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## Establishment of financing models of small and micro enterprise under the background asymmetric information

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### ABSTRACT

Patent pledge financing is a new type of financing established through the support of government decision-making, the degree of perfection of the law, market competition, the level of enterprise management and other factors, and people establish the corresponding model primarily from the angle of quantitative analysis on enterprise's financing environment, economic information and patent products. From the perspective of economic information asymmetry, through the theoretical study of the patent, from multiple angles entity experiments, and by analyzing data and index of the gained information, get the influence of economic information on the amount of financing which is obtained by enterprise patent pledge, and finally put forward other factors that have impact on this model.

### KEYWORDS

Economic information; Patent; Financing; Model.



## INTRODUCTION

IPR(intellectual property right) pledge financing, a new type of financing, different from the traditional way with real estate as collateral for loans to financial institutions, refers to enterprises or individuals who are legal owner of the patents, trademarks, copyrights in the assessed property treat its/his property as a pledge to the banks for financing. The patent pledge financing as one of IPR pledge financing has been very popular in Europe and developed countries in recent years, however, it is still in infancy in our country, but in recent years, patent pledge financing also has developed rapidly in China, and many domestic cities have started pilot of IPR pledge loan. According to statistics, the amount of financing of patent pledge up to 90 billion Yuan in 2011, involving in 1953 patents, an increase of 28%, a new record in recent years. According to its trend, it is expected that the amount of financing gained by using patent pledge will continue to increase, which indicates that, with the development of economy, the position of patent has been increasing in enterprise's financing. In addition, both the person and enterprises are not isolated, and they exist in this great social environment. For business to say, faced with the complex economic information, how to use these economic information effectively to make use of business's patent to get effective financing, at this stage, little research involving in this regard. This paper is written from the perspective of economic information, through the establishment of patent pledge financing model to evaluate the role of economic information on the financing of the patent, and give the patent pledge financing a scientific evaluation. After this model, companies who intend to use the patent pledge financing will have a very good practical value.

## ESTABLISHMENT OF MODEL

### Domestic Situation

At present, many domestic cities have started loan pilot of patent pledge and Shanghai Pudong New Area, Bank of Communications Beijing Branch are typical; Wuhan which based on the models of Beijing, Shanghai Pudong began to push patent pledge to work. These pilots mainly for enterprises to do the work of patent pledge and the important task of building service platform of patent pledge financing with bank.

Currently, overall, from mode operation point of view in various parts of the country's patent pledge financing, Beijing, Shanghai Pudong and Wuhan modes are three mainly representations. Beijing mode is "Bank + corporate patent / trademark pledge" direct pledge financing model; Pudong model is "Bank + guarantee + patents government counter-guarantee fund" indirect pledge model; Wuhan mode is drawing on Beijing and Shanghai Pudong, on the basis of two models launched "Bank Guarantee + + technology patent counter-guarantee" hybrid mode. These types of models are mainly related to banking, corporate, government, security companies and other party's subject.

The work mentioned above, need to have intermediary service organizations. In Beijing modes, Beijing Jingwei Law Firm, Liancheng Assets Appraisal Co., Ltd., Beijing invested company limited by guarantee and letter and other intermediaries all participate to provide professional services and ask for a fee, and each company have to take some risks in proportion, so there is a need for a professional calculation method to calculate the amount of financing or the ability of financing in order to spread patent pledge approach. In the following we will start the process of establishing patent pledge financing model and the validation process.

### Analysis of Index

The existing time of economic information is relatively short, some of the key indicators, for example economic information, still not have a unified definition. In market economy, economic information includes broad economic information and narrow economic information. Broad economic information has innovative, integrated, interconnected type, pressing type, globalization, digitization, virtualization, molecular, hollow and other characteristics, is a reflection of economic activity and features a variety of live news, intelligence, collectively data, instructions, etc.; narrow economic information refers to information generated in existing economic sectors and existing economic activity and can be directly used, such as commodity prices and sales.

Therefore, the patent pledge clearly belongs to the broad economic information, the so-called patent pledge financing is patent pledge which means that the debtor or a third person will have to fulfill its patents secured debt, when the case of the debtor defaults, the creditor have the right to conduct discount, auction or sell the patent priority for repayment of the proceeds. Since 1996 the State Intellectual Property made registration method of patent pledge contract, which means that the patentee give valid patent pledge of themselves to a creditor in debtor-creditor relationship when the debtor defaults, the creditor have priority to get the value of pledge patent for compensation. in the volume of business the study of patent pledge basically reflected in the qualitative analysis, this method in the analysis of practical problems, especially when some of the data is not sufficient, often seems a bit rough, so it not suitable for an accurate description of the patent financing. Therefore, in order to make up for deficiencies of qualitative analysis, this article quantitatively analyze the financing capacity of the patent.

The quantitative evaluation of the financing ability of patent pledge, take the following method, first analyze factors that affect patent pledge financing, then take these factors into corresponding indicators according to the degree of their influence, and finally through the assignment of these indicators calculated obtain quantitative data, and these data represent

the financing level of patent pledge so that it achieve evaluation of enterprise's ability of patent pledge financing. According to national experts Lu Zhiying, Zhang Lin, Sun Ye, Ma Biyu and foreign experts Ludmila Striukova, Roger Svenson's academic guidance from the patented features, trading market, risk facing, legal improvement; economic factors, legal factors, technical factors; government support, the degree of perfection of the law ; business conditions; patented product quality, patented product market characteristics and other aspects to analyzed indicators, and ultimately established the relevant indicators, after sorting out, indicators as follows TABLE 1:

**TABLE 1 : The Indexes related to financing model**

Target layer(O)	criterion layer(C)	Index layer(P)	quantitative criteria of Index layer: 80-99 : strong; 70-80: quite strong; 50-70: General; 30-50: quite Weak; 0-30: Poor	Data acquisition method
The financing capacity of Patent pledge(O)	Political characteristics of patent pledge(C1)	The degree of perfection of Patent pledge law (P1)	degree of perfection of law	Experts score
		Policy support level of patent pledge (P2)	support strength of policy decision	Experts score
		Restriction of law competition (P3)	Restriction of law competition	Experts score
		Industry capacity (P4)	speed of development of the industry	Experts score
		Market risk of Patent pledge (P5)	market risk	Experts score
	Market Characteristics of patent pledge(C2)	The degree of technical impact on market (P6)	Technical impact	Experts score
		Degree of market competition (P7)	Degree of market competition	Experts score
		Degree of market demand (P8)	Patent Demand	Experts score
		Whether the core patent (P9)	core patent	Experts score
		Remaining term of the patent (P10)	Remaining Term rate = (authorized term of protection - has been used in) / authorized term of protection	actual data analysis
Features of patented product(C3)	market size of patented product (P11)	market size=60-99: large; 30-60: Meddle; 0-30: small	Experts score	
	Situation of replacement of patented product (P12)	situation of replacement =0-30: strong; 30-60: middle; 60-99: weak	Experts score	
	Ability to obtain excess profits of patented product (P13)	Ability to obtain excess profits = corporate profit margins - the industry average profit margin	actual data analysis	
	Size of firm (P14)	size of firm =60-99: large; 30-60: middle; 0-30: small	Experts score	
Corporate management level(C4)	Management level of patent (P15)	management level of patent =70-99: strong; 60-70: quite strong; 40-60: general; 20-40: quite weak; 0-20: poor	Experts score	
	Level of sales and service (P16)	Year sales growth of main business income / last main business income -1	Consult Financial Statements	

### Model

Through indicators summarized by the above table, and calculations of the indicators, we eventually obtain the following formula:

$$PPFI = O = \sum_{i=1}^4 C_i * w_{c_i}$$

$$C_i = \sum_{j=1}^n P_j * W_{p_j}$$

The model was built according to the above formula. In the formula, PPFI represents the index of patent pledge financing, and this calculation is what we finally need;  $C_i$  represents the i-th indicator of the criterion layer, and it is determined mainly by experts and it is a representative one;  $w_{c_i}$  represents the i-th index corresponding to the weight of the criterion layer, and it is also determined by experts;  $P_j$  represents the j-th index of index layer;  $W_{p_j}$  represents the weight level of the j-th index of Index layer, and they all serve for the calculation of  $C_i$ .

**Index weight**

Through the expert guidance and reference standards, finally lists weights of various indicators and criteria, the detailed data in the TABLE 2 below.

**TABLE 2 : The detailed data of weights of various indicators and criteria**

index	C1	C2	C3	C4	Total Weight
P1	0.3202	\	\	\	0.1063
P2	0.5571	\	\	\	0.1850
P3	0.1226	\	\	\	0.0407
P4	\	0.0870	\	\	0.0290
P5	\	0.2196	\	\	0.0731
P6	\	0.1967	\	\	0.0655
P7	\	0.1849	\	\	0.0615
P8	\	0.3117	\	\	0.1037
P9	\	\	0.1217	\	0.0169
P10	\	\	0.0688	\	0.0096
P11	\	\	0.2027	\	0.0281
P12	\	\	0.3441	\	0.0478
P13	\	\	0.2627	\	0.0365
P14	\	\	\	0.4538	0.0891
P15	\	\	\	0.3470	0.0682
P16	\	\	\	0.1991	0.0391

For these indicators, its weight can also be tested by coefficient retrieval (CR). The coefficient retrieval is mainly between the criterion layer, and we define the coefficient retrieval must meet  $CR < 0.1$ , only in this case can we believe that the result of layer's order is appropriate, and then accept the results of the analysis. After experts's admission, we identified coefficient of the criterion layer and interior. specific coefficient retrieval summarized as follows TABLE 3:

**TABLE 3: The specific coefficient retrieval summarized**

criterion	Consistency index(CI)	Average random consistency index (RI)	coefficient retrieval (CR)
A	0.0282	0.8931	0.0316
C1	0.0092	0.5149	0.0178
C2	0.0656	1.1185	0.0587
C3	0.0236	1.1185	0.0211
C4	0.0092	0.5149	0.0178

### Index number

Quantizing indicator is the first key work after completes the model, only complete quantitative indicators can we carry out the work of verifying the model. In the process of quantitative indicators, we mainly take the combination of the two methods. The first one is experts' guidance which means that the experts give score on a particular index, then analyze the scores, and convert the scores according to the weight of these scores for experts in the first time, and finally the scores will be converted mathematical average getting the quantified indicators; another is the assignment of index is based on relatively real data, which look for the representative enterprises to cooperate, such as the Shanghai Stock Exchange, and through the number provided by these enterprises and corresponding analysis conducted by man, get an objective and accurate values.

Through the above two methods, we finally come to a complete quantitative indicators, from the criteria of quantitative index to see, most are between 0-99, and there are some more specific indicators of these data, for example, the two special indicators of sales and service level and patented products' ability to obtain excess profits whose data is not in the range of 0-99, expressed as a percentage style but data like this requires special treatment and need for appropriate transformation, and finally after the study and experts' exploration, we decided to make it calculated directly as a percentage of its index value. In addition to these two issues, there is a special problem: Many of the data units are not uniform, and in order to maintain the computability of the data, we directly made dimensionless treatment to the data, so that the data are in the range of 0-99. After these operations above, all indicators are quantified.

### ACTUAL VERIFICATION

In the above operation, we have developed a formula model, also conducted quantification of indicators, but it still need actual verification of whether the model is correct and indicators are reasonable or not.

In order to ensure the accuracy and persuasiveness of the verification, after conducting a careful screening, we selected seven representative companies who are listed companies more than 5 years and have carried out a patent pledge, and the integrity of the business performance data are taken into account when selecting them; these seven companies in Beijing, Shanghai, Guangzhou, Shenzhen, Wuhan, Nanjing, Zhuhai, in order to make them can be easily distinguished, we use abbreviation of area instead of its name, and they are BJ, SH, GZ, SZ, WH, NJ, ZH. Moreover, in order to make them more convincing, the amount of these seven companies acquired through patent pledged more than 10 million, and the maximum loan amount is near to 50 million, the lowest amount is close to 30 million, so the companies are very representative.

The resulting data above is recorded in the excel form, and after careful calculation based on the formula and already quantifiable indicators, finally we get this seven companies' financing index of patent pledge, specific statistical data in the TABLE 4 below:

**TABLE 4 : seven companies' financing index of patent pledge**

critrion	BJ	SH	GZ	SZ	WH	NJ	ZH
PPFI	68.0394	69.4247	68.4087	68.3268	68.6378	67.7583	67.9771
C1	74.3997	74.3164	74.0045	73.9569	74.5890	74.0794	74.3997
C2	70.3499	72.3462	71.5545	71.5637	72.4870	71.0692	70.2682
C3	53.9322	59.3451	57.1017	53.6607	54.9846	54.1387	53.5281
C4	63.3467	63.3322	61.6137	63.6937	61.7084	51.0922	53.4535

The data in the table above is the financing index of this seven companies' patent pledge, and this index is in accordance with the amount of loans that the companies obtained. We analyze the index table of companies' financing capacity of patent pledge, and through statistical calculations, we get the result of statistical analysis of companies' index of financing capacity of patent pledge, the data as the following TABLE 5:

**TABLE 5 : The result of statistical analysis of companies' index of financing capacity of patent pledge**

critrion	N	Minimum	maximum	average	standard deviation
PPFI	7	67.75830	69.4247	68.3675	0.5516
C1	7	73.9569	74.5890	74.2494	0.2378
C2	7	70.2682	72.4870	71.3770	0.8772
C3	7	53.5281	59.3451	55.2416	2.1882
C4	7	61.0922	53.6937	62.6058	1.08469
valid N	7	\	\	\	\

Having got the analysis of pledged financing index and capability index, we can obtain the correlation among c1, c2, c3 and c4, through the statistics, the correlation data as the following TABLE 6.

Through the above verification, and compared with the financing business of patent pledge of company existing in reality, it can prove that the established model is effective, and the result of calculation is quite credible.

**TABLE 6 : The correlation among c1, c2, c3 and c4**

critierion	Variables	PPFI	C1	C2	C3	C4
PPFI	Pearson Relevance	1	0.203	0.786	0.853	0.220
	Significant (bilateral)	\	0.662	0.036	0.015	0.636
	N	7	7	7	7	7
C1	Pearson Relevance	\	1	0.060	-0.023	0.106
	Significant (bilateral)	\	0.898	0.961	0.820	\
	N	7	7	7	7	7
C2	Pearson Relevance	\	\	1	0.635	-0.263
	Significant (bilateral)	\	\	\	0.126	0.569
	N	7	7	7	7	\
C3	Pearson Relevance	\	\	\	1	-0.078
	Significant (bilateral)	\	\	\	\	0.868
	N	7	7	7	7	7
C4	Pearson Relevance	\	\	\	\	1
	Significant (bilateral)	\	\	\	\	\
	N	7	7	7	7	7

## CONCLUSION

So far, the patent pledge financing in China is still a relatively new thing, and its development is still in the initial stage, so, many of its theories are not mature. This article makes this kind of financing presented quantitatively and it provide the appropriate reference for the enterprise by creating a formula, establishing model, and design the corresponding index.

In general, enterprises with high-capacity of patent pledge financing can correspondingly get large amount of financing, therefore, corporate can consider the problem of increasing the amount of financing from aspects of financing capacity of patent pledge. Of course, we also need to take the characteristics of patent pledge and features of the patented product into consideration because of its high correlation.

Finally, the financing capacity of the patent pledge will also be affected by regions, the existing companies selected in this article are in big cities whose economic environment is relatively better, but in some places, there is a certain gap in the economic environment, which will lead to a deviation of calculation results, so that's why the related factors are placed in unimportant position in the final calculation of this paper, and although the final result will have some errors, the errors are acceptable.

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