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Industry Difference on Patent Drawing's Capability for Differentiating Stock Rates of Return of Chinese Listed Companies in Non-Manufacturing Industry Sectors -- An Explore into Invention Publication Patents and Utility Model Grant Patents

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Abstract

The industry difference on patent drawings of invention publications and utility model grants over top nine non-manufacturing industry sectors in China stock market was discussed via analysis of variation (ANOVA). Regarding patent drawing count's capability for differentiating Chinese listed company's stock rate of return, the invention publication and the utility model grant were different. The invention publication's drawing count showed well capability for one industry sector, fair capability for two industry sectors, partial capability for one industry sector, weak capability for two industry sectors, and ineffective capability for three industry sectors; whereas the utility model grant's drawing count showed partial capability for four industry sectors, weak capability for three industry sectors, and ineffective capability for two industry sectors. The patent drawing count of invention publications showed superior capability to those of utility model grants and invention grants. The higher patent counts of invention publications showed fairly connection with the capability, however, the higher patent counts of utility model grants showed weak connection with the capability. The higher stock rates of return also showed weak connection with the capability for either invention publications or utility model grants. Every non-manufacturing industry sector had its particularity. The industry difference among top nine non-manufacturing industry sectors in China stock market was distinct.

JEL classification number: C38, C46, G11.
Keywords: Patent, Invention publications, Utility model grants, ANOVA, Stock rate of return, Drawing count, Industry difference.

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1 Introduction

Innovation and its principal outcome, i.e. patent, is an essential driver of economic progress that benefits businesses and the economy as a whole. China is the largest domestic patent application country in the world. China Intellectual Property Administration (CNIPA), the patent office provided with the largest number of examiners in the world, published and/or granted more than six million China patents in a single year of 2021, including 1,720 thousand invention publications, 696 thousand invention grants, 3,120 thousand utility model grants and 785 thousand design grants.

The development of China innovation capabilities from 1985 to 2005 was examined by using China invention patents (Motohashi, 2008). A substantial trend of Chinese companies catching up with Western counterparts via patent statistics was found in two high-tech sectors including the pharmaceutical industry and mobile communications technology (Motohashi, 2009). These two high-tech sectors showed contrasting trends, Chinese company's rapid catching up was found in the mobile communications technology, while Chinese companies were lagging behind in the pharmaceutical industry. Hu and Jefferson (2009) used a company-level data set to explore the factors that accounting for the rising patent activity in China, and found that the patent surge in China was seemingly paradoxical given China's weak record of protecting intellectual property rights.

Lei, Zhao and Zhang *et al.* (2011) found that China inventive activities had experienced three developmental phases and had been promoted quickly while the innovation strengths of the three development phases had shifted from government to university and research institute and then industry. China patent statistics was found to be meaningful because China valid patent count was correlated with R&D input and financial output (Dang and Motohashi, 2015). Hanley, Liu and Vaona (2015) found that regional credit depth had a significantly positive effect on China innovation performance. Credit depth had more marked impacts on China invention patents than on utility model patents and design patents. Liu and Qiu (2016) used Chinese firm-level patent data from 1998 to 2007 and found that the input tariff cut in 2002, which resulting from China's WTO accession, resulted in less innovation undertaken by Chinese firms.

A patent quality index based on internationally comparable citation data from international search reports (ISR) of PCT patent applications was proposed to consider foreign, domestic, and self citations as economic indicators (Boeing and Mueller, 2019). However, the domestic and self citations suffered from an upward bias in China and were suggested to be employed with caution as a measure of patent quality. China's patent surge and its driving forces on patent applications filed by Chinese firms and found that R&D investment, foreign direct investment, and patent subsidy were found to have different effects on different types of patents (Chen and Zhang, 2019). R&D investment was found to have a positive and significant impact on patenting activities for all types of patents; the stimulating effect of foreign direct investment on patent applications was only robust for utility model patents and design patents; the patent subsidy only had a positive impact on design patents.

The stock market usually reflects the economic conditions of an economy. China is now the world No.2 economy and has a stock market having the world No.2 transaction volume and a large number of listed companies. Chinese listed companies of RMB common stocks (China A-shares) contribute more than 95% transaction volume of China stock market. They give a great impact on China patent development because what China A-shares act for patents, the unlisted companies and individuals follow. However, it was found to be very difficult in integrating China patent data with company data (He, Tong and Zhang *et al.*, 2016).

The research on China patent with China A-share's performance has been beginning recently. However, the relationship between China patent indicators and China A-share's performance in different industry sectors has not been thoroughly studied. Meanwhile, the patent drawing is usually ignored and less discussed than the other patent indicators.

It is therefore the objective of this research to find out the followings:

(1) Whether patent drawing counts of China A-share's invention publications and utility model grants in various non-manufacturing industry sectors are significantly different or not?

(2) Whether patent drawing count of invention publications and utility model grants is provided with the capability for differentiating China A-share's stock rates of return with regard to various non-manufacturing industry sectors?

(3) If the answer of (2) is positive, whether the capabilities are similar or different over the invention grants, the invention publications, and the utility model grants?

The managerial implication of this research therefore comprises:

(1) enriching the understanding of China, A-share's patent drawing count of invention publications and utility model grants in various non-manufacturing industry sectors;

(2) extending the application of China patent drawing count of invention publications and utility model grants to the China stock market; and

(3) helping the investment organizations to improve their stock portfolio strategy on China A-shares in non-manufacturing industry sectors by using the factor of patent drawing counts of invention publications and utility model grants.

In the following paragraphs, section 2 presents the literature review; section 3 presents the data and methodology which including the delimitation and limitation, population and samples for non-manufacturing industry sectors, and the instrumentation which showing the company integrated patent database used, the calculation of patent drawing counts for invention publications and utility model grants, the drawing groups by patent drawing counts, the calculation of stock rate of return, and the principal of analysis of variance (ANOVA); section 4 presents the result and finding; section 5 presents the conclusion and recommendation.

2 Literature Review

Chen, Wei and Che (2018, 2020) used the patent data and stock price data of China A-shares) in Shanghai main board from 2011 to 2017 and found the patent indicators have leading effect on A-share's stock price. Chiu, Chen and Che (2020a, 2020b) focused on the whole China A-shares without distinguishing the stock boards from 2016Q4 to 2018Q3. They found that the patent indicators also have leading effect on the financial indicators including the stock price, return-on-asset, return-on-equity, book-value-per-share, earnings-per-share, price-to-book and price-to-earnings. The patent prediction equations for quantitatively giving the predictive values of the aforementioned financial indicators are proposed.

The China A-shares are listed on four stock boards including Shanghai main board, Shenzhen main board, Growing-Enterprises board, and Small-and-Medium-Enterprises board. The A-share sizes are quite different in these four stock boards. Chiu, Chen and Che (2020c, 2020d, 2020e, 2020f, 2021), Li, Deng and Che (2020a, 2020b, 2021) further studied the patent leading effect in each of the four stock boards, proposed the patent prediction equations for each stock board on the stock price, return-on-asset, return-on-equity, book-value-per-share, earnings-per-share, price-to-book and price-to-earnings, finally proposed patent based stock selection criteria to build stock portfolios having preferable performance. For improving the performance of stock portfolios, Tsai, Che and Bai (2022) applied AI approach via patent forward citations to select preferable stocks for each stock boards and clearly showed AI's superiority and limitation when using patent indicators.

The statistic significance between various China patent indicators and the performance of China A-shares has been studied since 2021. Tsai, Che and Bai (2021a) found that the China A-shares with the higher innovation continuity of any patent species of the invention publication, the invention grant, the utility model grant, and the design grant, showed higher stock rates of return. Tsai, Che and Bai (2021b; 2021c) found that the A-shares having patents of higher patent counts showed higher stock prices and higher stock rates of return regardless of what patent species is. Tsai , Che and Bai (2021d) found that the A-shares having patents of higher technology variety showed higher stock rates of return. Tsai, Che and Bai (2021e)

found that the A-shares having the invention grants of the longer examination duration showed higher stock rate of return. Tsai, Che and Bai *(*2021f) found the A-shares having patents and receiving higher backward citation counts showed higher stock prices. Tsai, Che and Bai (2022b) found that the A-shares having patents but free of forward citation counts showed higher stock prices than the A-shares receiving higher forward citation counts. Tsai, Che and Bai (2022c) based on the forward citation count and the stock price, proposed a novel indicator called the 'price-citation' and found that the A-shares having higher price-citations showed higher stock rates of return. Tsai, Che and Bai (2022d) found that the A-shares having invention grant's patent lives above the general level usually showed higher market capitalization whereas the A-shares having longer utility model grant's patent lives and longer design grant's patent lives did not show higher market capitalization. Tsai, Che and Bai (2022e) found that the total claim count of any patent species was a good indicator for classifying A-share's stock rate of return, the A-shares having higher claim counts showed significantly higher stock rates of return.

The patent drawing is seldom discussed previously and usually regarded as a less important patent indicator when comparing with the patent claim. In fact, according to the patent examination criteria, the claim has to be supported by the drawings and/or the specification. It means that the drawings must clearly and fully reveal the claimed embodiments, and possibly show all alternatives of the claimed embodiments. A patent with more embodiments would result in more drawings while a patent with few embodiments and would result in few drawings.

Lai and Che (2009a, 2009b, 2009c) gave a first start on using the drawing count of US patents by applied the drawing count as an indicator for quantitatively modeling damage awards of infringement lawsuits. Though the drawing count of China patents has been applied for quantitatively giving the predictive values of A-share's financial indicators (Chiu *et al.,* 2020a, 2020b, 2020c, 2020d, 2020e, 2020f, 2021; Li *et al.,* 2020a, 2020b, 2021), however, the relationship between the drawing count and A-share's financial performance has not been discussed therein.

Tsai, Che & Bai (2022f) focused on China invention publication patents, discussed the average drawing count per patent and the total drawing count, and found that the average drawing count of invention publications was not a good indicator for differentiating China A-share's stock rate of return, whereas the total drawing count of invention publications was a good indicator because the A-shares having higher total drawing counts of invention publications usually showed higher stock rates of return. Chen, Chu, Che, Tsai & Bai (2022) focused on China invention grant patents, and also found that the average drawing count of invention grants was not a good indicator for differentiating China A-share's stock rate of return, whereas the total drawing count of invention grants was a good indicator because the A-shares having higher total drawing counts of invention grants usually showed higher stock rates of return. Chen, Chu, Che & Tsai (2022) focused on China utility model grant patents, and also found that China A-shares having higher total drawing counts of utility model grants usually showed higher stock rates of return.

Meanwhile, it is also well-known that the industry difference exists in many ways, the impact of patents and the indicators thereof on China A-shares might also show industry difference. Chen & Chu (2022) followed the methodology previously proposed (Tsai, Che & Bai, 2022f; Chen, Chu, Che, Tsai & Bai, 2022; Chen, Chu, Che & Tsai, 2022), further focused on China invention grant patent's total drawing counts of China A-shares in top ten non-manufacturing industries, and found that the industry difference was distinct, because the invention grant's total drawing count was not capable of differentiating A-share's stock rate of return for all top ten non-manufacturing industry sectors, it showed preferable capability for differentiating A-share's stock rate of return for one non-manufacturing industry sector, it showed partial capability for differentiating A-share's stock rate of return for two non-manufacturing industry sectors, it showed weak capability for differentiating A-share's stock rate of return for four non-manufacturing industry sectors, it showed ineffective capability for differentiating A-share's stock rate of return for three non-manufacturing industry sectors. The finding proposed by Chen & Chu (2022) is interesting, however, the industry difference relating to the drawing counts of invention publications and utility model grants are not yet found, which is solved in this research.

3 Data and Methodology

3.1 Delimitation and Limitation

The objective of this research is to explore industry difference by analyzing the relationship between China patent drawing counts of invention publications and utility model grants, and China A-share's stock rate of return in various non-manufacturing industry sectors. It is therefore only the patents filed by companies are discussed, while the patents filed by the government, the R&D institutes, the academic organizations, or the individuals, are all excluded.

Chinese companies are listed all over the world. In this research, Chinese companies listed with RMB common stocks in Shanghai stock exchange or Shenzhen stock exchange, so called China A-shares, are studied whereas Chinese companies listed in Hong Kong Special Administrative Region of China or any other overseas regions are excluded.

There are four major patent species in China patent system including the invention publication, the invention grant, the utility model grant and the design grant. Since the invention grant's drawing count has been discussed specifically for China A-shares in non-manufacturing industry sectors (Chen & Chu, 2022), it is therefore the invention publications and utility model grants are discussed in this research. The design patent's drawing is ignored because a design patent in China usually comprises seven drawings including a top view, a bottom view, a front view, a back view, a right view, a left view and a perspective view. The variance of drawing counts is not significant, the resulting effect of drawing counts would be also not significant.

3.2 Instrumentation

3.2.1 Company Integrated Patent Database

A listed company usually has a lot of subsidiaries. When a subsidiary's revenue is merged to its parent listed company in the formal financial reports, the subsidiary's patents are therefore inferred to contribute to its parent company's financial performance in this research. In order to collect the correct patents and count the correct drawing counts, a company integrated patent database is built in this research by carefully reviewing all China A-share's formal financial reports and integrating all subsidiaries' China patents together with their parent A-share's patents. The patent drawing count of each parent A-share is then calculated.

A patent is sometimes co-owned by plural companies. For avoiding duplicating calculation, if a patent is co-owned by the parent A-share and its subsidiaries or co-owned by several subsidiaries, it is regarded as a single one patent of the parent A-share. However, if a patent is co-owned by two or more A-shares, it is assumed to contribute equivalently to each parent A-share, so the patent is duplicated and distributed to each of the co-owning A-shares.

3.2.2 Patent Drawing Count and Drawing Groups

The total drawing count is applied in this research for setting up the drawing groups, whereas the average drawing count is ignored because of its low significance in differentiating A-share's stock rate of return (Tsai *et al.*, 2022f).

The time interval of one year is applied for retrieving each A-share's patents. The total drawing count, hereinafter the drawing count, is defined as the number of all drawings of either all invention publications or all utility model grants over previous one year of an A-share. For example, for 2017Q1, invention publications are retrieved by the publication date from 2016/04/01 to 2017/03/31 while utility model grants are retrieved by the issue date from 2016/04/01 to 2017/03/31; for 2018Q2, invention publications are retrieved by the publication date from 2017/07/01 to 2018/06/30 while utility model grants are retrieved by the issue date from 2017/07/01 to 2018/06/30; and so forth the other quarters.

When the drawing counts of all A-share are calculated, all A-shares in each non-manufacturing industry sector are divided into two drawing groups #B and #A by the median of the drawing counts respectively in each quarter as below:
Drawing group #B: the group in which the A-share having drawing count below or equal to the median of the non-manufacturing industry sector;
Drawing group #A: the group in which the A-share having drawing count above the median of the non-manufacturing industry sector.
Via the median, the numbers of effective samples in drawing groups #A and #B are about to similar for eliminating the bias as much as possible.

3.2.3 Stock Rate of Return (Return Rate)

In order to discuss whether A-shares of different drawing groups in various non-manufacturing industry sectors have different financial performance, the stock rate of return is applied in this research.
The stock rate of return is a simple but straight-forward indicator for beneficial investment. The time period for calculating the stock rate of return is another issue. Considering the reasonable investment behaviour and the earlier patent's effect on later market success, the annual stock rate of return (hereinafter the return rate) is applied for observing A-share's performance in this research.
The return rate is calculated by the stock prices. The stock price in every trading day is always varying. The opening price, the closing price, the highest price, the lowest price, and the mean price, are extensively used in various analyses according to different purposes. However, it does not matter to use any of the aforementioned stock prices in this research. For simplification and consistency, the closing prices of every China A-share in the last trading day of each quarter from 2016Q1 to 2021Q4 are applied as the stock prices to calculate the return rate for each quarter from 2017Q1 to 2021Q4.

3.2.4 Analysis of Variance

Analysis of Variance (ANOVA) is applied in this research for discovering:
(1) Whether the patent drawing counts significantly different between different non-manufacturing industry sectors?
(2) Which non-manufacturing industry sector showing significantly higher or lower patent drawing count?
(3) Whether the return rates significantly different between different non-manufacturing industry sectors?
(4) Which non-manufacturing industry sector showing significantly higher or lower return rate?
(5) Whether the A-shares in different drawing groups #A and #B showing significantly different return rates for each non-manufacturing industry sector?

ANOVA is a statistical approach used to compare variances across the means of different data groups. The outcome of ANOVA is the "F-Ratio".

$$F = \frac{MST}{MSE} = \frac{\sum n_j (\overline{x_j} - \bar{x})^2 / (k-1)}{\sum\sum (x - \overline{x_j})^2 / (N-k)} \quad (1)$$

This ratio shows the difference between the within group variance and the between group variance, which ultimately produces a result which allowing a conclusion that the null hypothesis H_0: $\mu_1 = \mu_2 = \ldots = \mu_k$ is supported or rejected. If there is a significant difference between the groups, the null hypothesis is not supported, the F-ratio will be larger and the corresponding p value should be smaller than 0.05.

3.3 Population and Sample

The population comprises all China A-shares listed in China stock exchanges including Shanghai stock exchange and Shenzhen stock exchange. By the end of 2021, the number of all A-shares is 4,686.

When a Chinese company is ready to be listed, it would be categorized by the securities supervision commission to a specific industry sector according to the company's core products and services. There are all nineteen principal industry sectors for categorizing A-shares, including one manufacturing industry sector and eighteen non-manufacturing industry sectors. However, the number of A-shares in the single one manufacturing industry sector is more than two times the number of A-shares in all the other eighteen non-manufacturing industry sectors. The manufacturing industry sector should be considered individually. Therefore, the A-shares in the manufacturing industry sector are excluded in this research. Meanwhile, top nine non-manufacturing sectors comprises more than 86% A-shares in all eighteen non-manufacturing industry sectors for invention publications while top nine non-manufacturing sectors comprises more than 87% A-shares in all eighteen non-manufacturing industry sectors. Hence, the A-shares in top nine non-manufacturing industry sectors are discussed in this research.

There are twenty-four quarters from 2016Q1 to 2021Q4 for collecting stock prices and calculating the return rates from 2017Q1 to 2021Q4. For each quarter from 2017Q1 to 2021Q4, an effective sample must meet the following conditions:

(1) The A-share was listed to have a definite return rate over previous one year in the last trading day of the quarter; and

(2) The A-share had at least one new patent (invention publication or utility model grant) by the end of the quarter over previous one year for calculating the drawing count; and

(3) The A-share was categorized to one of top nine non-manufacturing industry sectors.

Table 1 shows top nine non-manufacturing industry sectors and the descriptions thereof for invention publications and utility model grants. The effective samples statistics respectively for invention publications and utility model grants quarter by quarter from 2017Q1 to 2021Q4 are shown in Appendix Tables A1 and A2.

Table 1: Top Nine Non-Manufacturing Industry Sectors for Invention Publications and Utility Model Grants

Industry sector and description	A-share proportion	
	Invention publication	Utility model grant
N71 (information transmission, software & information technology services)	29.98%	21.76%
N72 (construction)	11.33%	13.60%
N73 (production & supply of electricity, heat, gas, water)	9.10%	11.44%
N74 (mining)	7.50%	9.00%
N75 (wholesale & retail)	6.64%	6.75%
N76 (management of water conservancy, environment & public facilities)	5.64%	6.40%
N77 (transportation, warehousing & postal)	5.48%	7.78%
N78 (R&D research services)	5.24%	5.56%
N79 (finance)	5.06%	--
N80 (real estate)	--	4.92%
Whole Top 9	86.00%	87.21%

Source: the securities supervision commission of China and author's calculation

It is because not every A-share has patents of all patent species, so the effective sample A-shares in each quarter for invention publications and for utility model grants are not the same. The industry sector N71 (information transmission, software & information technology services) ranks as top one for both of

invention publications and utility model grants, its A-share proportion for invention publications is much higher than that for utility model grants.

The industry sector ranking for utility model grants is similar to the ranking for invention publications, however, the industry sector N77 (transportation, warehousing & postal) has the higher ranking No.5 for utility model grants but the lower ranking as No.7 for invention publication. Meanwhile, the industry sector N80 (real estate) ranks as No. 9 for utility model grants but it is absent in the ranking for invention publications, the industry sector N79 (finance) ranks as No. 9 for invention publications but it is absent in the ranking for utility model grants.

Comparing with the previous study (Chen & Chu, 2022), nine non-manufacturing industry sectors for invention grants and invention publications are the same, though the ranking of some industry sectors are different. In addition, the industry sector N71 (information transmission, software & information technology services) for invention grants also ranks as top one and has higher A-share proportion than the ranking for invention publications.

4 Result and Finding

4.1 Variance of Patent Drawing Count

Table 2 shows the drawing count statistics of each non-manufacturing industry sector in each year from 2017 to 2021. Observing the invention publications, N79 (finance) shows the highest drawing count means in most years, while N75 (wholesale & retail) shows the lowest drawing count means in most years. Observing the utility model grants, N72 (construction) shows the highest drawing count means in every year from 2017 to 2021, while N80 (real estate) shows the lowest drawing count means in most years.

Table 2: Patent Drawing Count Statistics for Top Nine Non-Manufacturing Industry Sectors

Patent species	Industry sector	Patent drawing count mean				
		2017	2018	2019	2020	2021
Invention Publications	N71 (information transmission, software & information technology services)	129.0	132.8	171.2	212.0	257.8
	N72 (construction)	447.2	516.1	773.5	901.2	1174.8
	N73 (production & supply of electricity, heat, gas, water)	42.3	50.3	68.9	106.1	189.4
	N74 (mining)	442.5	435.1	511.7	528.2	586.4
	N75 (wholesale & retail)	46.4	49.0	59.7	57.0	67.6
	N76 (management of water conservancy, environment & public facilities)	28.1	39.8	61.0	65.8	81.0
	N77 (transportation, warehousing & postal)	46.4	49.0	77.3	95.6	126.6
	N78 (R&D research services)	52.6	67.5	89.3	107.9	124.1
	N79 (finance)	236.2	741.7	1206.9	1115.2	1428.2
Utility Model Grant	N71 (information transmission, software & information technology services)	40.5	51.6	58.3	72.1	73.0
	N72 (construction)	475.9	607.0	695.1	1000.4	1416.3
	N73 (production & supply of electricity, heat, gas, water)	61.9	92.1	95.4	147.1	210.2
	N74 (mining)	248.6	308.9	311.4	361.0	379.7
	N77 (transportation, warehousing & postal)	37.9	49.9	60.0	70.3	77.3
	N75 (wholesale & retail)	36.9	58.2	61.9	81.2	77.5
	N76 (management of water conservancy, environment & public facilities)	52.4	75.3	80.0	103.3	124.3
	N78 (R&D research services)	68.0	90.4	100.9	136.4	187.9
	N80 (real estate)	27.5	35.6	39.4	73.8	77.5

Data: Author's calculation

Table 3 shows the results of ANOVA on patent drawing counts between top nine different non-manufacturing industry sectors. It is clear that patent drawing count variance between top nine non-manufacturing industry sectors is of significance in each year from 2017 to 2021 for either invention publications or utility model grants. Some non-manufacturing industry sectors have significantly different patent drawing counts from the other non-manufacturing industry sectors.

Table 3: ANOVA on Patent Drawing Count between Top Nine Non-Manufacturing Industry Sectors

Patent species	Year	Industry sector	Patent drawing count			
			Sum square	Mean square	F	p
Invention Publication	2017	between sectors	41,633,059.3	4,625,895.5	9.866	0.001***
		within sectors	765,670,663.8	468,873.6		
	2018	between sectors	81,570,928.6	9,063,436.5	10.700	0.001***
		within sectors	1,639,847,098.1	847,028.5		
	2019	between sectors	243,054,469.9	27,006,052.2	9.274	0.001***
		within sectors	6,412,488,244.6	2,912,120.0		
	2020	between sectors	276,511,928.9	30,723,547.7	13.132	0.001***
		within sectors	5,565,974,581.5	2,339,627.8		
	2021	between sectors	522,277,639.7	58,030,848.9	20.796	0.001***
		within sectors	8,421,622,783.1	2,790,464.8		
Utility Model Grant	2017	between sectors	39,184,407.1	4,898,050.9	16.803	0.001***
		within sectors	423,543,619.1	291,496.0		
	2018	between sectors	74,621,877.1	9,327,734.6	18.316	0.001***
		within sectors	898,352,638.4	509,270.2		
	2019	between sectors	102,754,766.4	12,844,345.8	18.757	0.001***
		within sectors	1,300,360,157.4	684,760.5		
	2020	between sectors	220,950,804.8	27,618,850.6	20.924	0.001***
		within sectors	2,705,891,140.1	1,319,946.9		
	2021	between sectors	532,688,481.4	66,586,060.2	28.805	0.001***
		within sectors	6,118,859,503.1	2,311,620.5		

p*<0.05, p**≤0.01, p***≤0.001; Data: Author's calculation

In order to discover which non-manufacturing industry sector having the significantly higher or lower patent drawing count, the multiple comparison of ANOVA on patent drawing counts between every two different non-manufacturing industry sectors is applied.

The pairs of non-manufacturing industry sectors having significant patent drawing count variances therebetween for invention publications are shown in Appendix Table A3, wherein, the pairs of non-manufacturing industry sectors are ranked from high to low according to the mean difference of the patent drawing count for clearly observing the industry sectors of higher/lower patent drawing counts.

Based on Appendix Table A3, the invention publication's drawing count mean relationship diagrams of top nine non-manufacturing industry sectors from 2017 to 2021 are derived as shown in Figures 1 to 4, wherein, any line which connecting two industry sectors denotes the patent drawing count variance therebetween is of significance, and the arrow denotes the industry sector having lower patent drawing count mean.

As shown in Figure 1, there are 15 pairs of non-manufacturing industry sectors having significant invention publication's drawing count variances therebetween in 2017, while the other pairs of non-manufacturing industry sectors are free of significant drawing count variances. Two industry sectors including N72 (construction) and N74 (mining) show significantly higher patent drawing count means; while six industry sectors including N71 (information transmission, software & information technology services), N73 (production & supply of electricity, heat, gas, water), N75 (wholesale & retail), N76 (management of water

conservancy, environment & public facilities), N77 (transportation, warehousing & postal) and N78 (R&D research services), show significantly lower patent drawing count means.

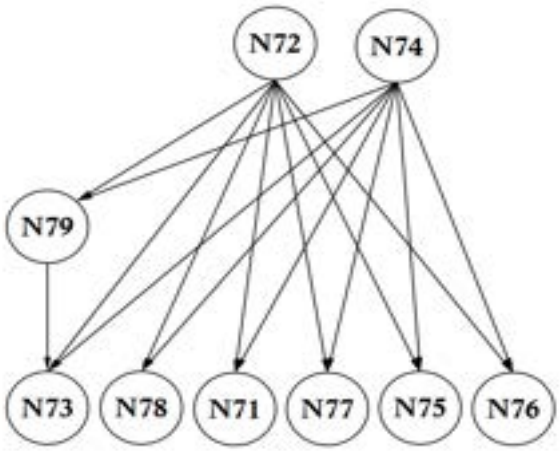

Figure 1: Patent Drawing Count Mean Relationship Diagram of Top Nine Non-Manufacturing Industry Sectors in 2017 (Invention Publications)

Data: Author's calculation

As shown in Figure 2, there are 19 pairs of non-manufacturing industry sectors having significant invention publication's drawing count variances therebetween in 2018. Three industry sectors including N72 (construction), N74 (mining) and N79 (finance) show significantly higher patent drawing count means; while the other six industry sectors show significantly lower patent drawing count means.

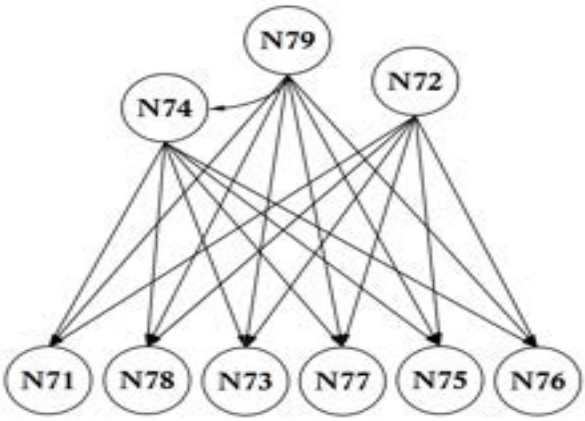

Figure 2: Patent Drawing Count Mean Relationship Diagram of Top Nine Non-Manufacturing Industry Sectors in 2018 (Invention Publications)

Data: Author's calculation

As shown in Figure 3, there are 20 pairs of non-manufacturing industry sectors having significant invention publication's drawing count variances therebetween in 2019. Three industry sectors including N72 (construction), N74 (mining) and N79 (finance) show significantly higher patent drawing count means; while the other six industry sectors show significantly lower patent drawing count means.

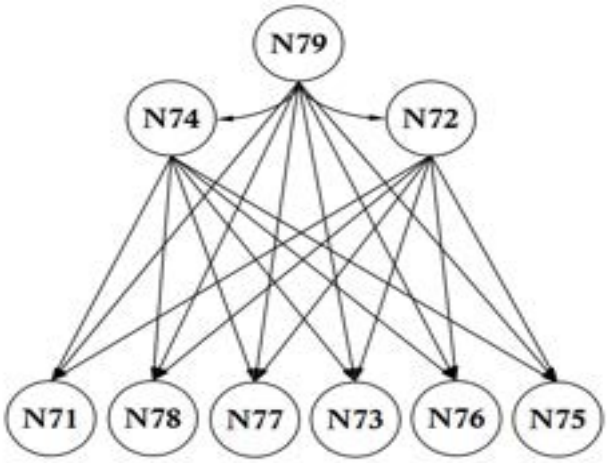

Figure 3: Patent Drawing Count Mean Relationship Diagram of Top Nine Non-Manufacturing Industry Sectors in 2019 (Invention Publications)

Data: Author's calculation

In either of 2020 and 2021, there are 20 pairs of non-manufacturing industry sectors having significant invention publication's drawing count variances therebetween as shown in Figure 4. Though the significant mean differences of patent drawing counts in 2020 and 2021 are not identical, but the high/low relationships are the same. Three industry sectors including N72 (construction), N74 (mining) and N79 (finance) show significantly higher patent drawing count means; while the other six industry sectors show significantly lower patent drawing count means.

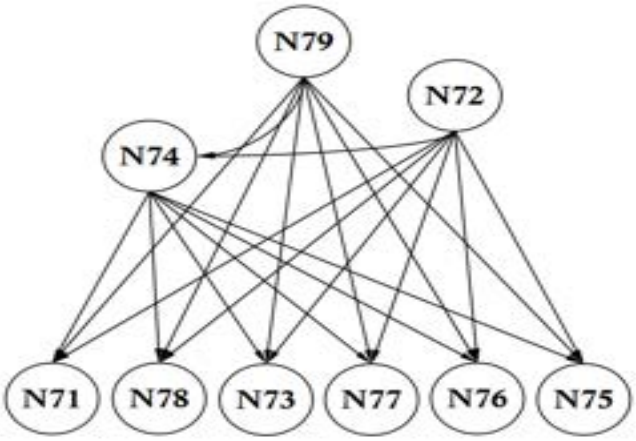

Figure 4: Patent Drawing Count Mean Relationship Diagram of Top Nine Non-Manufacturing Industry Sectors in 2020 and 2021 (Invention Publications)

Data: Author's calculation

In summary, the industry difference in invention publication's drawing count is significant. Three industry sectors including N72 (construction), N74 (mining) and N79 (finance) are verified to have significantly higher patent drawing count means. Six industry sectors including N71 (information transmission, software & information technology services), N73 (production & supply of electricity, heat, gas, water), N75 (wholesale & retail), N76 (management of water conservancy, environment & public facilities), N77 (transportation, warehousing & postal) and N78 (R&D research services) are verified to have significantly lower patent drawing count means.

According the multiple comparisons of ANOVA, the pairs of non-manufacturing industry sectors having significant patent drawing count variances therebetween for utility model grants are shown in Appendix Table A4, wherein, the pairs of non-manufacturing industry sectors are also ranked from high to low according to the mean difference of the patent drawing count for clearly observing the industry sectors of higher/lower patent drawing counts. Based on Appendix Table A4, the utility model grant's drawing count mean relationship diagrams of top nine non-manufacturing industry sectors from 2017 to 2021 are derived as shown in Figures 5 to 7, wherein, any line which connecting two industry sectors denotes the patent drawing count variance therebetween is of significance, and the arrow denotes the industry sector having significantly lower patent drawing count mean.

As shown in Figure 5, there are 15 pairs of non-manufacturing industry sectors in any of 2017, 2018 and 2019 having significant drawing count variances therebetween. Two industry sectors including N72 (construction) and N74 (mining) show significantly higher drawing count means, while the other seven industry sectors show significantly lower drawing count means.

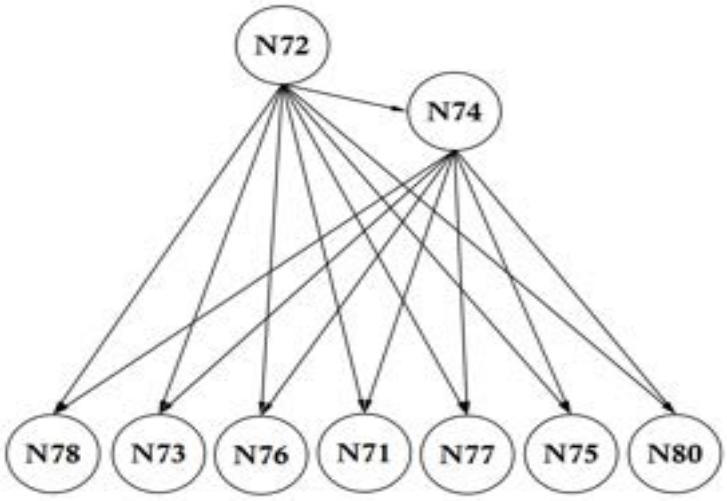

Figure 5: Patent Drawing Count Mean Relationship Diagram of Top Nine Non-Manufacturing Industry Sectors in 2017, 2018 and 2019 (Utility Model Grants)

Data: Author's calculation

As shown in Figure 6, there are 14 pairs of non-manufacturing industry sectors in 2020 having significant drawing count variances therebetween. Two industry sectors including N72 (construction) and N74 (mining) show significantly higher drawing count means, while six industry sectors including N71 (information transmission, software & information technology services), N73 (production & supply of electricity, heat, gas, water), N77 (transportation, warehousing & postal), N75 (wholesale & retail), N76 (management of water conservancy, environment & public facilities) and N80 (real estate) shows the significantly lower drawing count means.

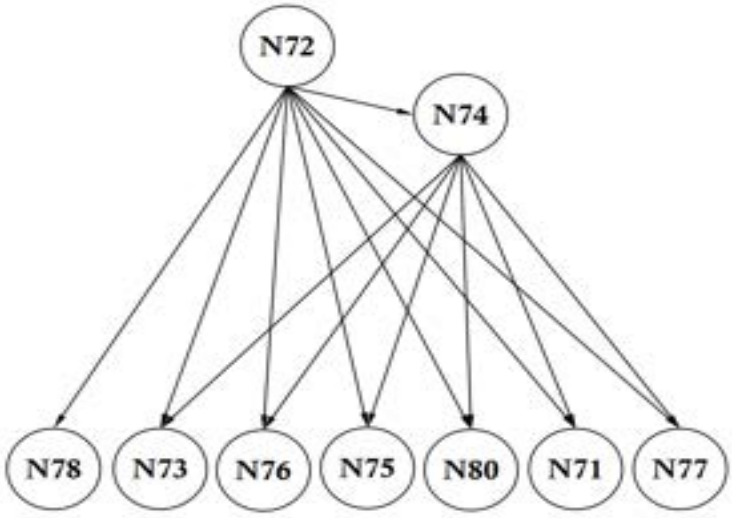

Figure 6: Patent Drawing Count Mean Relationship Diagram of Top Nine Non-Manufacturing Industry Sectors in 2020 (Utility Model Grants)

Data: Author's calculation

As shown in Figure 7, there are 12 pairs of non-manufacturing industry sectors in 2021 having significant drawing count variances therebetween. Two industry sectors including N72 (construction) and N74 (mining) show significantly higher drawing count means, while four industry sectors including N71 (information transmission, software & information technology services), N75 (wholesale & retail), N76 (management of water conservancy, environment & public facilities) and N80 (real estate) show significantly lower drawing count means.

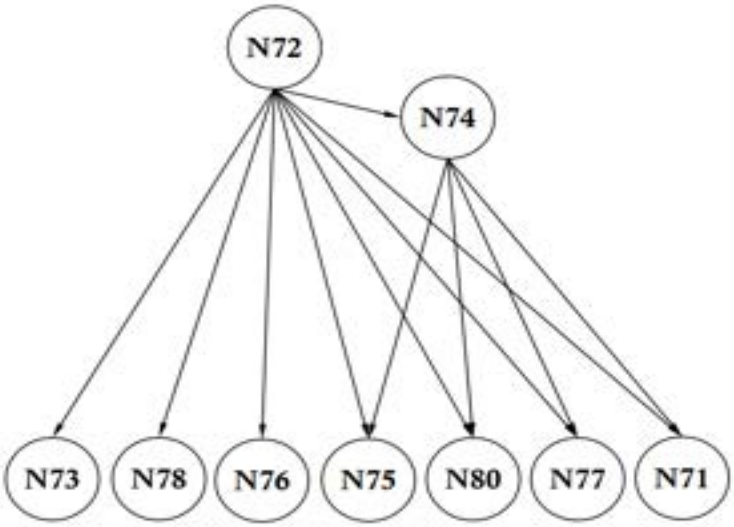

Figure 7: Patent Drawing Count Mean Relationship Diagram of Top Nine Non-Manufacturing Industry Sectors in 2021 (Utility Model Grants)

Data: Author's calculation

In summary, the industry difference in utility model grant's drawing count between top nine non-manufacturing industry sectors is also significant. Two industry sectors including N72 (construction) and N74 (mining) are verified to have significantly higher drawing count means; while seven industry sectors including N71 (information transmission, software & information technology services), N73 (production

& supply of electricity, heat, gas, water), N77 (transportation, warehousing & postal), N75 (wholesale & retail), N76 (management of water conservancy, environment & public facilities), N78 (R&D research services) and N80 (real estate) are verified to have significantly lower drawing count means.

4.2 Differentiating Return Rate by Patent Drawing Counts

Tables 4 shows the return rate statistics of top nine non-manufacturing industry sectors in each year from 2017 to 2021. The return rate means of any specific industry sector for invention publications and utility model grants are not the same but similar.

Table 4: Return Rate Statistics for Top Nine Non-Manufacturing Industry Sectors

Patent species	Industry sector	Return rate mean (%)				
		2017	2018	2019	2020	2021
Invention Publications	N71 (information transmission, software & information technology services)	-26.50	-29.31	10.40	9.72	-8.65
	N72 (construction)	-4.51	-35.08	-7.30	-8.87	10.51
	N73 (production & supply of electricity, heat, gas, water)	-4.42	-26.25	0.40	-8.87	35.47
	N74 (mining)	8.00	-20.23	3.93	-0.78	42.23
	N75 (wholesale & retail)	-11.54	-33.54	-7.20	6.97	3.99
	N76 (management of water conservancy, environment & public facilities)	-13.51	-37.67	-11.36	-5.70	0.01
	N77 (transportation, warehousing & postal)	2.91	-22.78	-0.12	-11.01	14.38
	N78 (R&D research services)	-14.72	-30.67	-8.58	1.48	13.63
	N79 (finance)	12.41	-14.65	29.47	0.69	-0.20
Utility Model Grant	N71 (information transmission, software & information technology services)	-25.83	-31.74	5.50	5.76	-4.73
	N72 (construction)	-5.73	-36.33	-7.88	-7.67	10.15
	N73 (production & supply of electricity, heat, gas, water)	-4.57	-26.53	-0.48	-8.20	31.45
	N74 (mining)	7.69	-20.57	1.71	-1.15	43.17
	N77 (transportation, warehousing & postal)	4.97	-25.77	0.89	-8.27	14.39
	N75 (wholesale & retail)	-12.05	-32.68	-8.56	3.35	5.08
	N76 (management of water conservancy, environment & public facilities)	-13.10	-37.08	-9.81	-5.83	-0.52
	N78 (R&D research services)	-17.59	-35.49	-8.57	2.01	8.71
	N80 (real estate)	-4.75	-20.39	9.05	-6.40	-1.88

Data: Author's calculation

Observing the invention publications, N79 (finance) shows the highest return rate means in most years while N71 (information transmission, software & information technology services) shows the lowest return rate means in two years and N76 (management of water conservancy, environment & public facilities) shows the lowest return rate means in two years.

Observing the utility model grants, N74 (mining) and N80 (real estate) show the highest return rate means in two years respectively; while N71 (information transmission, software & information technology services) shows the lowest return rate means in most years.

Table 5 shows the results of ANOVA on return rate between top nine non-manufacturing industry sectors. The return rate variance between different industry sectors is of significance in each year from 2017 to 2021 for either invention publications or utility model grants. Some non-manufacturing industry sectors have significantly different return rate means from the other non-manufacturing industry sectors.

Table 5: ANOVA on Return Rate between Top Nine Non-Manufacturing Industry Sectors

Patent species	Year	Industry sector	Return rate (%)			
			Sum square	Mean square	F	p
Invention Publication	2017	between sectors	260,887.7	32,611.0	34.494	0.001***
		within sectors	1,465,372.0	945.4		
	2018	between sectors	58,812.7	7,351.6	12.627	0.001***
		within sectors	1,079,962.6	582.2		
	2019	between sectors	227,319.8	28,415.0	20.180	0.001***
		within sectors	2,966,863.6	1,408.1		
	2020	between sectors	147,882.2	18,485.3	11.451	0.001***
		within sectors	3,679,112.9	1,614.4		
	2021	between sectors	260,887.7	32,611.0	34.494	0.001***
		within sectors	1,465,372.0	945.4		
Utility Model grant	2017	between sectors	186,656.5	23,332.1	25.867	0.001***
		within sectors	1,310,625.5	902.0		
	2018	between sectors	54,887.3	6,860.9	13.463	0.001***
		within sectors	898,980.7	509.6		
	2019	between sectors	71,540.5	8,942.6	8.003	0.001***
		within sectors	2,122,064.4	1,117.5		
	2020	between sectors	69,609.3	8,701.2	6.839	0.001***
		within sectors	2,608,312.2	1,272.3		
	2021	between sectors	626,964.4	78,370.6	28.071	0.001***
		within sectors	7,390,162.2	2,791.9		

p*<0.05, p**≤0.01, p***≤0.001; Data: Author's calculation

In order to discover which non-manufacturing industry sector having the significantly higher or lower return rate, the multiple comparison of ANOVA on return rate is applied. The pairs of different non-manufacturing industry sectors having significant return rate variances therebetween respectively for invention publications and utility model grants are shown in Appendix Tables A5 and A6, wherein, the pairs are ranked from high to low according to the mean difference of the return rate for clearly observation.

Based on Appendix Tables A5 and A6, the return rate mean relationship diagrams of top nine non-manufacturing industry sectors from 2017 to 2021 are derived as shown in Figures 8 to 17, wherein, any line which connecting two industry sectors denotes the return rate variance therebetween is of significance, and the arrow denotes the industry sector having significantly lower return rate mean.

Observing the return rate variances in 2017 as shown in Figures 8 and 9, there are 26 pairs of non-manufacturing industry sectors for invention publications having significant return rate variances therebetween while there are 25 pairs of non-manufacturing industry sectors for utility model grants having significant return rate variances therebetween. For invention publications, two industry sectors including N74 (mining) and N79 (finance) show significantly higher return rate means; while four industry sectors including N71 (information transmission, software & information technology services), N75 (wholesale & retail), N76 (management of water conservancy, environment & public facilities) and N78 (R&D research services) show significantly lower return rate means. For utility model grants, two industry sectors including N74 (mining) and N77 (transportation, warehousing & postal) show significantly higher return

rate means; while two industry sectors including N71 (information transmission, software & information technology services) and N78 (R&D research services) show significantly lower return rate means.

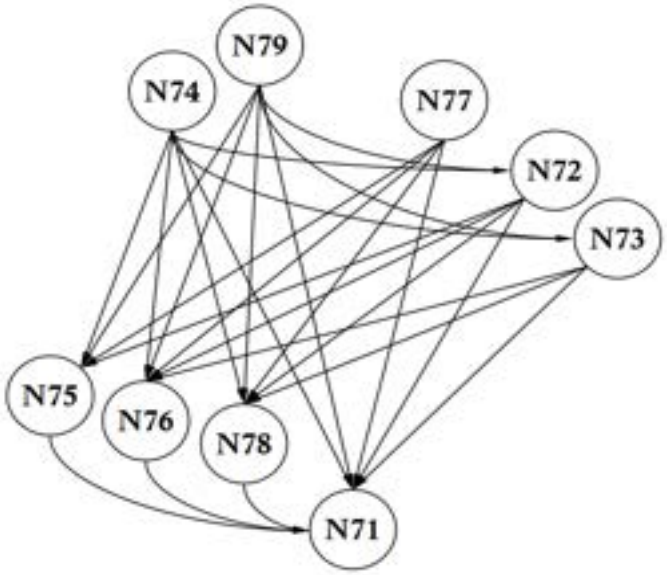

Figure 8: Return Rate Mean Relationship Diagram of Top Nine Non-Manufacturing Industry Sectors in 2017 (Invention Publications)

Data: Author's calculation

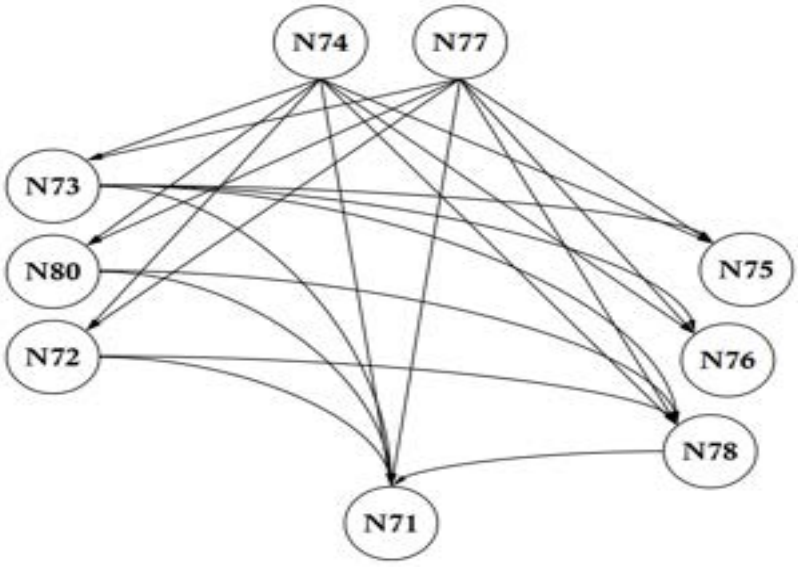

Figure 9: Return Rate Mean Relationship Diagram of Top Nine Non-Manufacturing Industry Sectors in 2017 (Utility Model Grants)

Data: Author's calculation

Observing the return rate variances in 2018 as shown in Figures 10 and 11, there are 24 pairs of non-manufacturing industry sectors for invention publications having significant return rate variances therebetween, while there are 25 pairs of non-manufacturing industry sectors for utility model grants having significant return rate variances therebetween. For invention publications, two industry sectors including N74 (mining) and N79 (finance) show significantly higher return rate means, while three industry sectors including N72 (construction), N75 (wholesale & retail) and N76 (management of water conservancy, environment & public facilities) show significantly lower return rate means. For utility model grants, two industry sectors including N74 (mining) and N80 (real estate) show significantly higher return rate means, while five industry sectors including N71 (information transmission, software & information technology services), N72 (construction), N75 (wholesale & retail), N76 (management of water conservancy, environment & public facilities) and N78 (R&D research services) show significantly lower return rate means.

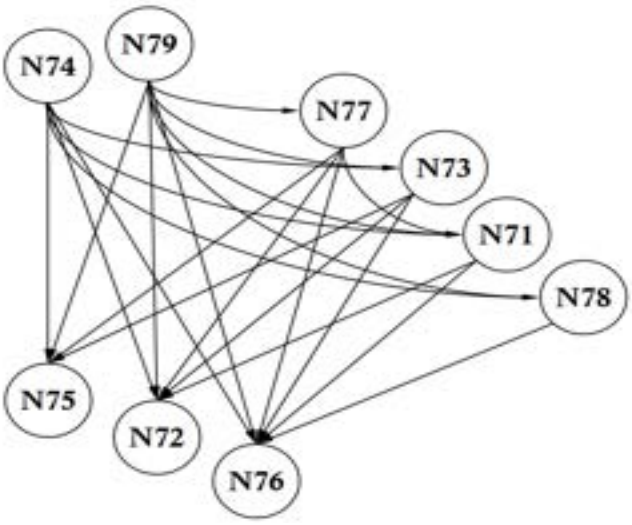

Figure 10: Return Rate Mean Relationship Diagram of Top Nine Non-Manufacturing Industry Sectors in 2018 (Invention Publications)

Data: Author's calculation

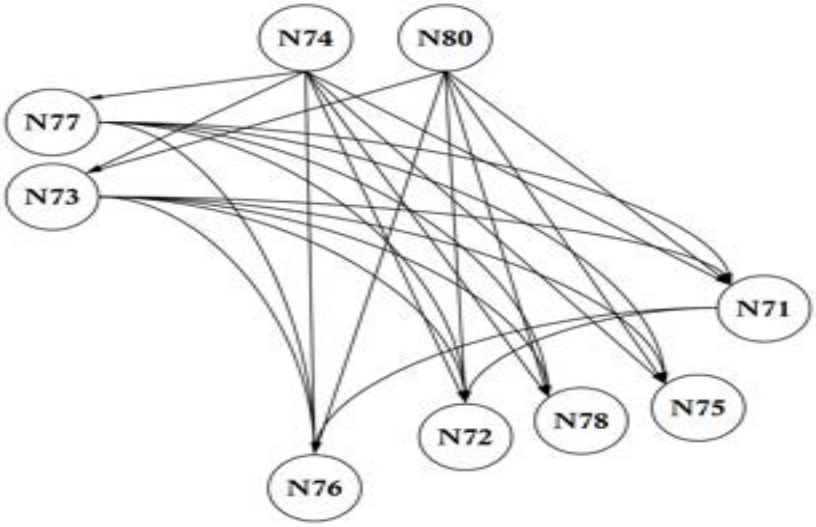

Figure 11: Return Rate Mean Relationship Diagram of Top Nine Non-Manufacturing Industry Sectors in 2018 (Utility Model Grants)

Data: Author's calculation

Observing the return rate variances in 2019 as shown in Figures 12 and 13, there are 24 pairs of non-manufacturing industry sectors for invention publications having significant return rate variances therebetween, while there are 23 pairs of non-manufacturing industry sectors for utility model grants having significant return rate variances therebetween. For invention publications, two industry sectors including N71 (information transmission, software & information technology services) and N79 (finance) show significantly higher return rate means; while four industry sectors including N72 (construction), N75 (wholesale & retail), N76 (management of water conservancy, environment & public facilities) and N78 (R&D research services) show significantly lower return rate means. For utility model grants, two industry sectors including N71 (information transmission, software & information technology services) and N80 (real estate) show significantly higher return rate mean; while four industry sectors including N72 (construction), N75 (wholesale & retail), N76 (management of water conservancy, environment & public facilities) and N78 (R&D research services) show significantly lower return rate means.

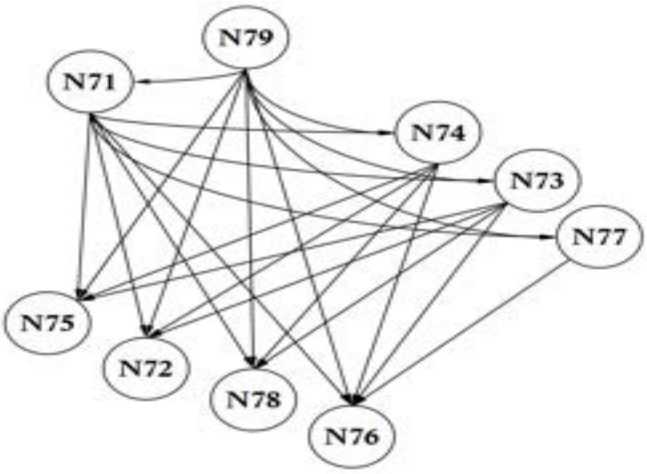

Figure 12: Return Rate Mean Relationship Diagram of Top Nine Non-Manufacturing Industry Sectors in 2019 (Invention Publications)

Data: Author's calculation

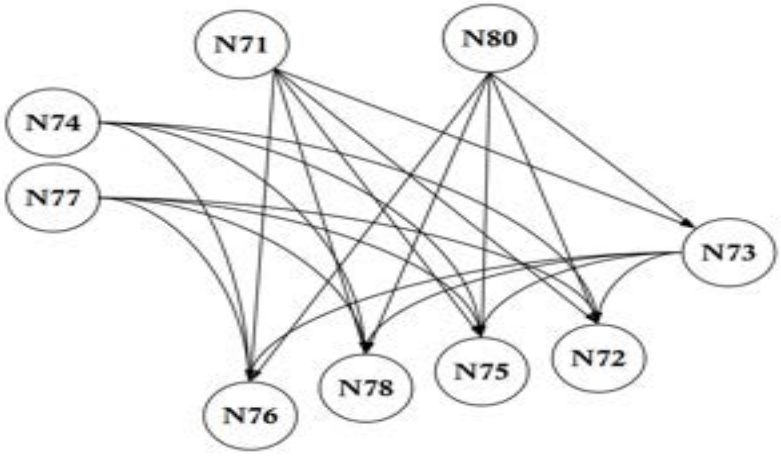

Figure 13: Return Rate Mean Relationship Diagram of Top Nine Non-Manufacturing Industry Sectors in 2019 (Utility Model Grants)

Data: Author's calculation

Observing the return rate variances in 2020 as shown in Figures 14 and 15, there are 20 pairs of non-manufacturing industry sectors for invention publications having significant return rate variances therebetween, while there are 18 pairs of non-manufacturing industry sectors for utility model grants having significant return rate variances therebetween. For invention publications, two industry sectors including N71 (information transmission, software & information technology services) and N75 (wholesale & retail) show significantly higher return rate means; while three industry sectors including N72 (construction), N73 (production & supply of electricity, heat, gas, water) and N77 (transportation, warehousing & postal) show significantly lower return rate means. For utility model grants, two industry sectors including N71 (information transmission, software & information technology services) and N75 (wholesale & retail) show significantly higher return rate mean; while four industry sectors including N72 (construction), N73 (production & supply of electricity, heat, gas, water), N76 (management of water conservancy, environment & public facilities) and N80 (real estate) show significantly lower return rate means.

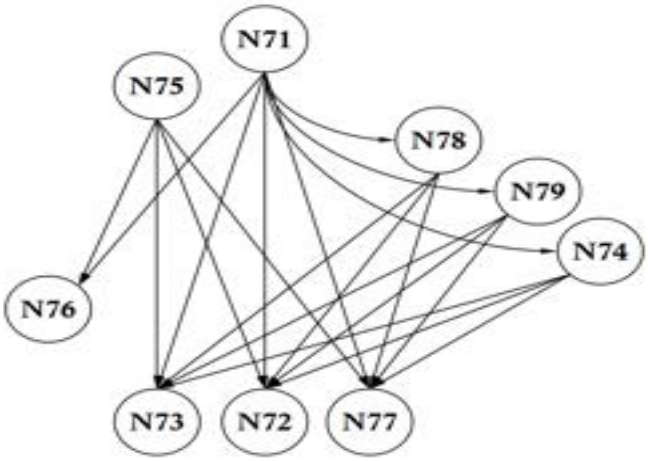

Figure 14: Return Rate Mean Relationship Diagram of Top Nine Non-Manufacturing Industry Sectors in 2020 (Invention Publications)

Data: Author's calculation

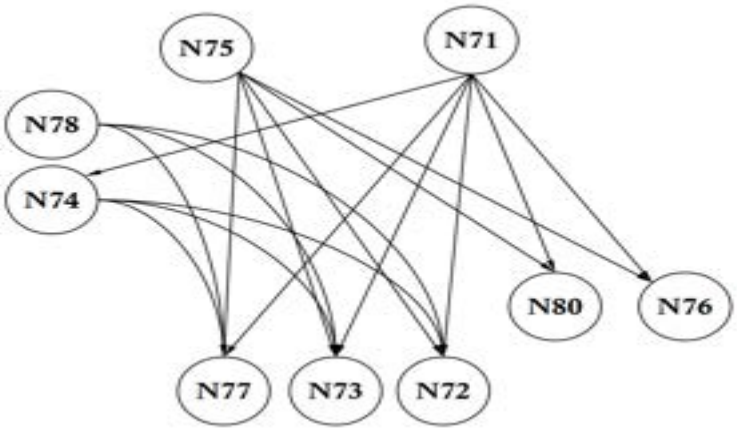

Figure 15: Return Rate Mean Relationship Diagram of Top Nine Non-Manufacturing Industry Sectors in 2020 (Utility Model Grants)

Data: Author's calculation

Observing the return rate variances in 2021 as shown in Figures 16 and 17, there are 28 pairs of non-manufacturing industry sectors for invention publication having significant return rate variances therebetween, while there are 23 pairs of non-manufacturing industry sectors for utility model grants having significant return rate variances therebetween. For invention publications, two industry sectors including N73 (production & supply of electricity, heat, gas, water) and N74 (mining) show significantly higher return rate means; while four industry sectors including N71 (information transmission, software & information technology services), N75 (wholesale & retail), N76 (management of water conservancy, environment & public facilities) and N79 (finance) show significantly lower return rate means. For utility model grants, two industry sectors including N73 (production & supply of electricity, heat, gas, water) and N74 (mining) show significantly higher return rate means, while five industry sectors including N71 (information transmission, software & information technology services), N75 (wholesale & retail), N76 (management of water conservancy, environment & public facilities), N78 (R&D research services) and N80 (real estate) show significantly lower return rate means.

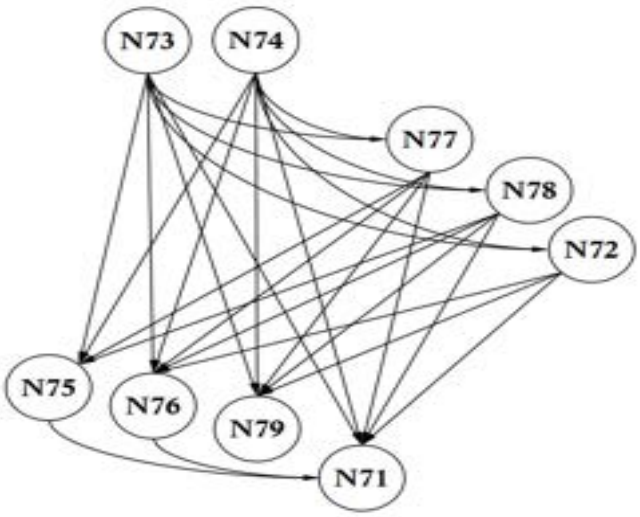

Figure 16: Return Rate Mean Relationship Diagram of Top Nine Non-Manufacturing Industry Sectors in 2021 (Invention Publications).

Data: Author's calculation

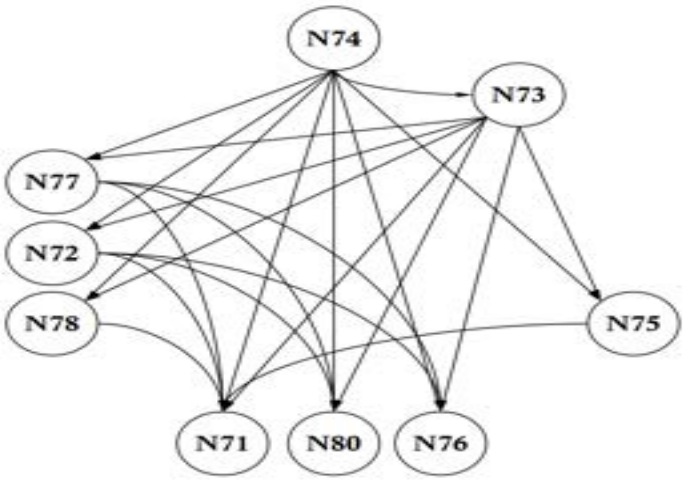

Figure 17: Return Rate Mean Relationship Diagram of Top Nine Non-Manufacturing Industry Sectors in 2021 (Utility Model Grants)

Data: Author's calculation

For discussing patent drawing's capability for differentiating A-share's return rate, Tables 6 and 7 show the results of ANOVA on the return rate between patent drawing groups #A and #B respectively for invention publications and utility model grants of each non-manufacturing industry sector in each year from 2017 to 2021.

Table 6: ANOVA on Return Rate between Drawing Groups for Top Nine Non-Manufacturing Industry Sectors (Invention Publications)

Industry sector	Year	Drawing group	Return rate (%)			
			Sum square	Mean square	F	p
N71 (information transmission, software & information technology services)	2017	between groups	3,546.0	3,546.0	4.232	0.040*
		within groups	449,912.2	837.8		
	2018	between groups	10,796.2	10,796.2	14.164	0.001***
		within groups	495,460.3	762.2		
	2019	between groups	6,742.8	6,742.8	2.762	0.097
		within groups	1,757,813.5	2,441.4		
	2020	between groups	4,569.4	4,569.4	1.705	0.192
		within groups	2,061,472.7	2,680.7		
	2021	between groups	934.5	934.5	0.507	0.477
		within groups	1,959,090.9	1,843.0		
N72 (construction)	2017	between groups	7,984.1	7,984.1	5.254	0.023*
		within groups	349,499.5	1,519.6		
	2018	between groups	2,669.6	2,669.6	7.242	0.008**
		within groups	96,572.1	368.6		
	2019	between groups	5,881.0	5,881.0	8.691	0.003**
		within groups	193,524.1	676.7		
	2020	between groups	6,230.7	6,230.7	4.995	0.026*
		within groups	370,450.6	1,247.3		
	2021	between groups	41,097.7	41,097.7	14.149	0.001***
		within groups	964,328.5	2,904.6		
N73 (production & supply of	2017	between groups	5,736.5	5,736.5	7.423	0.007**
		within groups	129,063.9	772.8		

electricity, heat, gas, water)	2018	between groups	7,767.5	7,767.5	19.684	0.001***
		within groups	80,104.2	394.6		
	2019	between groups	2,101.7	2,101.7	3.592	0.059
		within groups	134,589.8	585.2		
	2020	between groups	31.0	31.0	0.070	0.791
		within groups	106,605.1	440.5		
	2021	between groups	10,879.5	10,879.5	4.240	0.040*
		within groups	733,931.1	2,566.2		
N74 (mining)	2017	between groups	21.8	21.8	0.026	0.872
		within groups	127,522.6	833.5		
	2018	between groups	220.2	220.2	0.477	0.491
		within groups	77,103.6	461.7		
	2019	between groups	0.4	0.4	0.001	0.982
		within groups	143,047.6	765.0		
	2020	between groups	3,513.9	3,513.9	1.725	0.191
		within groups	395,187.8	2,037.1		
	2021	between groups	8,917.5	8,917.5	1.668	0.198
		within groups	1,213,395.2	5,345.4		
N75 (wholesale & retail)	2017	between groups	543.5	543.5	0.666	0.416
		within groups	92,166.6	815.6		
	2018	between groups	1,559.4	1,559.4	6.647	0.011*
		within groups	31,669.3	234.6		
	2019	between groups	11.9	11.9	0.017	0.896
		within groups	110,326.6	702.7		
	2020	between groups	139.3	139.3	0.134	0.714
		within groups	182,460.5	1,036.7		
	2021	between groups	82.7	82.7	0.038	0.846
		within groups	522,146.8	2,184.7		
N76 (management of water conservancy, environment & public facilities)	2017	between groups	3,096.7	3,096.7	3.398	0.068
		within groups	96,615.3	911.5		
	2018	between groups	68.9	68.9	0.124	0.725
		within groups	70,370.7	554.1		
	2019	between groups	2,938.5	2,938.5	3.274	0.073
		within groups	116,686.6	897.6		
	2020	between groups	257.2	257.2	0.366	0.546
		within groups	96,151.7	701.8		
	2021	between groups	18.4	18.4	0.014	0.905
		within groups	248,555.4	1,274.6		
N77 (transportation, warehousing & postal)	2017	between groups	125.3	125.3	0.124	0.726
		within groups	84,877.9	1,010.5		
	2018	between groups	6.2	6.2	0.013	0.910
		within groups	52,807.0	480.1		
	2019	between groups	1,312.7	1,312.7	2.742	0.100
		within groups	62,237.2	478.7		
	2020	between groups	490.6	490.6	0.668	0.415
		within groups	117,470.1	734.2		
	2021	between groups	6,809.5	6,809.5	1.602	0.207
		within groups	812,048.1	4,251.6		
N78 (R&D research services)	2017	between groups	2,276.9	2,276.9	2.524	0.116
		within groups	72,174.8	902.2		
	2018	between groups	665.2	665.2	0.697	0.406
		within groups	105,031.7	954.8		
	2019	between groups	2,042.6	2,042.6	1.636	0.203

		within groups	158,525.6	1,248.2		
	2020	between groups	2.5	2.5	0.002	0.968
		within groups	209,004.6	1,559.7		
	2021	between groups	21,939.3	21,939.3	6.375	0.012*
		within groups	667,685.2	3,441.7		
N79 (finance)	2017	between groups	593.9	593.9	1.064	0.306
		within groups	39,614.5	558.0		
	2018	between groups	6,274.7	6,274.7	12.606	0.001**
		within groups	40,815.8	497.8		
	2019	between groups	13,624.8	13,624.8	6.987	0.009**
		within groups	255,456.3	1,950.0		
	2020	between groups	10,393.2	10,393.2	14.591	0.001***
		within groups	114,682.2	712.3		
	2021	between groups	268.6	268.6	0.471	0.493
		within groups	101,412.6	569.7		

p*<0.05, p**≤0.01, p***≤0.001; Data: Author's calculation

TABLE 7: ANOVA on Return Rate between Drawing Groups for Top Nine Non-Manufacturing Industry Sectors (Utility Model Grants)

			Return rate (%)			
Industry sector	**Year**	**Drawing group**	**Sum square**	**Mean square**	**F**	**p**
N71 (information transmission, software & information technology services)	2017	between groups	2,839.1	2,839.1	3.620	0.058
		within groups	289,356.1	784.2		
	2018	between groups	4,292.0	4,292.0	7.576	0.006**
		within groups	261,748.1	566.6		
	2019	between groups	17,863.8	17,863.8	9.008	0.003**
		within groups	900,353.1	1,983.2		
	2020	between groups	3,884.8	3,884.8	2.463	0.117
		within groups	779,189.6	1,577.3		
	2021	between groups	449.2	449.2	0.210	0.647
		within groups	1,438,224.3	2,143.4		
N72 (construction)	2017	between groups	6,845.1	6,845.1	5.339	0.022*
		within groups	312,835.5	1,282.1		
	2018	between groups	5,802.3	5,802.3	16.339	0.001***
		within groups	103,336.4	355.1		
	2019	between groups	2,566.3	2,566.3	3.367	0.067
		within groups	236,307.2	762.3		
	2020	between groups	307.9	307.9	0.219	0.640
		within groups	450,505.9	1,407.8		
	2021	between groups	811.3	811.3	0.279	0.598
		within groups	1,051,969.2	2,906.0		
N73 (production & supply of electricity, heat, gas, water)	2017	between groups	866.4	866.4	1.141	0.287
		within groups	148,798.1	759.2		
	2018	between groups	4,823.7	4,823.7	12.131	0.001***
		within groups	87,881.0	397.7		
	2019	between groups	2,440.8	2,440.8	3.389	0.067
		within groups	185,812.8	720.2		
	2020	between groups	227.9	227.9	0.469	0.494
		within groups	134,521.5	485.6		
	2021	between groups	37,726.0	37,726.0	20.081	0.001***
		within groups	621,861.2	1,878.7		
	2017	between groups	2,377.2	2,377.2	2.940	0.088

N74 (mining)		within groups	128,553.9	808.5		
	2018	between groups	1,801.4	1,801.4	3.660	0.057
		within groups	88,589.8	492.2		
	2019	between groups	1,451.5	1,451.5	1.881	0.172
		within groups	154,369.0	771.8		
	2020	between groups	727.7	727.7	0.384	0.536
		within groups	424,820.4	1,896.5		
	2021	between groups	1,974.5	1,974.5	0.323	0.570
		within groups	1,491,316.8	6,112.0		
N77 (transportation, warehousing & postal)	2017	between groups	1,510.3	1,510.3	1.972	0.163
		within groups	82,718.7	765.9		
	2018	between groups	1,278.8	1,278.8	2.677	0.104
		within groups	66,399.8	477.7		
	2019	between groups	4,054.3	4,054.3	7.907	0.006**
		within groups	87,679.7	512.7		
	2020	between groups	0.5	0.5	0.001	0.983
		within groups	199,003.6	956.7		
	2021	between groups	10,323.0	10,323.0	2.804	0.095
		within groups	898,330.8	3,681.7		
N75 (wholesale & retail)	2017	between groups	1,417.9	1,417.9	1.964	0.164
		within groups	72,931.7	722.1		
	2018	between groups	1,918.2	1,918.2	4.395	0.038*
		within groups	56,741.5	436.5		
	2019	between groups	1,496.4	1,496.4	1.653	0.201
		within groups	137,614.4	905.4		
	2020	between groups	11,260.0	11,260.0	9.328	0.003**
		within groups	167,787.0	1,207.1		
	2021	between groups	680.5	680.5	0.241	0.624
		within groups	651,832.2	2,821.8		
N76 (management of water conservancy, environment & public facilities)	2017	between groups	519.3	519.3	0.499	0.481
		within groups	102,929.4	1,039.7		
	2018	between groups	2,198.4	2,198.4	3.797	0.054
		within groups	72,955.2	579.0		
	2019	between groups	5,712.6	5,712.6	6.945	0.009**
		within groups	115,973.0	822.5		
	2020	between groups	296.4	296.4	0.446	0.505
		within groups	96,329.8	664.3		
	2021	between groups	8,412.4	8,412.4	7.006	0.009**
		within groups	242,556.9	1,200.8		
N78 (R&D research services)	2017	between groups	167.6	167.6	0.191	0.663
		within groups	63,217.0	878.0		
	2018	between groups	1,599.5	1,599.5	3.005	0.086
		within groups	53,234.7	532.3		
	2019	between groups	855.6	855.6	0.622	0.432
		within groups	166,571.7	1,376.6		
	2020	between groups	256.6	256.6	0.149	0.700
		within groups	244,318.0	1,720.5		
	2021	between groups	1,511.6	1,511.6	0.873	0.351
		within groups	318,646.0	1,731.8		
N80 (real estate)	2017	between groups	2,369.2	2,369.2	2.517	0.116
		within groups	90,373.1	941.4		
	2018	between groups	7.9	7.9	0.010	0.921
		within groups	84,371.8	796.0		

	2019	between groups	5,490.6	5,490.6	4.774	0.032*
		within groups	95,451.6	1,150.0		
	2020	between groups	737.0	737.0	0.720	0.398
		within groups	94,137.5	1,023.2		
	2021	between groups	4,323.9	4,323.9	1.199	0.275
		within groups	609,212.3	3,604.8		

p*<0.05, p**≤0.01, p***≤0.001; Data: Author's calculation

Observing the industry sector N71 (information transmission, software & information technology services), the return rate variances between drawing groups #A and #B are of significance in 2017 and 2018 for invention publications, whereas the return rate variances between drawing groups #A and #B are of significance in 2018 and 2019 for utility model grants.

Observing the industry sector N72 (construction), the return rate variances between drawing groups #A and #B are of significance in all years from 2017 to 2021 for invention publications, whereas the return rate variances between drawing groups #A and #B are of significance in 2017 and 2018 for utility model grants.

Observing the industry sector N73 (production & supply of electricity, heat, gas, water), the return rate variances between drawing groups #A and #B are of significance in 2017, 2018 and 2021 for invention publications; whereas the return rate variances between drawing groups #A and #B are of significance in 2018 and 2021 for utility model grants.

Observing the industry sectors N74 (mining), the return rate variances between drawing groups #A and #B are free of significance in all years from 2017 to 2021 for both invention publications and utility model grants.

Observing the industry sector N75 (wholesale & retail), the return rate variance between drawing groups #A and #B is of significance only in 2018 for invention publications; whereas the return rate variances between drawing groups #A and #B are of significance in 2018 and 2020 for utility model grant.

Observing the industry sector N76 (management of water conservancy, environment & public facilities), the return rate variances between drawing groups #A and #B are free of significance in all years from 2017 to 2021 for invention publications, whereas the return rate variances between drawing groups #A and #B are of significance in 2019 and 2021 for utility model grants.

Observing the industry sectors N77 (transportation, warehousing & postal), the return rate variances between drawing groups #A and #B are free of significance in all years from 2017 to 2021 for invention publications, whereas the return rate variance between drawing groups #A and #B is of significance only in 2019 for utility model grants.

Observing the industry sector N78 (R&D research services), the return rate variance between drawing groups #A and #B is of significance only in 2021 for invention publications; whereas the return rate variances between drawing groups #A and #B are free of significance in all years from 2017 tot 2021 for utility model grants.

Observing the industry sector N79 (finance) for invention publications, the return rate variances between drawing groups #A and #B are of significance in 2018, 2019 and 2020.

Observing N80 (real estate) for utility model grants, the return rate variance between drawing groups #A and #B is of significance only in 2019.

Table 8 further shows the return rate means regarding drawing groups #A and #B of each non-manufacturing industry sector for invention publications and utility model grants from 2017 to 2021, wherein, (I) and (U) in drawing groups represents the invention publications and the utility model grants respectively, the values marked with '*' have the significant return rate variance therebetween, the values in bold and red denote the drawing group #A having significantly higher return rate mean than the drawing group #B, the values in bold and green denotes the drawing group #A having significantly lower return rate mean than the drawing group #B.

Table 8: Return Rate Means of Patent Drawing Groups

Industry sector	Drawing group	Stock rate of return mean (%)				
		2017	2018	2019	2020	2021
N71 (information transmission, software & information technology services)	#B(I)	**-29.06***	**-33.34*****	7.37	7.31	-9.57
	#A(I)	**-23.93***	**-25.20*****	13.48	12.18	-7.70
	#B(U)	-28.51	**-34.70****	**-0.68****	3.00	-5.54
	#A(U)	-22.98	**-28.62****	**11.84****	8.60	-3.91
N72 (construction)	#B(I)	**-10.32***	**-38.24****	**-11.79****	**-13.42***	**-0.45*****
	#A(I)	**1.41***	**-31.88****	**-2.75****	**-4.29***	**21.74*****
	#B(U)	-10.96*	**-40.77*****	-10.73	-8.65	8.67
	#A(U)	-0.41*	**-31.87*****	-5.00	-6.69	11.66
N73 (production & supply of electricity, heat, gas, water)	#B(I)	**-10.15****	**-32.31*****	3.39	-9.22	**29.41***
	#A(I)	**1.51****	**-20.00*****	-2.63	-8.51	**41.70***
	#B(U)	-6.66	**-31.11*****	2.45	-7.30	**20.84*****
	#A(U)	-2.47	**-21.81*****	-3.69	-9.10	**42.13*****
N74 (mining)	#B(I)	8.37	-21.34	3.88	3.41	48.38
	#A(I)	7.62	-19.06	3.98	-5.06	35.90
	#B(U)	3.92	-23.68	-0.94	0.61	45.98
	#A(U)	11.61	-17.39	4.42	-2.98	40.31
N75 (wholesale & retail)	#B(I)	-9.46	**-36.89***	-6.93	6.09	3.42
	#A(I)	-13.81	**-30.14***	-7.48	7.86	4.59
	#B(U)	-15.73	**-29.14***	-11.56	**-5.40****	3.41
	#A(U)	-8.30	**-36.79***	-5.32	**12.48****	6.82
N76 (management of water conservancy, environment & public facilities)	#B(I)	-18.77	-37.00	-6.85	-4.35	-0.29
	#A(I)	-8.06	-38.47	-16.29	-7.07	0.32
	#B(U)	-10.94	-33.00	**-3.62****	-7.22	**-6.88****
	#A(U)	-15.48	-41.29	**-16.27****	-4.38	**5.97****
N77 (transportation, warehousing & postal)	#B(I)	4.09	-22.56	2.90	-12.73	20.29
	#A(I)	1.68	-23.03	-3.42	-9.25	8.41
	#B(U)	1.40	-22.82	**5.59****	-8.32	20.76
	#A(U)	8.81	-28.85	**-4.09****	-8.23	7.80
N78 (R&D research services)	#B(I)	-9.57	-32.98	-12.53	1.62	**24.00***
	#A(I)	-20.12	-28.10	-4.57	1.35	**2.83***
	#B(U)	-19.06	-39.29	-11.15	3.32	11.50
	#A(U)	-16.05	-31.37	-5.87	0.65	5.79
N79 (finance)	#B(I)	9.60	**-23.09****	**39.36****	**8.43*****	-1.40
	#A(I)	15.30	**-5.80****	**19.12****	**-7.54*****	1.04
N80 (real estate)	#B(U)	-0.12	-20.12	**16.81***	-3.78	2.95
	#A(U)	-9.98	-20.67	**0.73***	-9.39	-7.12

p*<0.05, p**≤0.01, p***≤0.001; Data: Author's calculation

In order to compare patent drawing count's capability for differentiating return rate, six levels of capability are defined as below:

(1) Well capability: The return rate variances between drawing groups #A and #B are of significance in all five years from 2017 to 2021.

(2) Preferable capability: The return rate variances between drawing groups #A and #B are of significance in four years from 2017 to 2021.

(3) Fair capability: The return rate variances between drawing groups #A and #B are of significance in three years from 2017 to 2021.

(4) Partial capability: The return rate variances between drawing groups #A and #B are of significance in two years from 2017 to 2021.

(5) Weak capability: The return rate variance between drawing groups #A and #B is of significance in only one year from 2017 to 2021.

(6) Ineffective capability: The return rate variances between drawing groups #A and #B are free of significance in any year from 2017 to 2021.

As shown in Table 8, there is one non-manufacturing industry sector for invention publications, i.e. N72 (construction), in which the return rate variances between drawing groups #A and #B are of significance in all five years from 2017 to 2021. The invention publication's drawing count is provided with well capability for differentiating A-share's return rate in the industry sector N72 (construction), wherein, the A-shares in drawing group #A show higher return rate means than the A-shares in drawing group #B. However, the industry sector N72 (construction) for utility model grants has significant return rate variance between drawing groups only in one year, i.e. 2018. The utility model grant's drawing count is provided with weak capability for differentiating A-share's return rate in the industry sector N72 (construction), meanwhile, the A-shares in drawing group #A also show higher return rate mean.

As shown in Table 8, there are two non-manufacturing industry sectors for invention publications including N73 (production & supply of electricity, heat, gas, water) and N79 (finance), in which the return rate variances between drawing groups #A and #B are of significance in three years. The invention publication's drawing count is provided with fair capability for differentiating A-share's return rate in these two industry sectors, wherein, the A-shares in drawing group #A of industry sector N73 (production & supply of electricity, heat, gas, water) show higher return rate means than the A-shares in drawing group #B in these three significant years; the A-shares in drawing group #A of industry sector N79 (finance) show higher return rate mean than the A-shares in drawing group #B in 2018 but lower return rate means in 2019 and 2020. On the other hand, the industry sector N73 (production & supply of electricity, heat, gas, water) for utility model grants has significant return rate variances between drawing groups only in two years including 2018 and 2021. The utility model grant's drawing count is provided with partial capability for differentiating A-share's return rate in the industry sector N73 (production & supply of electricity, heat, gas, water), wherein, the A-shares in drawing group #A also show higher return rate means.

As shown in Table 8, there is one industry sector for invention publications, i.e. N71 (information transmission, software & information technology services), in which the return rate variances between drawing groups #A and #B are of significance in two years including 2017 and 2018. The invention publication's drawing count is is provided with partial capability for differentiating A-share's return rate in the industry sector N71 (information transmission, software & information technology services), wherein, the A-shares in drawing group #A show higher return rate means than the A-shares in drawing group #B. On the other hand, the industry sector N71 (information transmission, software & information technology services) for utility model grants has significant return rate variances between drawing groups in two years including 2018 and 2019. The utility model grant's drawing count is also provided with partial capability for differentiating A-share's return rate in the industry sector N71 (information transmission, software & information technology services), wherein, the A-shares in drawing group #A also show higher return rate means than the A-shares in drawing group #B.

As shown in Table 8, there are two industry sectors for invention publications including N75 (wholesale & retail) and N78 (R&D research services), in any of which the return rate variance between drawing groups #A and #B is of significance in one year wherein, the return rate variance for N75 (wholesale & retail) is significant in 2018, the return rate variance for N78 (R&D research services) is significant in 2021. The invention publication's drawing count is provided with weak capability for differentiating A-share's return rate in the industry sectors N75 (wholesale & retail) and N78 (R&D research services), wherein, the A-shares in drawing group #A of these two industry sectors show higher return rate means than the A-shares in drawing group #B in the significant years. On the other hand, the industry sector N75 (wholesale & retail) for utility model grants has significant return rate variances between drawing groups in two years including 2018 and 2020. The utility model grant's drawing count is provided with partial capability for differentiating A-share's return rate in the industry sector N75 (wholesale & retail), wherein, the A-shares in drawing group #A also show higher return rate means. In addition, the industry sector N78 (R&D research services) does not have significant return rate variances between drawing groups in any year. The utility model grant's drawing count is provided with ineffective capability for differentiating A-share's return rate in the industry sector N78 (R&D research services).

As shown in Table 8, there are three industry sectors for invention publications including N74 (mining), N76 (management of water conservancy, environment & public facilities) and N77 (transportation, warehousing & postal), in which the return rate variances between drawing groups #A and #B are free of significance in all years from 2017 to 2021. The invention publication's drawing count is provided with ineffective capability for differentiating A-share's return rate in the industry sectors N74 (mining), N76 (management of water conservancy, environment & public facilities) and N77 (transportation, warehousing & postal). Similarly, the industry sector N74 (mining) for utility model grants does not have significant return rate variances between drawing groups in any year. The utility model grant's drawing count is also provided with ineffective capability for differentiating A-share's return rate in the industry sector N74 (mining). However, the industry sector N76 (management of water conservancy, environment & public facilities) for utility model grants has significant return rate variances between drawing groups in two years including 2019 and 2021. The utility model grant's drawing count is provided with partial capability for differentiating A-share's return rate in the industry sector N76 (management of water conservancy, environment & public facilities), wherein, the A-shares in drawing group #A show higher return rate mean in 2019 whereas the A-shares in drawing group #B show higher return rate mean in 2021. Meanwhile, the industry sector N77 (transportation, warehousing & postal) for utility model grants has significant return rate variances between drawing groups in one year, i.e. 2019. The utility model grant's drawing count is provided with weak capability for differentiating A-share's return rate in the industry sector N77 (transportation, warehousing & postal), wherein, the A-shares in drawing group #A show higher return rate mean.

In addition, the industry sector N80 (real estate) for utility model grants has significant return rate variances between drawing groups in one year, i.e. 2019. The utility model grant's drawing count is provided with weak capability for differentiating A-share's return rate in the industry sector N80 (real estate), wherein, the A-shares in drawing group #B show higher return rate mean.

Considering the effect of higher patent drawing count, Figures 1 to 7 show the non-manufacturing industry sectors of higher patent drawing counts of invention publications and utility model grants. Three industry sectors including N72 (construction), N74 (mining) and N79 (finance) show significantly higher invention publication's drawing count means while N72 (construction), N74 (mining) show significantly higher utility model grant's drawing count means. For invention publications, the patent drawing count is well capable of differentiating return rate in the industry sector N72 (construction), fairly capable of differentiating return rate in the industry sector N79 (finance), and ineffectively capable of differentiating return rate in the industry sectors N74 (mining). The higher patent counts of invention publications show fairly connection with the capability of differentiating return rate. For utility model grants, the utility model grant's drawing count is less capable of differentiating return rate in the industry sector N72 (construction) and ineffectively capable of differentiating return rate in the industry sectors N74 (mining). The higher patent counts of utility model grants show very weak connection with the capability of differentiating return rate.

Considering the effect of higher stock rate, Figures 8, 10, 12, 14 and 16 show the non-manufacturing industry sectors of higher return rates regarding invention publications. Two industry sectors including N74 (mining) and N79 (finance) show significantly higher return rate means in 2017, however, the return rate variances between drawing groups are free of significance in these two industry sectors. In 2018, two industry sectors including N74 (mining) and N79 (finance) also show significantly higher return rate means, however, the return rate variances between drawing groups are of significance only in the industry sector N79 (finance) but free of significance in the industry sector N74 (mining). In 2019, two industry sectors including N71 (information transmission, software & information technology services) and N79 (finance) show significantly higher return rate means, however, the return rate variances between drawing groups are of significance only in the industry sector N79 (finance) but free of significance in the industry sector N71 (information transmission, software & information technology services). In 2020, two industry sectors including N71 (information transmission, software & information technology services) and N75 (wholesale & retail) show significantly higher return rate means, however, the return rate variances between drawing groups are free of significance in these two industry sectors. In 2021, two industry sectors including N73

(production & supply of electricity, heat, gas, water) and N74 (mining) show significantly higher return rate means, however, the return rate variances between drawing groups are of significance only in the industry sector N73 (production & supply of electricity, heat, gas, water) but free of significance in the industry sector N74 (mining).

Figures 9, 11, 13, 15 and 17 show the non-manufacturing industry sectors of higher return rates regarding utility model grants. Two industry sectors including N74 (mining) and N77 (transportation, warehousing & postal) show significantly higher return rate means in 2017, however, the return rate variances between drawing groups are free of significance in these two industry sectors. In 2018, two industry sectors including N74 (mining) and N80 (real estate) also show significantly higher return rate means, however, the return rate variances between drawing groups are still free of significance in these two industry sectors. In 2019, two industry sectors including N71 (information transmission, software & information technology services) and N80 (real estate) show significantly higher return rate means, while the return rate variance between drawing groups are of significance in these two industry sectors. In 2020, two industry sector including N71 (information transmission, software & information technology services) and N75 (wholesale & retail) show significantly higher return rate means, however, the return rate variances between drawing groups are of significance only in the industry sector N75 (wholesale & retail) but free of significance in the industry sector N71 (information transmission, software & information technology services). In 2021, two industry sectors including N73 (production & supply of electricity, heat, gas, water) and N74 (mining) show significantly higher return rate means, however, the return rate variances between drawing groups are of significance only in the industry sector N73 (production & supply of electricity, heat, gas, water) but free of significance in the industry sector N74 (mining).

In general, regarding either the invention publications or the utility model grants, the higher return rate shows very weak connection with the patent drawing's capability of differentiating return rate.

The comparison of patent drawing count's capabilities of three patent species for differentiating A-share's return rate is shown in Table 9, wherein, the capabilities regarding invention grants are previously proposed by Chen & Chu (2022). It clearly shows that different patent species are provided with different capabilities for differentiating return rate in different industry sectors. In addition, the industry sectors which showing significant return rate variances between drawing groups are not similar regarding the invention grants, the invention publications and the utility model grants.

Table 9: Comparison of Patent Drawing's Capability for Differentiating Return Rate

Industry sector	Capability for differentiating return rate		
	Invention publication	**Utility model grant**	**Invention grant**
N71 (information transmission, software & information technology services)	partial	partial	partial
N72 (construction)	well	weak	fair
N73 (production & supply of electricity, heat, gas, water)	fair	partial	partial
N74 (mining)	ineffective	ineffective	preferable
N75 (wholesale & retail)	weak	partial	ineffective
N76 (management of water conservancy, environment & public facilities)	ineffective	partial	weak
N77 (transportation, warehousing & postal)	ineffective	weak	ineffective
N78 (R&D research services)	weak	ineffective	ineffective
N79 (finance)	fair	--	partial
N80 (real estate)	--	weak	ineffective

Data: Author's calculation

As shown in Table 9, the invention grant's drawing count is provided with preferable capability for differentiating return rate in one industry sector N74 (mining). It is provided with fair capability for differentiating return rate in one industry sector N72 (construction). It is provided with partial capabilities for differentiating return rate in three industry sectors including N71 (information transmission, software & information technology services), N73 (production & supply of electricity, heat, gas, water) and N79

(finance). It is provided with weak capability for differentiating return rate in one industry sector N76 (management of water conservancy, environment & public facilities). It is provided with ineffective capabilities for differentiating return rate in four industry sectors including N75 (wholesale & retail), N77 (transportation, warehousing & postal), N78 (R&D research services) and N80 (real estate).

Via the comparison in Table 9, the invention publication's drawing count is provided with well or fair capabilities for differentiating return rate in three industry sectors, while the invention grant's drawing count is provided with well or fair capabilities for differentiating return rate in two industry sectors, whereas the utility model grant's drawing count is not provided with well or fair capabilities for differentiating return rate in any industry sectors. The invention publication's drawing count therefore shows superior capability to the other two patent species' drawing counts among top nine non-manufacturing industry sectors while the utility model grant's drawing count shows inferior capability although the utility model grants play the majority part of whole China patents. The invention grant is usually regarded as the most valuable patent species in many ways for the reason of its higher innovation level by overcoming the substantial examination. China government also provides lots of favor policies which urging companies to get the invention grants through high level innovation. However, it is interesting that the invention grant's drawing count does not show outstanding capability for differentiating return rate. The invention grant is not provide with higher value when considering the patent drawing count's capability for differentiating return rate.

5. Conclusion and Recommendation

Based on the company integrated patent database of China A-shares and the return rate data in twenty quarters from 2017Q1 to 2021Q4, the industry difference and the patent drawing's capability for differentiating A-share's return rate in top nine non-manufacturing industry sectors for invention publications and utility model grants was thoroughly analyzed via ANOVA.

The population for analysis was the China A-shares listed in either of Shanghai and Shenzhen stock exchanges whereas Chinese companies listed overseas were excluded. Any effective sample was the A-share which being categorized by China securities supervision commission to one of top nine non-manufacturing industry sectors, having an annual return rate over previous one year, have at least one new China invention publication patent or utility model grant patent over previous one year by the end of any quarter from 2017Q1 to 2021Q4. The patent drawing count was defined as the quantity of patent drawings of all invention publications or all utility model grants over previous one year of an A-share. According to the median of A-share's patent drawing counts in each quarter, all effective sample A-shares in each of top nine non-manufacturing industry sectors were divided into two drawings groups of the higher and the lower drawing counts: #A and #B. The following conclusions were arrived:

(1) The invention publication's drawing count showed well capability for differentiating A-share's return rate for the industry sector N72 (construction), wherein, the A-shares in different drawing groups showed significantly different return rate means in all five years from 2017 to 2021 while the A-shares in the drawing groups #A showed higher return rate means.

(2) The invention publication's drawing count did not show preferable capability for differentiating A-share's return rate for any industry sectors. However, the invention publication's drawing count showed fair capability for the industry sectors N73 (production & supply of electricity, heat, gas, water) and N79 (finance), wherein, the A-shares of said aforementioned industry sectors in different drawing groups showed significantly different return rate means in three years from 2017 to 2021. The A-shares in the drawing groups #A of N73 (production & supply of electricity, heat, gas, water) showed higher return rate means in the years of significance; whereas the A-shares in the drawing groups #A of N79 (finance) showed higher return rate mean in one year of significance but lower return rate means in the other years of significance.

(3) The invention publication's drawing count showed partial capability for differentiating A-share's return rate for the industry sector N71 (information transmission, software & information technology services), wherein, the A-share in different drawing groups showed significantly different return rate means in

two years from 2017 to 2021. The A-shares in the drawing groups #A showed higher return rate means in the years of significance.

(4) The invention publication's drawing count showed weak capability for differentiating A-share's return rate for the industry sectors N75 (wholesale & retail) and N78 (R&D research services). The A-shares of any aforementioned industry sector in different drawing groups showed significantly different return rate mean in only one year from 2017 to 2021, wherein, the A-shares in the drawing group #A of N75 (wholesale & retail) showed higher return rate mean in the year of significance whereas the A-shares in the drawing group #A of N78 (R&D research services) showed lower return rate mean in the year of significance.

(5) The invention publication's drawing count showed ineffective capability for differentiating A-share's return rate for the industry sectors N74 (mining), N76 (management of water conservancy, environment & public facilities) and N77 (transportation, warehousing & postal). The A-shares of aforementioned industry sectors in different drawing groups did not showed significantly different return rate means in any years from 2017 to 2021.

(6) The utility model grant's drawing count did not show well capability, preferable capability or fair capability for differentiating A-share's return rate for any industry sectors. However, the utility model grant's drawing count showed partial capability for the industry sectors N71 (information transmission, software & information technology services), N73 (production & supply of electricity, heat, gas, water), N75 (wholesale & retail) and N76 (management of water conservancy, environment & public facilities). The A-shares of any aforementioned industry sectors in different drawing groups showed significantly different return rate means in two years from 2017 to 2021. The A-shares in the drawing groups #A of N71 (information transmission, software & information technology services), N73 (production & supply of electricity, heat, gas, water) and N75 (wholesale & retail) showed higher return rate means in the years of significance; the A-shares in the drawing groups #A of N76 (management of water conservancy, environment & public facilities) showed higher return rate mean in one year of significance but lower return rate mean in the other year of significance.

(7) The utility model grant's drawing count showed weak capability for differentiating A-share's return rate for the industry sectors N72 (construction), N77 (transportation, warehousing & postal) and N80 (real estate). The A-shares of any of aforementioned industry sectors in different drawing groups showed significantly different return rate mean in only one year from 2017 to 2021, wherein, the A-shares in the drawing groups #A of N72 (construction) and N77 (transportation, warehousing & postal) showed higher return rate means in the years of significance whereas the A-shares in the drawing group #A of N80 (real estate) showed lower return rate mean in the year of significance.

(8) The utility model grant's drawing count showed ineffective capability for differentiating A-share's return rate for the industry sectors N74 (mining) and N78 (R&D research services). The A-shares of any aforementioned industry sectors in different drawing groups did not showed significantly different return rate means in any years from 2017 to 2021.

(9) The higher patent counts of invention publications showed fairly connection with the capability for differentiating return rate, however, the higher patent counts of utility model grants showed very weak connection with the capability for differentiating return rate.

(10) Regarding either the invention publications or the utility model grants, the higher return rates showed very weak connection with the patent drawing's capability of differentiating return rate.

(11) Though the utility model grants played the majority part of China patents, the utility model grant's drawing count showed inferior capability for differentiating return rate to the invention publication's drawing count, because there was no any non-manufacturing industry sectors in which the utility model grant's drawing count showed well, preferable or fair capability whereas there were three non-manufacturing industry sectors in which the invention publication's drawing count showed well or fair capability.

(12) Comparing the finding on invention grants by Chen & Chu (2022), the invention grant's drawing count showed preferable capability for differentiating return rate for one industry sector, fair capability for one industry sector, partial capability for three industry sectors, weak capability for one industry sector,

and ineffective capability for four industry sectors. The invention grant's drawing count was not provided with outstanding capability for differentiating return rate, though the invention grant was usually regarded as the most valuable patent species and received quite a lot of government's policy favor. In addition, the invention publication's drawing count showed superior capability to the other two patent species' drawing counts among top nine non-manufacturing industry sectors.

For the common sense, different industry sectors were supposed to be provided with different attributes of products, services, technologies and innovations. Via the data of China A-shares in top nine non-manufacturing industry sectors, this research proved that the industry difference regarding patent drawings was also distinct. Different non-manufacturing industry sectors showed different patent drawing counts, and different patent drawing count's capability for differentiating A-share's return rate. The industry difference was strongly suggested to take into consideration when using any patent indicators for analysis because every non-manufacturing industry sector had its particularity.

The finding of this research would help financial organizations improve their investment strategy by finding the proper non-manufacturing industry sectors in which the invention publication's drawing count, utility model grant's drawing count and/or the invention grant's drawing count being capable of differentiating the return rate and selecting the the proper stocks from the drawing group which showing the significantly higher return rate. Since the return rate was a straight-forward indicator for evaluating listed companies, the finding of this research would also contribute the state of art in evaluating Chinese listed companies. The related researchers interested in this issue might follow the methodology to explore the industry differences for the manufacturing industry sectors and/or other patent indicators.

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Appendix

Table A1: Effective Samples Statistics of Top Nine Non-Manufacturing Industry Sectors for Invention Publications

Year	Industry sector	Effective sample A-shares				
		Q1	Q2	Q3	Q4	Whole year
2017	N71	124	124	138	148	539
	N72	51	51	63	62	232
	N73	38	38	44	44	169
	N74	38	38	40	40	155
	N75	30	30	29	30	115
	N76	23	23	27	30	108
	N77	19	19	21	24	86
	N78	19	19	20	24	82
	N79	18	18	19	18	73
	Whole Top 9	360	360	401	420	1,559
2018	N71	157	157	162	174	652
	N72	66	66	64	69	264
	N73	48	48	51	55	205
	N74	41	41	41	44	169
	N75	31	31	34	38	137
	N76	32	32	33	33	129
	N77	25	25	30	30	112
	N78	24	24	31	32	112
	N79	20	20	22	23	84
	Whole Top 9	444	444	468	498	1,864
2019	N71	176	129	182	187	722
	N72	72	56	73	71	288
	N73	57	43	58	59	232
	N74	46	37	48	48	189
	N75	39	26	39	43	159
	N76	33	28	33	33	132
	N77	34	22	32	33	132
	N78	31	19	34	32	129
	N79	25	18	35	39	133
	Whole Top 9	513	378	534	545	2,116
2020	N71	191	159	196	194	771
	N72	74	65	75	76	299
	N73	58	51	63	63	244
	N74	46	43	48	51	196
	N75	42	34	46	46	178
	N76	34	31	34	37	139
	N77	37	27	40	43	162
	N78	34	25	33	34	136
	N79	39	19	44	40	163
	Whole Top 9	555	454	579	584	2,288
2021	N71	251	177	276	279	1,065
	N72	82	72	85	83	334
	N73	72	58	74	74	288
	N74	54	47	59	58	229
	N75	55	38	64	63	241
	N76	46	33	50	53	197
	N77	46	33	48	53	193
	N78	45	32	49	54	196
	N79	46	34	44	47	180
	Whole Top 9	697	524	749	764	2,923

Source: the securities supervision commission of China and author's calculation

Table A2: Effective Samples Statistics of Top Nine Non-Manufacturing Industry Sectors (Utility Model Grants)

Year	Industry sector	Effective sample A-shares				
		Q1	Q2	Q3	Q4	Whole year
2017	N71	91	90	90	100	371
	N72	58	60	63	65	246
	N73	46	52	50	50	198
	N74	38	40	40	43	161
	N77	27	30	25	28	110
	N75	28	26	25	24	103
	N76	25	22	26	28	101
	N78	18	19	18	19	74
	N80	23	26	24	25	98
	Whole Top 9	354	365	361	382	1,462
2018	N71	107	113	121	123	464
	N72	72	73	74	74	293
	N73	53	51	56	63	223
	N74	45	44	45	48	182
	N77	29	34	38	40	141
	N75	25	33	37	37	132
	N76	31	32	33	32	128
	N78	20	22	29	31	102
	N80	27	28	28	25	108
	Whole Top 9	409	430	461	473	1,773
2019	N71	112	112	115	117	456
	N72	78	77	78	79	312
	N73	63	64	67	66	260
	N74	50	49	50	53	202
	N77	44	43	41	45	173
	N75	38	42	39	35	154
	N76	33	36	37	37	143
	N78	29	30	31	33	123
	N80	23	21	20	21	85
	Whole Top 9	470	474	478	486	1,908
2020	N71	119	124	128	125	496
	N72	77	82	81	82	322
	N73	68	67	70	74	279
	N74	52	56	59	59	226
	N77	49	53	53	55	210
	N75	31	34	37	39	141
	N76	35	36	37	39	147
	N78	35	36	37	36	144
	N80	20	24	23	27	94
	Whole Top 9	486	512	525	536	2,059
2021	N71	164	160	167	182	673
	N72	89	91	92	92	364
	N73	81	82	84	86	333
	N74	61	60	62	63	246
	N77	61	61	57	67	246
	N75	60	56	56	61	233
	N76	46	48	52	58	204
	N78	45	46	48	47	186
	N80	41	43	44	43	171
	Whole Top 9	648	647	662	699	2,656

Source: the securities supervision commission of China and author's calculation

Table A3: Multiple Comparisons of ANOVA on Patent Drawing Count between Pairs of Non-Manufacturing Industry Sectors in Each Year (Invention Publication)

Year	Industry sector (I)	Industry sector (J)	Invention publication's drawing count		
			Mean difference (I-J)	Std. error	p
2017	N72	N76	419.126	81.868	0.001***
	N74	N76	414.399	88.091	0.001***
	N72	N73	404.888	71.075	0.001***
	N72	N77	400.800	88.726	0.001***
	N72	N75	400.755	80.150	0.001***
	N74	N73	400.161	78.161	0.001***
	N74	N77	396.073	94.498	0.001***
	N74	N75	396.028	86.496	0.001***
	N72	N78	394.550	90.291	0.001***
	N74	N78	389.823	95.969	0.001***
	N72	N71	318.145	55.185	0.001***
	N74	N71	313.417	64.054	0.001***
	N72	N79	210.940	94.313	0.025*
	N74	N79	206.212	99.763	0.039*
	N79	N73	193.949	98.431	0.049*
2018	N79	N76	701.897	129.034	0.001***
	N79	N75	692.719	127.540	0.001***
	N79	N77	692.708	132.840	0.001***
	N79	N73	691.414	119.229	0.001***
	N79	N78	674.235	132.840	0.001***
	N79	N71	608.895	106.690	0.001***
	N72	N76	476.292	98.866	0.001***
	N72	N75	467.114	96.908	0.001***
	N72	N77	467.103	103.784	0.001***
	N72	N73	465.809	85.675	0.001***
	N72	N78	448.630	103.784	0.001***
	N74	N76	395.289	107.602	0.001***
	N74	N75	386.111	105.805	0.001***
	N74	N77	386.100	112.137	0.001***
	N74	N73	384.806	95.623	0.001***
	N72	N71	383.290	67.138	0.001***
	N74	N78	367.627	112.137	0.001***
	N79	N74	306.608	122.864	0.013*
	N74	N71	302.287	79.443	0.001***
2019	N79	N75	1,147.229	200.526	0.001***
	N79	N76	1,145.955	209.660	0.001***
	N79	N73	1,138.069	185.601	0.001***
	N79	N77	1,129.598	209.660	0.001***
	N79	N78	1,117.691	210.880	0.001***
	N79	N71	1,035.725	161.025	0.001***
	N72	N75	713.803	168.602	0.001***
	N72	N76	712.529	179.368	0.001***
	N72	N73	704.643	150.545	0.001***
	N72	N77	696.173	179.368	0.001***
	N79	N74	695.257	193.142	0.001***
	N72	N78	684.266	180.793	0.001***
	N72	N71	602.299	118.932	0.001***
	N74	N75	451.972	183.639	0.014*
	N74	N76	450.698	193.571	0.020*

	N74	N73	442.812	167.213	0.008**
	N74	N77	434.342	193.571	0.025*
	N79	N72	433.426	178.905	0.015*
	N74	N78	422.434	194.891	0.030*
	N74	N71	340.468	139.433	0.015*
2020	N79	N75	1,058.194	165.824	0.001***
	N79	N76	1,049.411	176.594	0.001***
	N79	N77	1,019.683	169.693	0.001***
	N79	N73	1,009.104	154.733	0.001***
	N79	N78	1,007.371	177.642	0.001***
	N79	N71	903.221	131.864	0.001***
	N72	N75	844.152	144.806	0.001***
	N72	N76	835.370	157.025	0.001***
	N72	N77	805.642	149.221	0.001***
	N72	N73	795.062	131.960	0.001***
	N72	N78	793.330	158.202	0.001***
	N72	N71	689.179	104.208	0.001***
	N79	N74	587.081	162.143	0.001***
	N74	N75	471.113	158.369	0.003**
	N74	N76	462.331	169.613	0.006**
	N74	N77	432.603	162.416	0.008**
	N74	N73	422.023	146.716	0.004**
	N74	N78	420.291	170.704	0.014*
	N72	N74	373.039	140.576	0.008**
	N74	N71	316.140	122.358	0.010**
2021	N79	N75	1,360.653	164.564	0.001***
	N79	N76	1,347.252	172.242	0.001***
	N79	N78	1,304.171	172.452	0.001***
	N79	N77	1,301.616	173.092	0.001***
	N79	N73	1,238.857	158.719	0.001***
	N79	N71	1,170.454	134.621	0.001***
	N72	N75	1,107.264	141.186	0.001***
	N72	N76	1,093.863	150.065	0.001***
	N72	N78	1,050.781	150.306	0.001***
	N72	N77	1,048.226	151.040	0.001***
	N72	N73	985.468	134.327	0.001***
	N72	N71	917.064	104.761	0.001***
	N79	N74	841.834	166.397	0.001***
	N72	N74	588.444	143.318	0.001***
	N74	N75	518.820	154.156	0.001***
	N74	N76	505.419	162.328	0.002**
	N74	N78	462.338	162.550	0.004**
	N74	N77	459.782	163.229	0.005**
	N74	N73	397.024	147.900	0.007**
	N74	N71	328.621	121.678	0.007**

p*<0.05, p**≤0.01, p***≤0.001; Data: Author's calculation

Table A4: Multiple Comparisons of ANOVA on Patent Drawing Count between Pairs of Non-Manufacturing Industry Sectors in Each Year (Utility Model Grants)

Year	Industry sector (I)	Industry sector (J)	Utility model grant's drawing count		
			Mean difference (I-J)	Std. error	p
2017	N72	N80	448.441	63.059	0.001***
	N72	N75	439.057	61.954	0.001***
	N72	N77	438.076	60.549	0.001***
	N72	N71	435.457	43.404	0.001***
	N72	N76	423.565	62.385	0.001***
	N72	N73	414.052	50.401	0.001***
	N72	N78	407.944	69.990	0.001***
	N72	N74	227.372	53.513	0.001***
	N74	N80	221.069	67.635	0.001***
	N74	N75	211.685	66.607	0.002**
	N74	N77	210.704	65.301	0.001***
	N74	N71	208.085	49.820	0.001***
	N74	N76	196.193	67.007	0.003**
	N74	N73	186.680	56.021	0.001***
	N74	N78	180.573	74.140	0.015*
2018	N72	N80	571.345	78.856	0.001***
	N72	N77	557.023	71.797	0.001***
	N72	N71	555.395	52.271	0.001***
	N72	N75	548.746	73.431	0.001***
	N72	N76	531.622	74.218	0.001***
	N72	N78	516.574	80.533	0.001***
	N72	N73	514.836	62.251	0.001***
	N72	N74	298.070	66.113	0.001***
	N74	N80	273.275	85.086	0.001***
	N74	N77	258.952	78.589	0.001***
	N74	N71	257.324	61.267	0.001***
	N74	N75	250.676	80.085	0.002**
	N74	N76	233.552	80.807	0.004**
	N74	N78	218.503	86.642	0.012*
	N74	N73	216.766	69.976	0.002**
2019	N72	N80	655.685	99.638	0.001***
	N72	N71	636.751	59.833	0.001***
	N72	N77	635.085	77.195	0.001***
	N72	N75	633.178	80.200	0.001***
	N72	N76	615.067	82.239	0.001***
	N72	N73	599.654	68.384	0.001***
	N72	N78	594.204	86.703	0.001***
	N72	N74	383.727	73.544	0.001***
	N74	N80	271.958	105.287	0.010**
	N74	N71	253.024	68.829	0.001***
	N74	N77	251.358	84.360	0.003**
	N74	N75	249.450	87.118	0.004**
	N74	N76	231.340	88.999	0.009**
	N74	N73	215.927	76.380	0.005**
	N74	N78	210.477	93.139	0.024*
2020	N72	N77	930.100	99.958	0.001***
	N72	N71	928.328	80.650	0.001***
	N72	N80	926.620	132.115	0.001***
	N72	N75	919.202	113.802	0.001***

	N72	N76	897.122	112.176	0.001***
	N72	N78	864.047	112.975	0.001***
	N72	N73	853.317	92.173	0.001***
	N72	N74	639.402	97.793	0.001***
	N74	N77	290.698	108.013	0.007**
	N74	N71	288.926	90.442	0.001***
	N74	N80	287.218	138.310	0.038*
	N74	N75	279.800	120.939	0.021*
	N74	N76	257.720	119.410	0.031*
	N74	N73	213.915	100.853	0.034*
2021	N72	N71	1,343.281	97.011	0.001***
	N72	N77	1,338.972	123.066	0.001***
	N72	N80	1,338.849	138.236	0.001***
	N72	N75	1,338.790	125.098	0.001***
	N72	N76	1,291.977	130.407	0.001***
	N72	N78	1,228.423	134.390	0.001***
	N72	N73	1,206.149	113.067	0.001***
	N72	N74	1,036.577	123.066	0.001***
	N74	N71	306.704	111.090	0.006**
	N74	N77	302.394	134.443	0.025*
	N74	N80	302.272	148.455	0.042*
	N74	N75	302.213	136.306	0.027*

p*<0.05, p**≤0.01, p***≤0.001; Data: Author's calculation

Table A5: Multiple Comparisons of ANOVA on Return Rate between Pairs of Non-Manufacturing Industry Sectors in Each Year (Invention Publications)

Year	Industry sector (I)	Industry sector (J)	Return rate (%)		
			Mean difference (I-J)	Std. error	p
2017	N79	N71	38.912	3.835	0.001***
	N74	N71	34.498	2.802	0.001***
	N77	N71	29.417	3.570	0.001***
	N79	N78	27.125	4.948	0.001***
	N79	N76	25.921	4.659	0.001***
	N79	N75	23.951	4.601	0.001***
	N74	N78	22.711	4.199	0.001***
	N73	N71	22.080	2.711	0.001***
	N72	N71	21.997	2.414	0.001***
	N74	N76	21.506	3.854	0.001***
	N74	N75	19.536	3.784	0.001***
	N77	N78	17.631	4.746	0.001***
	N79	N72	16.915	4.126	0.001***
	N79	N73	16.832	4.306	0.001***
	N77	N76	16.426	4.444	0.001***
	N75	N71	14.961	3.158	0.001***
	N77	N75	14.456	4.383	0.001***
	N76	N71	12.991	3.242	0.001***
	N74	N72	12.500	3.190	0.001***
	N74	N73	12.418	3.420	0.001***
	N78	N71	11.787	3.645	0.001***
	N73	N78	10.293	4.138	0.013*
	N72	N78	10.211	3.950	0.010*
	N73	N76	9.089	3.788	0.017*
	N72	N76	9.006	3.582	0.012*

	N72	N75	7.036	3.507	0.045*
2018	N79	N76	23.021	3.383	0.001***
	N79	N72	20.430	3.023	0.001***
	N79	N75	18.887	3.344	0.001***
	N74	N76	17.441	2.821	0.001***
	N79	N78	16.018	3.483	0.001***
	N77	N76	14.890	3.116	0.001***
	N74	N72	14.850	2.377	0.001***
	N79	N71	14.658	2.797	0.001***
	N74	N75	13.308	2.774	0.001***
	N77	N72	12.299	2.721	0.001***
	N79	N73	11.593	3.126	0.001***
	N73	N76	11.428	2.712	0.001***
	N77	N75	10.756	3.074	0.001***
	N74	N78	10.438	2.940	0.001***
	N74	N71	9.079	2.083	0.001***
	N73	N72	8.837	2.246	0.001***
	N71	N76	8.363	2.325	0.001***
	N79	N77	8.131	3.483	0.020*
	N77	N78	7.887	3.224	0.015*
	N73	N75	7.294	2.663	0.006**
	N78	N76	7.003	3.116	0.025*
	N77	N71	6.527	2.468	0.008**
	N74	N73	6.014	2.507	0.017*
	N71	N72	5.772	1.760	0.001***
2019	N79	N76	40.826	4.610	0.001***
	N79	N78	38.053	4.637	0.001***
	N79	N72	36.768	3.934	0.001***
	N79	N75	36.672	4.409	0.001***
	N79	N77	29.587	4.610	0.001***
	N79	N73	29.067	4.081	0.001***
	N79	N74	25.540	4.247	0.001***
	N71	N76	21.754	3.552	0.001***
	N79	N71	19.072	3.541	0.001***
	N71	N78	18.981	3.587	0.001***
	N71	N72	17.696	2.615	0.001***
	N71	N75	17.600	3.287	0.001***
	N74	N76	15.286	4.256	0.001***
	N74	N78	12.513	4.286	0.004**
	N73	N76	11.759	4.091	0.004**
	N77	N76	11.239	4.619	0.015*
	N74	N72	11.228	3.513	0.001***
	N74	N75	11.132	4.038	0.006**
	N71	N77	10.515	3.552	0.003**
	N71	N73	9.995	2.832	0.001***
	N73	N78	8.986	4.121	0.029*
	N73	N72	7.701	3.310	0.020*
	N73	N75	7.605	3.863	0.049*
	N71	N74	6.468	3.066	0.035*
2020	N71	N77	20.729	3.473	0.001***
	N71	N72	18.591	2.737	0.001***
	N71	N73	18.591	2.951	0.001***
	N75	N77	17.976	4.363	0.001***

	N75	N72	15.839	3.804	0.001***
	N75	N73	15.838	3.961	0.001***
	N71	N76	15.425	3.702	0.001***
	N75	N76	12.672	4.548	0.005**
	N78	N77	12.491	4.673	0.008**
	N79	N77	11.698	4.457	0.009**
	N71	N74	10.502	3.214	0.001***
	N78	N72	10.354	4.156	0.013*
	N78	N73	10.353	4.300	0.016*
	N74	N77	10.227	4.266	0.017*
	N79	N72	9.561	3.912	0.015*
	N79	N73	9.560	4.065	0.019*
	N71	N79	9.031	3.464	0.009**
	N71	N78	8.238	3.737	0.028*
	N74	N72	8.090	3.693	0.029*
	N74	N73	8.089	3.854	0.036*
2021	N74	N71	50.873	3.649	0.001***
	N73	N71	44.115	3.327	0.001***
	N74	N79	42.430	4.990	0.001***
	N74	N76	42.219	4.868	0.001***
	N74	N75	38.232	4.623	0.001***
	N73	N79	35.672	4.760	0.001***
	N73	N76	35.461	4.632	0.001***
	N74	N72	31.713	4.298	0.001***
	N73	N75	31.474	4.374	0.001***
	N74	N78	28.594	4.875	0.001***
	N74	N77	27.847	4.895	0.001***
	N73	N72	24.955	4.029	0.001***
	N77	N71	23.025	3.919	0.001***
	N78	N71	22.279	3.894	0.001***
	N73	N78	21.836	4.639	0.001***
	N73	N77	21.089	4.660	0.001***
	N72	N71	19.160	3.142	0.001***
	N77	N79	14.583	5.191	0.005**
	N77	N76	14.371	5.074	0.005**
	N78	N79	13.837	5.172	0.008**
	N78	N76	13.625	5.054	0.007**
	N75	N71	12.640	3.574	0.001***
	N72	N79	10.718	4.632	0.021*
	N72	N76	10.506	4.500	0.020*
	N77	N75	10.385	4.839	0.032*
	N78	N75	9.639	4.819	0.046*
	N76	N71	8.654	3.885	0.026*
	N79	N71	8.442	4.037	0.037*

p*<0.05, p**≤0.01, p***≤0.001; Data: Author's calculation

Table A6: Multiple Comparisons of ANOVA on Return Rate between Pairs of Non-Manufacturing Industry Sectors in Each Year (Utility Model Grants)

Year	Industry sector (I)	Industry sector (J)	Stock rate of return (%)		
			Mean difference (I-J)	Std. error	p
2017	N74	N71	33.520	2.842	0.001***
	N77	N71	30.796	3.270	0.001***
	N74	N78	25.285	4.230	0.001***
	N77	N78	22.561	4.528	0.001***
	N73	N71	21.261	2.651	0.001***
	N80	N71	21.078	3.421	0.001***
	N74	N76	20.794	3.823	0.001***
	N74	N75	19.745	3.800	0.001***
	N77	N76	18.070	4.151	0.001***
	N77	N75	17.021	4.129	0.001***
	N75	N71	13.775	3.354	0.001***
	N74	N72	13.426	3.053	0.001***
	N73	N78	13.026	4.104	0.002**
	N80	N78	12.843	4.638	0.006**
	N76	N71	12.726	3.380	0.001***
	N74	N80	12.442	3.859	0.001***
	N74	N73	12.259	3.196	0.001***
	N72	N78	11.859	3.993	0.003**
	N77	N72	10.702	3.454	0.002**
	N77	N80	9.718	4.184	0.020*
	N77	N73	9.535	3.582	0.008**
	N73	N76	8.535	3.683	0.021*
	N78	N71	8.235	3.834	0.032*
	N73	N75	7.486	3.659	0.041*
	N72	N76	7.368	3.559	0.039*
2018	N80	N76	16.699	3.009	0.001***
	N74	N76	16.514	2.657	0.001***
	N80	N72	15.945	2.593	0.001***
	N74	N72	15.760	2.174	0.001***
	N80	N78	15.101	3.180	0.001***
	N74	N78	14.915	2.849	0.001***
	N80	N75	12.293	2.988	0.001***
	N74	N75	12.107	2.633	0.001***
	N80	N71	11.351	2.461	0.001***
	N77	N76	11.312	2.812	0.001***
	N74	N71	11.165	2.014	0.001***
	N77	N72	10.558	2.361	0.001***
	N73	N76	10.558	2.554	0.001***
	N73	N72	9.805	2.047	0.001***
	N77	N78	9.713	2.994	0.001***
	N73	N78	8.960	2.753	0.001***
	N77	N75	6.905	2.789	0.013*
	N73	N75	6.152	2.529	0.015*
	N80	N73	6.141	2.700	0.023*
	N77	N71	5.963	2.215	0.007**
	N74	N73	5.955	2.301	0.010**
	N71	N76	5.348	2.299	0.020*
	N73	N71	5.210	1.877	0.006**
	N74	N77	5.202	2.584	0.044*

	N71	N72	4.595	1.719	0.008**
2019	N80	N76	18.868	4.943	0.001***
	N80	N76	18.868	4.943	0.001***
	N80	N78	17.627	5.091	0.001***
	N80	N75	17.611	4.877	0.001***
	N80	N72	16.938	4.416	0.001***
	N71	N76	15.315	3.459	0.001***
	N71	N78	14.074	3.667	0.001***
	N71	N75	14.058	3.364	0.001***
	N71	N72	13.384	2.652	0.001***
	N74	N76	11.526	3.944	0.004**
	N77	N76	10.704	4.079	0.009**
	N74	N78	10.285	4.128	0.013*
	N74	N75	10.269	3.861	0.008**
	N74	N72	9.595	3.259	0.003**
	N80	N73	9.531	4.509	0.035*
	N77	N78	9.463	4.257	0.026*
	N77	N75	9.447	3.999	0.018*
	N73	N76	9.337	3.758	0.013*
	N77	N72	8.774	3.421	0.010**
	N73	N78	8.096	3.950	0.041*
	N73	N75	8.081	3.670	0.028*
	N73	N72	7.407	3.031	0.015*
	N71	N73	5.977	2.805	0.033*
2020	N71	N77	14.037	3.067	0.001***
	N71	N77	14.037	3.067	0.001***
	N71	N73	13.960	2.788	0.001***
	N71	N72	13.437	2.666	0.001***
	N71	N80	12.168	4.190	0.004**
	N75	N77	11.620	4.056	0.004**
	N71	N76	11.592	3.498	0.001***
	N75	N73	11.543	3.849	0.003**
	N75	N72	11.020	3.762	0.003**
	N78	N77	10.280	4.030	0.011*
	N78	N73	10.202	3.822	0.008**
	N75	N80	9.752	4.960	0.049*
	N78	N72	9.680	3.734	0.010**
	N75	N76	9.175	4.391	0.037**
	N74	N77	7.120	3.570	0.046*
	N74	N73	7.043	3.334	0.035*
	N71	N74	6.917	2.990	0.021*
	N74	N72	6.521	3.233	0.044*
2021	N74	N71	47.900	3.899	0.001***
	N74	N80	45.047	5.211	0.001***
	N74	N76	43.685	4.956	0.001***
	N74	N75	38.088	4.784	0.001***
	N73	N71	36.183	3.506	0.001***
	N74	N78	34.460	5.085	0.001***
	N73	N80	33.331	4.924	0.001***
	N74	N72	33.012	4.320	0.001***
	N73	N76	31.969	4.653	0.001***
	N74	N77	28.780	4.719	0.001***
	N73	N75	26.372	4.470	0.001***

	N73	N78	22.743	4.791	0.001***
	N73	N72	21.296	3.969	0.001***
	N77	N71	19.119	3.899	0.001***
	N73	N77	17.064	4.400	0.001***
	N77	N80	16.267	5.211	0.002**
	N77	N76	14.905	4.956	0.003**
	N72	N71	14.887	3.405	0.001***
	N78	N71	13.440	4.335	0.002**
	N72	N80	12.035	4.852	0.013*
	N74	N73	11.717	4.400	0.008**
	N72	N76	10.673	4.577	0.020*
	N75	N71	9.811	3.978	0.014*

p*<0.05, p**≤0.01, p***≤0.001; Data: Author's calculation