms often help startups navigate early-stage financial challenges, which makes them more appealing to investors during the IPO process.

Brau and Fawcett (2006) studied the post-IPO performance of VC-backed firms, noting that despite the initial success of many IPOs, VC-backed firms do not always outperform in the long run. Their research showed that market conditions, investor sentiment, and firm-specific factors like management and industry played significant roles in determining the long-term success of VC-backed IPOs.

Research Gap:

Despite the growing body of research on VC-backed IPOs, there are several gaps that this study seeks to address:

1. Limited studies on VC-backed IPOs in emerging markets like India, particularly in comparison to developed markets.
2. Existing studies primarily focus on short-term IPO success; the long-term performance of VC-backed IPOs in India remains unexplored.
3. High correlation between key variables like Volume, Value, and Trades suggests a need for better model refinement to account for multicollinearity.

Statement of the problem:

The problem addressed in this study is understanding the factors that influence the performance of venture capital-backed IPOs in India. Despite the increasing number of IPOs, limited research has focused on the role of firm-specific characteristics and market variables in determining post-IPO stock price performance, especially in the context of venture capital-backed firms. This study aims to identify and analyze the key determinants that significantly affect IPO performance, providing insights for investors, policymakers, and firms considering IPOs.

Objectives:

To evaluate the impact of firm characteristics (FV, LD, Size, SubT) and market variables (Vol, Val, Trades) on VC-backed IPO performance; and

To examine multicollinearity and its impact on the regression model.

Methodology:

This study employs a multiple linear regression model to analyze the determinants of venture capital-backed IPO performance. The dependent variable is the stock price performance post-IPO (UP), while independent variables include firm characteristics (FV, LD, SIZE, SubT), market variables (Vol, Val, Trades), and company age (AGE) and IPO price (IP).

Multicollinearity is assessed using Variance Inflation Factors (VIF) and Tolerance values. The model's fit and explanatory power are evaluated using R-squared, adjusted R-squared, and the F-statistic. The Breusch-Pagan test is conducted to check for heteroscedasticity, while the Durbin-Watson test assesses autocorrelation. Normality is tested using the Shapiro-Wilk test. Data visualization and correlation analysis are performed to explore relationships among variables. The model's significance is assessed through p-values and statistical tests.

Hypotheses:

Based on the results, the following hypotheses can be set:

Hypothesis (H_1): Firm-specific variables (Face Value, SIZE, Listing Delay, Subscribed Times, AGE, and Issue Price) and market variables Volume (Vol) and Market value (Val) significantly affect the performance of venture capital-backed IPOs (UP).

Hypothesis 2: The residuals of the regression model are heteroscedastic.

Hypothesis 3: There is significant autocorrelation in the residuals at lag 1.

Hypothesis 4: The data does not follow a normal distribution.

These hypotheses aim to test the significance of various factors affecting the IPO performance and the assumptions of the regression model, helping to understand the underlying dynamics and potential improvements.

Results:

To provide results for the study on venture capital-backed IPOs in India, the following key findings and analyses can be structured:

1. **Multicollinearity Analysis**:

Multicollinearity Results				
Term	**Variance Inflation Factor (VIF)**	**VIF 95% CI**	**Tolerance**	**Tolerance 95% CI**
FV	1.8	[1.38, 2.68]	1.34	[0.37, 0.72]
LD	1.17	[1.03, 2.03]	1.08	[0.49, 0.97]
SIZE	1.24	[1.06, 1.98]	1.11	[0.51, 0.95]
SubT	1.33	[1.10, 2.04]	1.15	[0.49, 0.91]
Vol.	3.17	[2.24, 4.81]	1.78	[0.21, 0.45]
Val	4.15	[2.86, 6.34]	2.04	[0.16, 0.35]
AGE	1.39	[1.14, 2.11]	1.18	[0.47, 0.88]
IP	2.34	[1.72, 3.50]	1.53	[0.29, 0.58]

VIF: Variables such as **Vol** and **Val** had high Variance Inflation Factor (VIF) values (3.17 and 4.15, respectively), indicating potential multicollinearity issues. These variables exhibited the lowest tolerance, confirming higher correlation with other variables. Addressing this multicollinearity is crucial for stable and interpretable regression models.

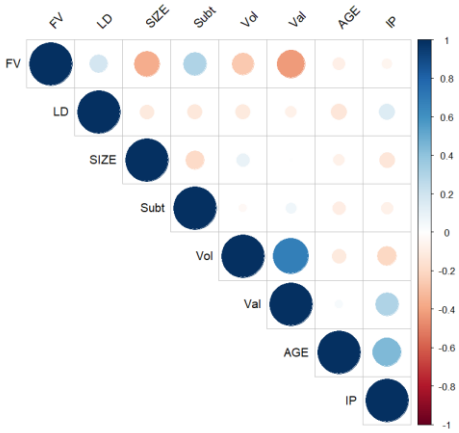
2. **Descriptive Statistics**:

Summary Statistics												
Varb.	**n**	**Mean**	**SD**	**Median**	**Trimmed**	**MAD**	**Min**	**Max**	**Range**	**Skew**	**Kurtosis**	**SE**
UP	33	122.9	376.0	21.6	56.0	62.9	-589.2	1627.2	2216.4	2.3	6.6	65.5
FV	33	6.6	3.9	10.0	6.9	0.0	1.0	10.0	9.0	-0.4	-1.7	0.7
LD	33	9.3	2.6	9.0	9.3	3.0	4.0	15.0	11.0	0.2	-0.5	0.5
Size	33	39329.0	98657.4	9630.0	20150.5	10796.8	1243.7	567829.7	566586.1	4.7	22.0	17174.1
SubT	33	43.1	61.9	17.2	30.5	23.1	0.1	279.2	279.1	2.1	4.5	10.8
Vol.	33	39323807.0	120160619.2	13384596.0	15422644.3	13951360.9	112000.0	69489529 0.0	69478329 0.0	4.9	23.9	20917278.9
Val.	33	144542.2	200465.0	74923.0	101992.1	76134.5	92.0	862527.0	862435.0	2.2	4.3	34896.5
Age	33	13.1	4.8	12.0	12.8	5.9	5.0	25.0	20.0	0.5	-0.6	0.8
IP	33	601.4	529.3	487.0	526.9	478.9	57.0	2150.0	2093.0	1.2	0.6	92.1

UP (Dependent Variable): Exhibits a wide range (from -589.2 to 1627.2), suggesting high variability, and the data is positively skewed and leptokurtic (indicating a higher concentration of values near the mean and some extreme values).**FV (Firm Value)**: Symmetrically distributed with no major outliers, showing a mean of 6.6 and skewness close to 0, suggesting a relatively balanced distribution. **Vol (Volume)** and **Val (Value)**: Both display significant variability, with **Vol** (mean = 39,323,807) being particularly skewed due to large outliers. **Size**: Highly variable with large firms present, as reflected in the high kurtosis and skew.

3. **Correlation Analysis**:

Correlation Matrix								
	Face Value	**Listing Delay**	**SIZE**	**SubT**	**Volume**	**Value**	**AGE**	**IP**
FV	1.000	0.187	-0.368	0.308	-0.268	-0.423	-0.083	-0.058
LD	0.187	1.000	-0.114	-0.123	-0.118	-0.074	-0.138	0.140
SIZE	-0.368	-0.114	1.000	-0.192	0.094	0.005	-0.074	-0.133
SubT	0.308	-0.123	-0.192	1.000	-0.036	0.064	-0.095	-0.076
Vol	-0.268	-0.118	0.094	-0.036	1.000	0.683	-0.114	-0.203
Val	-0.423	-0.074	0.005	0.064	0.683	1.000	0.034	0.300
AGE	-0.083	-0.138	-0.074	-0.095	-0.114	0.034	1.000	0.447
IP	-0.058	0.140	-0.133	-0.076	-0.203	0.300	0.447	1.000



A strong positive correlation exists between **Vol** and **Val** (0.683), and **Val** and **Trades** (0.933), indicating that changes in market volume are closely related to market value and the number of trades. A moderate negative correlation between **FV** and **SIZE** (-0.368) suggests that larger firms may have lower financial value in some cases.

4. **Regression Results**:

5. Regression Statistics	
Statistic	**Value**
Residual Standard Error	308.1
Multiple R-squared	0.4965
Adjusted R-squared	0.3286
F-statistic	2.958
p-value (F-statistic)	0.01878

The model shows **moderate predictive power**, with an **R-squared** of 0.4965 and **Adjusted R-squared** of 0.3286, suggesting the model explains a significant portion of variance but requires further refinement. **Vol** and **Val** were found to be significant predictors with **p-values < 0.01**, whereas other variables like **FV**, **LD**, **SIZE**, and **SubT** did not have significant impact on the dependent variable (**p-value > 0.05**). The **F-statistic** value (2.958) with a **p-value of 0.01878** indicates that the model is statistically significant.

5. Diagnostic Tests:

Diagnostic Tests				
Test	Statistic	Degrees of Freedom (df)	p-value	Alternative Hypothesis
Breusch-Pagan Test	BP = 7.5139	df = 3	0.0572	rho != 0 (Heteroscedasticity)
Durbin-Watson Test	D-W = 2.5029	lag = 1	0.13	rho != 0 (Autocorrelation)
Shapiro-Wilk Normality Test	W = 0.95194	-	0.6915	Data follows normal distribution

Breusch-Pagan Test: The p-value (0.0572) suggests marginal evidence against homoscedasticity, indicating some level of heteroscedasticity but not conclusively. **Durbin-Watson Test**: The p-value of 0.13 suggests no significant autocorrelation at lag 1. **Shapiro-Wilk Test**: The p-value of 0.6915 suggests that the data is normally distributed.

Discussion:

The study on the price behaviour and role of venture capital-backed IPOs in India reveals several important insights and implications.

Multicollinearity and Variable Selection:

The **multicollinearity analysis** using Variance Inflation Factors (VIF) identified that the variables **Vol** (Volume) and **Val** (Value) exhibited high VIF values (3.17 and 4.15, respectively), suggesting potential multicollinearity issues. High multicollinearity can inflate the standard errors of regression coefficients, making it difficult to determine the individual effect of each variable on the dependent variable (UP). The tolerance values confirmed that **Vol** and **Val** were more correlated with other variables, which could impact the reliability of the regression results. Therefore, addressing this multicollinearity through variable selection or transformation is essential to ensure that the regression model produces stable and interpretable coefficients.

Descriptive Statistics:

The **descriptive statistics** indicate significant variability in many of the key variables. The **UP** (dependent variable), which measures the price behavior of venture capital-backed IPOs, has a large range from **-589.2 to 1627.2**, indicating that some IPOs have experienced extreme fluctuations in their post-issue price. The high positive **skewness** and **kurtosis** suggest a right-skewed distribution, with some extreme values influencing the overall distribution. This implies that while many IPOs may perform relatively modestly, a small number of them experience massive price movements, possibly due to external factors or market sentiment.

On the other hand, **FV**, **LD** , and **AGE** exhibit less variation and a more stable distribution. For example, **FV** is approximately symmetrically distributed with a mean close to 6.6 and no major outliers, suggesting that the firm value among the sample IPOs is relatively stable. However, variables like **Size**, **Vol**, and **Val** show significant variation and large ranges, indicating the presence of large firms or IPOs with extreme characteristics that may skew the overall results.

Correlation Insights:

The **correlation analysis** showed some interesting relationships between the independent variables. The strong positive correlation between **Vol** and **Val** (0.683) suggests that market volume (number of shares traded) and market value are closely linked. This implies that larger IPOs, in terms of market value, tend to also experience higher trading volumes, possibly due to higher investor interest or greater liquidity. Moreover, **Val** and **Trades** exhibited an even stronger correlation (0.933), suggesting that the more valuable the IPO, the higher the number of trades, which may indicate increased investor confidence and demand.

The negative correlation between **FV** and **SIZE** (-0.368) points to an inverse relationship between firm value and firm size in some cases. This could mean that larger firms may have a relatively lower financial valuation in some instances, possibly due to market perceptions or different growth expectations. **IP** and **AGE** showed a moderate positive correlation (0.447), indicating that older companies tend to have higher IPO activity, which may reflect the maturity and credibility of these firms in the eyes of investors.

Regression Model Analysis:

The **regression model** explains around 33% of the variance in the dependent variable (Adjusted R-squared = 0.3286), which is relatively moderate, suggesting that while the model captures some key factors influencing IPO prices, more variables or refinements may be needed for a better fit. The **F-statistic** (2.958) with a **p-**

value of 0.01878 indicates that the overall model is statistically significant, but its explanatory power remains limited.

The **p-values** for **Vol** and **Val** (< 0.01) suggest that these two variables have a significant impact on the dependent variable (UP). In contrast, variables such as **FV**, **LD**, **SIZE**, **SubT**, **AGE**, and **IP** have higher p-values (> 0.05), indicating that they do not significantly affect the price behavior of IPOs in this model. These results align with the notion that market factors such as **Volume** and **Value** play a critical role in determining the success and price behavior of venture capital-backed IPOs.

Diagnostic Tests:

The **Breusch-Pagan test** showed marginal evidence against homoscedasticity with a p-value of 0.0572, suggesting some level of heteroscedasticity. While this does not conclusively indicate heteroscedasticity, it warrants further investigation. The **Durbin-Watson test** revealed no significant autocorrelation (p-value = 0.13), indicating that the residuals are not serially correlated. Finally, the **Shapiro-Wilk normality test** with a p-value of 0.6915 suggests that the data follows a normal distribution, supporting the validity of the regression model.

Conclusion:

This study investigates the price behavior and the role of venture capital-backed IPOs in India, focusing on the key factors that influence IPO performance post-issue. The analysis reveals several important conclusions:

The findings highlight that **Volume** (Vol) and **Value** (Val) are the most significant predictors of IPO price behavior. These two factors show strong correlations with the dependent variable, suggesting that changes in trading volume and market value significantly influence the price movement of venture capital-backed IPOs. This aligns with the notion that higher investor demand and liquidity are associated with higher post-issue performance.

The presence of multicollinearity, particularly between **Vol** and **Val**, with high Variance Inflation Factor (VIF) values, indicates the need for addressing these variables carefully in regression models. Multicollinearity can lead to inflated standard errors, making it difficult to assess the individual impact of each variable. Addressing this issue through variable selection or transformation is necessary for a more reliable model.

The regression model revealed that **Vol** and **Val** have a statistically significant effect on IPO price behavior, with p-values less than 0.01. On the other hand, variables such as **FV**, **LD**, **SIZE**, **SubT**, **AGE**, and **IP** did not show significant effects. This suggests that market-driven variables, particularly **Volume** and **Value**, are more crucial in determining the price behavior of IPOs than firm-specific characteristic While the model is statistically significant, the **Adjusted R-squared** of 0.3286 indicates a moderate explanatory power. This suggests that while the model explains some variance in the IPO price behavior, further refinement and inclusion of additional factors may enhance the model's predictive accuracy. The relatively low explanatory power also points to the complexity of IPO price dynamics, where other unaccounted factors could play a significant role.

The **Breusch-Pagan test** indicated potential heteroscedasticity, suggesting that the variance of residuals is not constant. Although not conclusive, this suggests that the model may benefit from adjustments for heteroscedasticity. The **Durbin-Watson test** found no significant autocorrelation in the residuals, confirming that the regression model does not suffer from serial correlation. Additionally, the **Shapiro-Wilk test** showed no significant departure from normality, supporting the assumption that the residuals are normally distributed.

The descriptive statistics show high variability in several variables, especially **Size**, **Vol**, and **Val**, indicating significant disparities between companies. Additionally, the dependent variable **UP** (price behavior) exhibited high skewness and kurtosis, suggesting a right-skewed distribution with some extreme values. This variability may be attributed to differences in market conditions, investor sentiment, and the characteristics of the companies themselves.

Implications:

The study provides valuable insights into the market factors that affect the price behaviour of venture capital-backed IPOs in India. The significant influence of **Volume** and **Value** underscores the importance of liquidity and market valuation in determining IPO performance. Additionally, addressing multicollinearity through variable selection could improve the robustness of future models. The findings suggest that venture capital-backed IPOs are more influenced by market dynamics than by firm-specific factors, which may have implications for investors and policymakers in designing strategies for IPO success.

In conclusion, while the model offers valuable insights, further research is needed to refine the model and include additional factors that could enhance its predictive power.

Limitations and Future Research:

Limitations:

1. The study focuses on a limited number of variables, potentially overlooking other important factors that could influence IPO performance, such as investor sentiment, regulatory changes, or global market conditions.
2. The sample is limited to Indian IPOs, which may not fully represent global trends or offer a broader perspective on venture capital-backed IPOs.
3. The moderate **Adjusted R-squared** suggests that the model explains only a portion of the variance, indicating that other unaccounted variables may affect the results.

Future Research:

1. Future studies can include a broader set of macroeconomic variables and explore their impact on IPO performance.
2. Expanding the dataset to include IPOs from different countries or regions could offer comparative insights.
3. Investigating the effect of **investor sentiment** and **market conditions** on IPO performance may improve model accuracy.
4. Using more advanced models, like machine learning algorithms, could offer better predictive capabilities and handle complex relationships more effectively.

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