

# Research on the Impact of Innovation Output on IPO Underpricing Rate based on Multiple Linear Regression Model

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**Keywords:** Innovation Capacity Output, Science And Innovation Board, Degree Of IPO Price Suppression, Multiple Linear Regression Model, Book Value Of Intellectual Property, Invention Patent Intensity.

**Abstract:** In the context of the reform of the registration system of China's science and technology innovation board, this paper empirically investigates the impact of a company's innovation output capability on the degree of its IPO depression, using 212 companies listed on the science and technology innovation board since 2019 as a research sample. In this paper, the company's intellectual property book value and invention patent intensity are used as indicators of the company's innovation output capability. This paper establishes a multiple linear regression model that affects the company's IPO underpricing rate, and explore the impact of the company's innovation output capacity on the degree of IPO underpricing. The results find that both the book value of intellectual property and the intensity of invention patents have a positive effect on the degree of IPO depression of the company, among which the former has a more significant effect. It is suggested to improve the assessment process of the actual innovation capacity of science and technology companies. Also, it can be urgent for relevant departments and organizations to guide secondary market investors to correctly understand the value of enterprises, as well as to participate in investment and pricing activities in an orderly manner.

## 1 INTRODUCTION

### 1.1 Background of the Study of the Problem

Due to the late establishment of the Chinese stock market, the short development time of the capital market and the imperfection of the relevant system, the IPO price suppression in the Chinese A-share market has been at a high level for a long time, with the average price suppression rate even exceeding 140%. The severe price suppression makes IPOs rarely break in the primary market, weakening the efficiency of market resource allocation. New shares are generally undervalued in the primary market, a phenomenon that is particularly evident in the KSE, increasing the cost of financing for KSEs, weakening their financing, and reducing the efficiency of resource allocation in the primary market. At the same time, it has been a long-standing iron law in the secondary market that new stocks are undefeated, and influenced by various factors such as investor sentiment and information asymmetry, the prices of

new stocks often jump wildly on the first day of listing in the secondary market, seriously affecting the fairness and rationality of market pricing. 2020 In June 2020, the STB began to implement the registration system reform on a trial basis, and the stock market as a whole evolved in a market-oriented direction, with the role played by the market in valuation and pricing is increasing day by day, and this initiative helps to guide the market towards rationalization, enhance market activity and the effectiveness of resource allocation, and guide the rationalization of the market valuation and pricing process. This paper aims to explore the impact of innovation output capacity on the degree of underpricing of stocks listed on the Sci-Tech Innovation Board for the first time, and to explore the relationship between stock valuation pricing and its intrinsic value after the registration system reform.

### 1.1.1 Changes in IPO Review and Pricing Brought about by the Registration-based IPO System

The reform of the registration system of the China Science and Technology Innovation Board (STIB) has clarified the issuance and listing review and registration procedures, shortened the working days required for registration review by the SFC, and further optimized the STIB delisting indicators. The registration system has improved the order of entry and exit in the capital market, effectively combating the investment behavior of the market and emphasizing the focus and screening of the intrinsic value of companies. This initiative creates a high-quality capital market and financing environment for science-based companies under the new normal of economic environment. At the same time, it hedges the negative impact of the epidemic on the capital market, accelerating the recovery of capital market vitality, as well as boosting the high-quality development of China's economy.

### 1.1.2 Innovation Capacity is Becoming an Increasingly Important Indicator of the Value of Listed Companies

With the gradual implementation of China's innovation-driven development strategy, improving innovation capability and truly realizing value innovation are important requirements for companies to achieve differentiation and improve industry competitiveness. In recent years, enterprises are interested in the key significance of innovation activities such as technological output for their long-term survival and development, and more and more listed companies are taking the initiative to disclose data on technological innovation, using R&D expenditure, patent quantity, intangible assets, etc. as indicators to measure their innovation capability and conduct empirical research related to enterprise value (Lu, 2009). In this paper, we will start from the innovation output capability of enterprises and introduce indicators such as relative patent intensity and intangible assets to explore the correlation between them and enterprise value, and then explore the impact on the IPO suppression of enterprises.

## 1.2 Research Value of the Problem

Compared with the existing literature, the contribution of this paper as long as the research is as follows: ① The research object is science and innovation companies to explore whether the science

and innovation board is tilted towards companies with strong innovation capability at the valuation pricing level. ② Most scholars in the past have mostly used R&D inputs to measure the R&D innovation capability of enterprises mainly, ignoring the role of the capability of the actual outcome output in valuation pricing. This paper starts from the innovation output capability of enterprises and explains the impact of innovation capability influence on the IPO suppression of science and technology innovation enterprises from a new perspective, making the evaluation system of valuation pricing more complete.

## 2 REVIEW OF THE LITERATURE AND THEORETICAL FOUNDATIONS

### 2.1 Study on IPO Price Suppression

#### 2.1.1 Interpretation of the Concept of IPO Price Suppression Rate

IPO (initial public offerings) pricing, which is a reasonable valuation of the intrinsic value of the proposed listed company, has always occupied an important position in the financial field (Dong, Liu, Xu). Since the proposed listed company cannot predict the market demand for its shares, the issuer will give its issue price to the investment bank, which will be responsible for issuing and underwriting the shares of the proposed company. Due to the uniqueness of a company's IPO listing event and the lack of historical trading data for the IPO company's stock, underwriters usually need to combine different valuation methods to more accurately predict the price of a company's IPO stock (Roosenboom, 2007). Due to the difficulty of IPO pricing, it is usually necessary to make judgments about the reasonableness of the pricing. In addition to the method of valuing and judging reasonableness by using comparable companies (companies with financial and industry characteristics similar to those of the proposed IPO) as a reference, a central measure of the efficiency of the IPO market is the degree of IPO price suppression (CHAMBERS, 2009, DIMSON, 2009). A central measure of the efficiency of the Initial Public Offering (IPO) market is the extent to which issues are underpriced.

The IPO price suppression phenomenon, which refers to the pricing of initial public offerings of listed

companies below the market price on the first day of listing (Li, 2020, Li, 2020), is widespread in stock markets around the world, and the degree of IPO price suppression in China's main board market is particularly significant (Gao, 2020). China's securities market has experienced a high degree of IPO depression in the A-share market for a long time since the establishment of a unified stock issuance system in 1993. In China, although the high IPO price suppression has promoted the rapid development of the capital market in the early years, the long-term high price suppression has affected the efficiency of resource allocation in the primary market for stock issuance. Also, the high IPO price suppression has affected the normal financing function of the secondary market. With a long period of high IPO price suppression, IPO subscribers can often obtain risk-free excess returns in the primary market, while small and medium-sized investors in the secondary market can often only buy new shares at high levels. This obviously unbalanced risks and returns of investors in the primary and secondary markets have resulted in a large number of secondary market investors transferring funds to the primary market to wait for new shares to be purchased. Seriously, the secondary market financing function is low.

### 2.1.2 Causes and Mechanisms of Action of IPO Price Suppression

The phenomenon of IPO price suppression in IPO pricing was first identified by Hatfield and Reilly in their study that investors in IPOs tend to enjoy higher short- and long-term return returns than the general market (Reilly, 1969, Hatfield, 1969). There has been foreign literature on IPOs, mainly based on the premise that secondary markets are efficient and based on the theory of information asymmetry to explain the phenomenon of IPO price suppression. Among them, Rock proposed the winner's curse hypothesis in 1986, explaining IPO price suppression as compensation by stock issuers to informationally disadvantaged investors in order to induce them to join the market to buy shares (Rock, 1986) (Allen, 1989, Faulhaber, 1989) (Levis, 1993). Baron proposed the investment bank buyer monopoly hypothesis in 1982. As issuers and underwriters face the risk of disclosing negative information during the subscription period, underwriters routinely resort to discounted offering strategies to reduce the risk of breakage (Baron, 1982, Myerson, 1982). In addition, the information transmission theory suggests that in the IPO market, potential investors lack knowledge of the true value of a listed company, and the

company entrusts a reputable underwriter to send signals of lower risk and make investors believe that they can gain excess returns by purchasing the company's new shares through IPO price suppression (Li, 2020, Li, 2020).

Some domestic scholars study the impact of institutional reform on IPO price suppression from the perspective of the IPO system. The IPO issuance system in China's capital market has gone through three stages: the audit system, the approval system and the registration system. Due to the late start and immature development of China's capital market, the marketization of IPO pricing is low. Before the reform of the registration system for IPO issuance of A shares, the administrative intervention in IPO issuance was more obvious, and the IPO issuance of enterprises received heavy restrictions. The number of enterprises that could go public was very limited and the listing cycle was long, causing the platform of listed enterprises to become a scarce resource (Li, 2020, Li, 2020). Companies and underwriters often need to drive down the stock issue price to ensure a smooth IPO. This makes the IPO pricing deviate from the actual intrinsic value of firms to a high degree and weakens the pricing efficiency of IPOs. Under the long-term IPO price suppression and inflexible stock supply, IPOs receive frenzied pursuit from investors, a strong speculative atmosphere in the secondary market, often blind speculation on IPO prices, irrational investors follow the trend to buy shares, and the price of IPOs in the secondary market is further inflated, further leading to a high degree of IPO price suppression in the A-share market.

## 2.2 A Study on the Impact of Firm Innovation Capability on IPO Price Suppression

The causes of the extent of IPO price suppression are now widely discussed by scholars both at home and abroad. On the one hand, underwriters tend to depress IPO prices in order to compensate for the costs required to obtain additional information about the firm Dong, Liu, Xu) (Benveniste, 1989, Spindt, 1989). Among other things, the more shares institutional investors receive, the more the IPO pricing deviates from the firm's internal value and the less efficient the pricing is Dong, Liu, Xu).

In terms of investor concern, current research identifies underpricing due to irrational behavior of small and medium-sized investors as the main reason why the first day price of IPOs is much higher than the issue price (Zou, 2020, Cheng, 2020, Chen, 2020, Ginger, 2020). There is room for arbitrage in the

primary and secondary markets under the current system, and investor sentiment and speculative psychology lead to serious overvaluation of IPO stock prices after listing (Song, 2019, Tang, 2019). Chi Jing and Padgett find through their study that the first-day increase of IPO stock limits the signal of the firm's true value to outside investors, and government control over IPO issuance exacerbates the extent of IPO price suppression (Chi, 2005, Padgett, 2005).

On the institutional side, by comparing the IPO of technology companies listed on the STB and the main board A-shares in the past year, Takatada verifies through an empirical study that the key factor of IPO price suppression of Chinese companies is the change of the IPO system, and that the reform of the registration system of stock issuance on the STB is conducive to the role of the market in pricing and resource allocation in IPO.

In terms of R&D intensity, at this stage, scholars at home and abroad have conducted more studies on the impact of R&D investment on IPO pricing, but have not yet reached a unified conclusion. From the perspective of IPO companies, companies with high R&D intensity and strong technical strength hope to signal the company's strong R&D capability and gain investors' recognition through high-quality R&D investment disclosure, which leads to higher stock issue pricing and a lower degree of IPO price suppression (Qiu, 2013, Peng, 2013, Yao, 2013). Some scholars also argue that large R&D investment exacerbates cash flow constraints and fails to deliver current earnings, exposing firms to a situation of high risk and uncertainty of earnings profile. As a result, underwriters tend to be associated with undervaluing firms in order to hedge risk and the degree of IPO depression rises (Schankerman, 1985, Pakes, 1985) (Han, 2001, Chuang, 2001).

Most of the existing domestic and international empirical studies exploring the pricing efficiency of IPOs on China's A-share STB have focused on the impact of R&D investment on the causes of IPO price suppression. The influence factor of innovation capacity output (IPR output/IPR owned) of STB IPO firms has been less explored.

A company's intellectual property rights contain patents, trademarks, copyrights, trade secrets, etc. Patents, as an important part of a company's intellectual property, are often discussed more by domestic and foreign scholars as one of the main R&D information disclosed by listed companies. It is widely believed at home and abroad that the core asset of patented technology owned by a company can influence the value of the company and its market value after IPO. The relationship between patent

output and company value has been widely discussed and verified in mature capital markets in Europe and the U.S (Li, 2012, Hong, 2012, Wu, 2012). Griliches first found the positive impact of the growth in the number of patents on the growth of company market capitalization and argued that this impact is particularly significant for smaller companies (Griliches, 1990). Subsequently, many foreign scholars have verified the positive relationship between patent ownership and firm value in their studies of listed companies in different industries in European and American capital markets, especially high-tech listed companies (Hall 2001, Jaffe 2001, Trajtenberg 2001). Similar findings have been obtained from relevant studies conducted by our scholars. By analyzing data on total intangible assets of listed companies from 1999-2003, it was found that the market recognizes companies' investment in intangible assets, among which the value of technological intangible assets is mainly reflected in high-tech industries (Shao, 2006, Fang, 2006). Fabrizi S. et al. further found through a series of studies that patented technologies developed by companies can convey to external investors. On this basis, Li Xiaoxia et al. explored the influence of patent quantity and patent quality on the market performance of listed companies after IPO, and concluded that there is a positive relationship between the number of patents and IPO market performance of companies, among which, the contribution of invention patents is particularly significant (Li, 2019, Luo, 2019, Wang, 2019). Some other scholars explain the impact of patent technology on a company's financing ability and value from the perspective of the company's future cash flow and operational risk, thus providing some thoughts on the IPO price suppression phenomenon. Patents can affect a company's future cash flow by affecting its operating performance and thus its future cash flow (Zheng, 2012, Song, 2012). Li et al. argue that technology brings more stable income, which can reduce the uncertainty of the company's future business situation and thus reduce the company's business risk. Patents can signal to the market that the company has good R&D capability and comprehensive value, and reduce the risk of financing failure (Li, 2019, Luo, 2019, Wang, 2019).

### 3 INTRODUCTION OF THE RESEARCH CONCEPT AND HYPOTHESIS FORMULATION

#### 3.1 Introduction of the Research Concepts in This Paper

This paper mainly adopts literature research method and empirical research method to investigate the impact of a company's innovation output capacity on its IPO depression rate by taking innovative companies listed on the KCI board as the object of study, using IPO underpricing rate as the explanatory variable, using IPR book value and invention patent intensity as the explanatory variables, and setting other control variables according to the existing literature.

#### 3.2 Formulation of the Research Hypothesis in This Paper

Based on the above analysis, two hypotheses are proposed in this paper.

H1: The higher the share of a company's intellectual property in intangible assets, the stronger the company's innovation potential and innovation output capacity, the more the secondary market recognizes the value of the company and has confidence in its profitability, and the more severe the price suppression. In other words, there is a significant positive relationship between a company's innovation output capacity and the degree of IPO price suppression.

H2: The higher the number of invention patents owned by a firm at a certain size, the higher the proportion of technologies that can really create value for economic growth, the more confidence secondary market investors have in the firm's innovation capability and the easier it is to overestimate the real value of the firm's stock. There is a significant positive relationship between the intensity of a company's invention patents and the degree of IPO price suppression.

### 4 MODEL CONSTRUCTION AND EMPIRICAL STUDY

#### 4.1 Study Sample and Data Sources

In this paper, the initial sample of China A-share KSC IPO companies from 2019/7/22-2021/2/10 is used

and screened: special marker companies (sample of companies with unprofitability, voting rights difference, and red-chip structure) are excluded, and a final sample of 212 KSC companies is obtained. The data of financial indicators such as total assets, gearing ratio, return on net assets, and years of establishment for the sample of companies in this paper are obtained from the WIND database.

#### 4.2 Definition of Model Variables

##### 4.2.1 Explained Variables

The explanatory variable is the IPO Underpricing Rate

(IUR) of the firm. In the robustness test, the Adjusted Initial Public Offering Underpricing rate (AIUR) is used as the moderating explanatory variable in this paper.

##### 4.2.2 Explanatory Variables

The explanatory variables are Book Value of Intellectual

Property (IPBV) and Intensity of Patent of Invention (PI). The two are used as indicators of the level of innovation capacity output of science and innovation companies.

##### 4.2.3 Control Variables

Control variable is the logarithm value of a company's

Total Assets (lnTA), Debt to Asset ratio (LEV), Return on Equity (ROE), Years of Establishment (Years), The First Big Proportion of Shareholding (TOPI), Industry Price Earnings ratio (IPE), First-day Turnover rate (FTR), Online Demand-to-Offer ratio (OTR), and the number of Shares sold in the online offering. demand-to-offer ratio (OISR), Issuance Cost (IC), and Earnings per Share (EPS).

#### 4.3 Construction of the Model

To test the hypothesis, the following model (1) and model (2) are developed in this paper, respectively.

$$IUR = \beta_0 + \beta_1 IPBV + \beta_2 \ln TA + \beta_3 LEV + \beta_4 ROE + \beta_5 TOPI + \beta_6 IPE + \beta_7 FTR + \beta_8 OISR + \beta_9 IC + \beta_{10} EPS + \beta_{11} Years \quad (1)$$

$$IUR = \beta_0 + \beta_1 PI + \beta_2 \ln TA + \beta_3 LEV + \beta_4 ROE + \beta_5 TOPI + \beta_6 IPE + \beta_7 FTR + \beta_8 OISR + \beta_9 IC + \beta_{10} EPS + \beta_{11} Years \quad (2)$$

Among them, the explanatory variables of model (1) are the book value of intellectual property (IPBV) and the explanatory variable of model (2) is the

intensity of intellectual property (PI). Referring to the study of Jianghong Zeng and Xiaoxia Li et al. the IPO underpricing rate is also affected by total assets (lnTA), gearing ratio (LEV), return on net assets (ROE), years of establishment (Years), percentage of shares held by the largest shareholder (TOPI), price-to-earnings ratio of the industry to which it belongs (IPE), First-day turnover ratio (FTR), Online Offering Winning rate (OISR), IPO offering expense ratio (IC), and earnings per share (EPS). In addition, the model controls for the company's duration of establishment (Years), which is calculated by calculating the number of days between the company's establishment date and listing date divided by 365 days, rounded to single digits, and the result is recorded as the company's duration of establishment (Years). The specific variables are defined in Table 1.

Table 1.

Variable definition table			
Variable Type	Variable Name	Variable symbol	Variable definition
Explained variables	IPO Underpricing Rate	<i>IUR</i>	
	Adjusted IPO Underpricing Rate	<i>AIUR</i>	
Moderated explanatory variables	Book Value of Intellectual Property	<i>IPBV</i>	(Intangible assets - land use rights)/intangible assets*100
	Intensity of Patent	<i>PI</i>	Total number of patents invented/intangible assets
Control variables	Total assets	<i>lnTA</i>	The total assets of the firm as of the day before the sample cut-off date are taken as the natural logarithm
	Debt to Asset ratio	<i>LEV</i>	Gearing of the company as of the day before the sample cut-off date

Return on Equity	<i>ROE</i>	Net return on equity of the company on the day before the sample cut-off date
The First Big Proportion of Shareholding	<i>TOPI</i>	The percentage of shares held by the company's largest shareholder on the day before the sample cut-off date
Industry Price Earning Ratio	<i>IPE</i>	P/E ratio of the company's industry on the day before the sample cut-off date
First-day Turnover Rate	<i>FTR</i>	First-day turnover rate of the company's initial listing
Online Issue Winning Rate (Online demand-to-offer ratio)	<i>OISR</i>	The winning percentage of the online offering of the company's initial listing
Issuance Cost	<i>IC</i>	Issue expense ratio for the company's initial public offering
Earnings per Share	<i>EPS</i>	Earnings per share for the company's initial public offering
Number of years of establishment	<i>Years</i>	Logarithm value of Number of years of incorporation at the time of the IPO

#### 4.4 Descriptive Statistics

To preliminarily analyze the relationship between the book value of IPRs, the intensity of invention patents and the degree of IPO depression for companies listed on the KSE since 2019, this paper presents descriptive statistics on the variables of the sample.

Table 2 shows the results of descriptive statistics for all variables. The statistics of IPO price suppression level (*IUR*, *AIUR*) show that the high price suppression phenomenon is serious in China's science and technology board, with the average price

suppression rate as high as 156.26%, and the degree of price suppression on the first day of listing varies greatly among different companies in the science and technology board, with a standard deviation as high as 124.90. The maximum value of intellectual property book value (IPBV) is 100.00% and the mean value is 37.13% with a standard deviation as high as 40.56. The ownership of IPBV of KCI companies in the sample pool is generally high, but the results from the cross-sectional comparison show that the ownership varies greatly from company to company. The maximum value of Invention Patent Intensity (PI) is 8.61, the minimum value is 0.00, and the standard deviation is 0.61. The ability of companies per unit size in the sample pool to produce invention patents does not vary much.

lnT	212	3.0	0.04	2.93	3.22
A		2			
LEV	212	32.99	16.73	83.84	83.84
ROE	212	13.28	13.74	-13.70	124.35
TOP	212	30.77	13.86	9.35	81.88
I		41.40			
IPE	212	74.53	15.31	12.97	131.69
FTR	212	4.0	5.65	57.57	98.96
OIS	212	8	1.57	2.72	22.54
R		9.8			
IC	212	6	3.40	1.67	34.89
EPS	212	0.9	1.15	0.00	15.13
Year	212	8	4.93	5.00	32.00
s		61			

Table 2.

Descriptive statistics of variables					
Variables	Number of samples	average value	(statistics) standard deviation	minimum value	maximum value
IUR	212	156.26	124.90	-2.15	923.91
AUR	212	156.09	124.36	-1.9	908.1
IPBV	212	37.13	40.56	0.00	100.00
PI	212	0.09	0.61	0.00	8.61

### 4.5 Correlation Analysis

First, this paper analyzes the correlation coefficients of the explanatory variables, explanatory variables, and control variables, and Table 3 shows the correlation matrix encompassing all variables, and Fig. 1 shows the correlation scatter plots of all variables. As shown in Table 3, there is a positive relationship between both IPR book value and invention patent intensity and IPO price suppression rate, sign this paper expects.

Table 3: Correlation matrix of variables.

Names of Variables	IUR	AUR	IPBV	PI	lnTA	LEV	EPS	TOPI	ROE	IC	OIS	FTR	IPE	Years
IUR	1	0.999678359	0.093840934	0.114497913	-0.000676464	-0.070021416	-0.169244766	-0.084720052	0.098840555	0.28008789	-0.011714264	0.323672413	0.049335921	0.006626562
AUR	0.999678359	1	0.093749693	0.116784662	0.000189331	-0.070372874	-0.172612836	-0.085129737	0.101083929	0.28101959	-0.009547488	0.324269707	0.04878373	0.006626562
IPBV	0.093840934	0.093749693	1	0.169573466	-0.141595019	-0.194365617	0.101946362	-0.126692632	-0.083165356	-0.064524001	0.019661625	-0.010716004	0.275435748	-0.147996434
PI	0.114497913	0.116784662	0.169573466	1	-0.072490426	-0.096253892	-0.011129475	-0.002760072	-0.007234123	-0.003622992	-0.044575152	-0.04576718	0.146752875	0.035270101
lnTA	-0.000676464	0.000189331	-0.141595019	-0.072490426	1	0.461292227	-0.045142354	0.104621933	-0.081572006	-0.367298739	0.501849641	-0.186094999	-0.17482777	0.004067442
LEV	-0.070021416	-0.070372874	-0.194365617	-0.096253892	0.461292227	1	-0.060762256	0.030296679	-0.009169496	-0.002936206	0.092745503	-0.100470881	-0.1187251	0.027862398
EPS	-0.169244766	-0.172612836	0.101946362	-0.011129475	-0.045142354	-0.060762256	1	0.001354362	0.100987781	-0.244857231	-0.108447175	-0.130830282	-0.044763145	-0.12318908
TOPI	-0.084720052	-0.085129737	-0.126692632	-0.002760072	0.104621933	0.030296679	-0.001354362	1	0.094023322	0.0360487	0.142421646	-0.100391624	-0.086533193	0.112199987
ROE	0.098840555	0.101083929	-0.083165356	-0.007234123	-0.081572006	-0.009169496	0.100987781	0.094023322	1	-0.027090386	-0.111236175	-0.09490774	0.019091321	0.011057491
IC	0.28008789	0.28101959	-0.064524001	-0.003622992	-0.367298739	-0.002936206	-0.244857231	0.0360487	-0.027090386	1	0.254894591	1	0.323964966	0.046566388
OIS	-0.011714264	-0.009547488	0.019661625	-0.044575152	0.501849641	0.092745503	-0.108447175	0.142421646	-0.111236175	-0.254894591	1	0.033516719	-0.161156709	-0.124907702
FTR	0.323672413	0.324269707	-0.010716004	-0.04576718	-0.186094999	-0.100470881	-0.130830282	-0.100391624	-0.09490774	0.254894591	0.033516719	1	0.035717084	-0.112488673
IPE	0.049335921	0.04878373	0.275435748	0.146752875	-0.17482777	-0.1187251	-0.044763145	-0.086533193	0.019091321	0.046566388	-0.161156709	0.035717084	1	-0.033740989
Years	0.006626562	0.006626562	-0.147996434	0.035270101	0.004067442	0.027862398	-0.12318908	0.112199987	0.011057491	0.135881387	-0.124907702	-0.112488673	-0.033740989	1

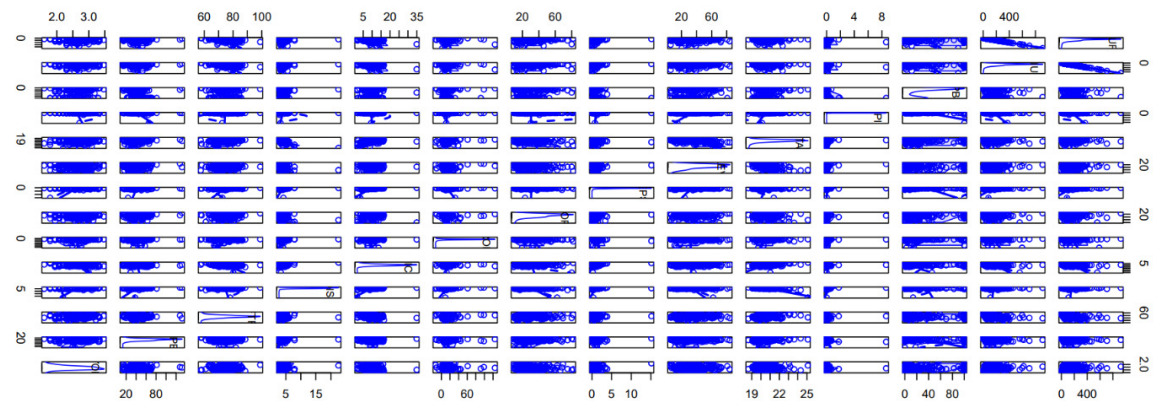


Figure 1: Scatter plot of variable correlations.

Secondly, this paper also performs variance inflation factor tests on the variables to exclude multicollinearity, and Tables 4 and 5 use the book value of intellectual property and patent intensity of invention as explanatory variables, respectively. Observing the test results, the VIF values of all factors are low and stable, and no large values or significant outliers are found. Therefore, the multicollinearity is negligible and there are no factors that need to be excluded.

Table 4.

VIF test (Explanatory Variable 1 IPBV)	
IPBV	1.190295224
lnTA	1.995935436
LEV	1.386475373
EPS	1.14023079
TOPI	1.084941262
ROE	1.055505566
IC	1.494960568
OISR	1.500969826
FTR	1.217930872
IPE	1.135804759
Years	1.106044695

Table 5.

VIF Test (Explanatory Variable 2 PI)	
PI	1.031047698
lnTA	1.979954064
LEV	1.375743561
EPS	1.128830362
TOPI	1.074703973
ROE	1.045573152
IC	1.494749516
OISR	1.483353476
FTR	1.215232249
IPE	1.074787317
Years	1.09509684

### 4.6 Multiple Regression Analysis

Table 6 shows the regression results of IPBV and IPO price suppression of science and innovation firms. the coefficient of IPBV is positive, which is consistent with H1, i.e., higher IPBV increases the likelihood of IPO price suppression of firms. The regression results in Table 6 show that IPBV has a significant positive effect on IPO price suppression of innovative firms,

which is in line with the conjecture of H1. The regression result has a statistic of 5.439 and a p-value of 1.48e-7, the overall regression is more significant and the explanatory variable book value of IPR has some degree of explanation on IPO price suppression rate.

Table 6.

Regression results of the effect of IPBV on IUR					
Variable	Estimate	Std. Error	t value	Pr(> t )	
(Intercept)	-1145.73	283.06	-4.05	0.00	**
IPBV	0.41*	0.21*	1.98*	0.05*	*
lnTA	38.58	12.13	3.18	0.00	**
LEV	-1.01	0.54	-1.85	0.07	
EPS	-10.66	7.18	-1.49	0.14	
TOPI	-0.77	0.58	-1.33	0.19	
ROE	1.62	0.58	2.81	0.01	**
IC	9.97	2.76	3.61	0.00	**
OISR	-4.67	6.11	-0.76	0.45	
FTR	6.11	1.51	4.05	0.00	**
IPE	-0.11	0.54	-0.20	0.84	*
Years	3.31	23.27	0.14	0.89	

Signif. codes: 0'\*\*\*'0.001'\*\*\*'0.01'\*\*\*'0.05'.'0.1' .1

Multiple R-squared: 0.2312, Adjusted R-squared: 0.1887

F-statistic: 5.439 on 11 and 199 DF, p value: 1.48e-07

Table 7 shows the regression results of invention patent intensity on IPO price suppression for COST companies. The positive coefficient of PI supports the positive correlation expected by H2, i.e., higher invention patent intensity exacerbates the degree of IPO price suppression for COST companies. From the regression results in Table 7, it can be seen that invention patent intensity has a less significant positive effect on IPO depression of innovative companies. With a statistic of 4.986 and a p-value of 7.682e-7, the overall regression is more significant, but the explanatory variable invention patent intensity has a lower degree of explanation for the IPO price suppression rate.

Table 7.

Regression results of the effect of PI on IUR					
Variable	Estimate	Std. Error	t value	Pr(> t )	
(Intercept)	-1068.80	77	-13.77	0.00	**
PI	3.25	53.84	0.06	0.95	
lnTA	36.38	12.32	2.95	0.00	**



LEV	-1.12	0.55	-2.04	0.04	*
EPS	-9.25	7.21	-1.28	0.20	
TOPI	-0.88	0.58	-1.51	0.13	
ROE	1.51	0.58	2.60	0.01	**
IC	9.81	2.79	3.51	0.00	***
OISR	-3.31	6.14	-0.54	0.59	
FTR	5.95	1.52	3.90	0.00	***
IPE	0.16	0.53	0.31	0.76	
Years	-1.59	23.52	-0.07	0.95	

Signif. codes: 0'\*\*\*\*'0.001'\*\*\*'0.01'\*'0.05'.'0.1' '1  
 Multiple R-squared: 0.216, Adjusted R-squared: 0.1727  
 F-statistic: 4.986 on 11 and 199 DF, p value: 7.682e-07

### 4.7 Robustness Tests

To make the empirical results more reliable, this paper uses the adjusted IPO underpricing rate (AIUR), replacing the IPO underpricing rate (IUR) as the explanatory variable, to conduct the robustness test of this regression model. The regression results in Tables 8 and 9 remain largely consistent with those in Tables 6 and 7, and the empirical results are more robust. According to the regression results shown in Tables 8 and 9, the coefficients of the book value of intellectual property and the intensity of invention patents are both positive, and both have a positive effect on the degree of IPO depression of innovative companies. Among them, the former's has a significant positive effect on the IPO price suppression rate of KIC companies. The overall regression of the model is more significant, but the explanatory variables are not well explained.

Table 8.

Variable	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	-1142.65	281.21	-4.06	0.0002
IPBV	0.41	0.21	1.99	0.05
lnTA	38.53	12.05	3.2	0.001
LEV	-1.01	0.54	-1.87	0.06
EPS	-10.96	7.13	-1.54	0.13
TOPI	-0.78	0.58	-1.35	0.18
ROE	1.64	0.57	2.86	0.005
IC	9.97	2.74	3.63	0.0003
OISR	-4.48	6.07	-0.74	0.46

FTR	6.08	1.5	4.06	0	**
IPE	-0.11	0.53	-0.21	0.83	*
Years	3.19	23.12	0.14	0.89	

Signif. codes: 0'\*\*\*\*'0.001'\*\*\*'0.01'\*'0.05'.'0.1' '1  
 Multiple R-squared: 0.234, Adjusted R-squared: 0.1917  
 F-statistic: 5.527 on 11 and 199 DF, p value: 1.078e-07

Table 9.

Variables	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	1065.96	281.94	-3.78	0.0003
PI	3.36	53.49	0.06	0.95
lnTA	36.33	12.24	2.97	0.003
LEV	-1.12	0.54	-2.06	0.04
EPS	-9.56	7.17	-1.33	0.18
TOPI	-0.89	0.58	-1.53	0.13
ROE	1.53	0.58	2.66	0.01
IC	9.81	2.77	3.54	0.0004
OISR	-3.12	6.10	-0.51	0.61
FTR	5.92	1.51	3.91	0.0001
IPE	0.15	0.53	0.29	0.77
Years	-1.70	23.37	-0.07	0.94

Signif. codes: 0'\*\*\*\*'0.001'\*\*\*'0.01'\*'0.05'.'0.1' '1  
 Multiple R-squared: 0.2188, Adjusted R-squared: 0.1756  
 F-statistic: 5.068 on 11 and 199 DF, p value: 5.697e-07

## 5 CONCLUSIONS AND RECOMMENDATIONS OF THE STUDY

### 5.1 Conclusion

IPO price suppression in China receives multiple factors, and the price that exists between the IPO issue price and the first-day closing price of the IPO is simultaneously undervalued by the primary market and overvalued by the secondary market. The actual innovation capability of a company is increasingly valued in IPO valuation pricing, and this paper explores the impact of innovation output capability of

science and technology companies on IPO valuation pricing by using a sample of IPO listed companies in China's A-share science and technology board from 2019/7/22-2021/2/10. It is found that both the book value of intellectual property and the intensity of invention patents have positive effects on the degree of IPO price suppression of innovative firms, with the positive correlation of the book value of intellectual property being more significant. It is concluded that the higher the book value of intellectual property rights or the higher the intensity of invention patents, the stronger the innovative output capability of the STB companies, the higher the confidence of secondary market investors in the competitiveness and sustainable profitability of the listed companies, the recognition of the innovative R&D capability and the actual value of the companies, and the higher the cumulative excess return after the first IPO of the companies, the more severe the IPO price suppression.

## 5.2 Relevant Recommendations based on the Findings of the Study

Based on the findings of this paper, the following recommendations are made.

a) From the perspective of science and technology companies, while continuously improving their actual innovation capabilities, science and technology companies should stand more from the perspective of investors, and reasonably increase the quality of information disclosure while ensuring that key technology secrets are protected, so that the value and competitiveness of the company is fully recognized by investors, weakening the pricing bias caused by information asymmetry in valuation pricing, and making the company's R&D value correctly reflected in IPO pricing. The company's R&D value is correctly reflected in the IPO pricing.

b) At the institutional level, the rules and regulations governing information disclosure by listed enterprises need to be further improved. It is recommended to improve the relevant institutional acts regulating the review of the assessment of innovation capability of science and innovation enterprises and the first-day excess return rate of IPOs, so as to effectively promote the reasonable and correct reflection of the actual innovation capability of enterprises in the valuation and pricing process from an institutional perspective. At the same time, by limiting the cumulative excess return rate and related incentives and penalties, the speculation of stock prices by investment institutions and blind

follow-through investment by investors should be combated.

c) At the regulatory level, it is recommended that the relevant authorities should strengthen the supervision of the rationality of the behavior of secondary market investors in assessing the innovation capability of science and innovation enterprises, help investors to correctly understand the actual value of enterprises, supervise the orderly communication of information between enterprises and the capital market, and build a bridge of communication between enterprises, investment and the capital market.

d) From the perspective of education and publicity, education and guidance for individual investors in the secondary market should be strengthened, investors should be guided to participate in market activities in an orderly manner, and the threshold for investors to enter the securities market should be raised moderately. Education and dissemination of relevant knowledge to investors should be enhanced to raise the risk awareness of stockholders and reduce the emergence of speculative behavior such as blind investment in a flurry of activity and price hugging.

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