

Econometric analysis of political connection affect corporate credit financing constraints based on fuzzy logic and SEM model

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Abstract. Fuzzy logic system can build process data model by learning data. It is widely used in modeling, monitoring and control. Based on the concept of charity culture education, this paper takes the survey data of private enterprises in Jiangsu, Zhejiang and Shanghai as samples, and uses the structural equation model to test the mechanism of political connection to ease corporate credit financing constraints in companies. The survey shows that bank loans are the main way of financing for private enterprises, but it is difficult for private enterprises to obtain long-term loans. It can be seen that private enterprises are facing strong credit financing constraints. We found that in the process of enterprise management and operation, political connections are beneficial to reduce the cost of financial borrowing. Through charitable donation, enterprises can have stronger strategic conditions, thus optimizing the management structure of enterprises and reducing financial cost constraints. This kind of association behavior also has huge economic effects, empirical results show that charitable motivation has a significant positive impact on corporate credit demand satisfaction, loan maturity and loan cost. According to the research conclusion, this paper puts forward some suggestions from three aspects: enterprise, government and financial system to promote the healthy development of private enterprises.

Keywords: Fuzzy mathematics, charitable donations, credit financing constraints, structural equation model

1. Introduction

In the 2016 Central Economic Work Conference, Premier Li Keqiang pointed out that private enterprises play an irreplaceable role in maintaining socio-economic stability and, easing employment pressure, which has become an important force to promote China's economic development [1]. However, private enterprises are still in a weak status in society, facing a financing plight in particular. Survey shows that bank loans are the main way of private enterprises' external financing, but it is difficult for

private enterprises to obtain long-term loans, and the scale of bank loans is far from meeting the actual needs [2, 3]. This suggests that private enterprises are faced with higher credit financing constraints [4]. Therefore, it is imperative to solve the dilemma of credit financing of private enterprises and promote their healthy development. Facing the transitional economy and with the allocation right of financial resources being held in the hands of the government, most of the private enterprises choose to establish contact with the government to obtain more financial resources [5]. As charitable donations not only meet the public values and have no legal risk, many private enterprises prefer to establish political connections [6, 7]. Political connections or charitable donations will both cause loss of corporate resources,

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but why private enterprises facing financing plight are still willing to pay political costs and donate corporate assets? Will cooperate political connections and charitable donations ease financing plight? How to cultivate the charity culture concept of enterprises? For this purpose, this paper takes the survey data of private enterprises in Jiangsu, Zhejiang and Shanghai as samples, taps the correlative mechanism among political connection, charitable donations and credit financing constraints, guides the healthy development of private enterprises and solves the problems of private enterprises in the development process to promote sustainable and healthy development of private enterprises.

The main contribution of this paper is to use the structural equation model to test the mechanism of political connection to ease corporate credit financing constraints in companies. As fuzzy logic system can build process data model by learning data. It is widely used in modeling, monitoring and control. Based on the concept of charity culture education, this paper takes the survey data of private enterprises in Jiangsu, Zhejiang and Shanghai as samples, and uses the structural equation model to test the mechanism of political connection to ease corporate credit financing constraints in companies.

This paper is organized as follows: The related work is introduced in Section II. SVM algorithm and sample data distribution characteristics is described in Section III. Research design and data sources based on neural network is presented in Section IV and Section V. Empirical analysis based on structural equation in Section VI. Finally, Conclusions are given in Section VII.

2. Related work

Domestic and foreign scholars confirmed that the corporate social capital can indeed ease the credit financing constraints from the perspective of social capital theory [9, 10]. Khwaja and Mian studied Pakistan and found that enterprise-government relation is a very valuable social capital that can be transformed into a recessive relationship contract between enterprises and governments. As the government can have a greater impact on the bank's business decisions, the implicit relationship contract between the government and enterprise will help the enterprise to obtain more long-term loans at a lower loan cost. Claessens et al. used Brazil's empirical evidence and found that direct or indirect social networks formed by the

political background of executives are an important way to form social capital, improve corporate bank lending rates and satisfaction degree of the credit demand [11]. Based on social capital theory, Infante, Luigi & M. Piazza found that corporate political connection not only can reduce the cost of loans, but also can bring more favorable terms of loan such as longer terms to the enterprise [12].

Fan et al. pointed out that a private enterprise with political connections can get more attention from media, public and other stakeholders in charities, which is conducive to shape a good corporate image and expand social influence [17]. And the higher the political connection level, the better charitable donations. Arthur Gautier et al found that private enterprises were disadvantaged in the allocation of resources compared to state-owned enterprises, which led private enterprises to actively participate in charities to get government attention. Jia Ming and Zhang Zhe uses the theory of resource dependence in studying the enterprises with political connections, and found that enterprise-government resources and relations can drive the enterprises to respond to natural disasters in a charitable way [18]. Godfrey, Roberts & Goss argued that enterprises can increase reputation capital through donation, and that a good corporate reputation is conducive to obtaining loans from creditors such as banks and providing financing for enterprises.

In the development process of China's financial market, the signal indication of capital demander is becoming increasingly important, especially private enterprises [25]. The higher the enthusiasm of private enterprises' participation in charity, the greater the amount of donation, the more they are able to meet the demands of the public. At the same time, the public's positive appraisal of the enterprise can enhance the capital supplier's trust in the enterprise [26]. Huang Jun and Zhu Hui found that the higher amount of corporate donations indicates better business performance, which provides adequate protection for the bank debt security and banks will favor the lending to such enterprises. Gao Fan and Wang Yannan took the survey data of national private enterprises as the sample for an empirical test, the results show that the higher the level of corporate donations, the amount of loans can better meet the actual demand. Li Yu and Yu Wen pointed out that compared to private enterprises with no donation or a low level of donation, enterprises with a higher level of donation can get more bank loans and a larger proportion of long-term loans.

Through charitable donation, enterprises can have stronger strategic conditions, thus optimizing the management structure of enterprises and reducing financial cost constraints.

3. SVM algorithm and sample data distribution characteristics

3.1. SVM algorithm

Analytic Hierarchy Process (AHP) is suitable for those problems that are difficult to be fully quantified [8, 10, 11]. It is a simple way to make decisions for complex and fuzzy problems. Its algorithm flow is as follows:

- (1) Establish hierarchical structure model;
Generally, it is divided into three levels: the target layer, the standard layer and the factor layer.
- (2) construction of judgment matrix;
According to the relative quality and order of each evaluation index, the judgement matrix of evaluation index is constructed [9]. For a evaluation index, the weight comparison judgement matrix can be expressed as:

$$A = (a_{ij})_{n \times n} \tag{1}$$

- (3) calculate the weight of each evaluation ω_1 .
- (4) consistency test.

In AHP, the consistency test judgment index is shown as formula (2).

$$C = \frac{\lambda_{\max} - n_A}{n_A - 1} \tag{2}$$

calculation weight ω_2 ;

$$\omega_2 = \frac{V_{\max j}}{\sum_{j=1}^n V_{\max j}} \tag{3}$$

In order to improve the accuracy of teaching quality evaluation index weight, we use AHP and ISD weighting method to calculate the comprehensive weight. SVM algorithm.

In the formula, λ_{\max} is the maximum eigenvalue of the judgment matrix A is expressed; n_A is the order of the judgment matrix A is expressed.

SVM algorithm is widely used in the field of data mining:

$$R(\pi) = \int L(y, f(x, \pi)) dF(x, y) \tag{4}$$

The data of integrated is still complex, and may be mixed with some incomplete data. For linearly separable training sets:

$$T = \{(x_1, y_1), (x_2, y_2), K, (x_n, y_n)\} \tag{5}$$

We need to clean up the incomplete, inconsistent data in the integrated database. Data cleaning can further narrow the data range. Hypothesis existence discriminate function:

$$f(x) = \text{sgn}((\omega \cdot x) + b) \tag{6}$$

On the basis of data cleaning, select the data that related to the government input policy of science and technology, and then select the indicators that may have an impact on the ability of independent innovation. That is, structural optimization problem:

$$\begin{aligned} &\min \frac{1}{2} \|\omega\|^2 \\ &s.t. \quad y_i (\omega \cdot x + b) - 1 \geq 0 \end{aligned} \tag{7}$$

When the linearity is not available, there are some sample points which are not satisfied, then the formula is introduced into the:

$$\begin{aligned} &\min \frac{1}{2} \|\omega\|^2 + c \sum_{i=1}^n \xi_i \\ &s.t. \quad y_i (\omega \cdot x + b) \geq 1 - \xi_i \end{aligned} \tag{8}$$

We will standardize the data that basically in line with the requirements, that is to find the characteristics of data, reduce the effective variables or find the invariant of bibliographic data. The solution can be obtained by solving the equation:

$$\omega = \sum_{i=1}^n \alpha_i y_i x_i \tag{9}$$

$$b = y_i - \sum_{i=1}^n y_i \alpha_i (x_i \cdot x_j) \tag{10}$$

The data that different units and different properties are transformed into data which can be uniformly identified, and the problem of data inconsistency will be solved. Then we get the linear discriminate function:

$$f(x) = \text{sgn} \left(\sum_{i=1}^n \alpha_i y_i (x_i \cdot x_j) + b \right) \quad (11)$$

3.2. Identification of sample data distribution characteristics

Mercer condition: for any symmetric function $K(x_i, x_j)$, the necessary and sufficient condition for the inner product computation in a feature space, for arbitrary $\varphi(x) \neq 0$ and $\int \varphi^2(x) dx < \infty$, (1) was established:

$$\iint K(x, x') \varphi(x') dx dx' \geq 0 \quad (12)$$

By such as shown in the formula (13) support vector machine function, shows that the SVM through the inner product kernel function the original low dimensional space transform to high dimension space, and classification of SVM discriminant is only related to the test samples and training samples, the support vectors.

$$\begin{aligned} f(x) &= \text{sgn}(w^* \bullet x + b) \\ &= \text{sgn} \left(\sum_{i=1}^n \alpha_i^* y_i K(x_i \bullet x) + b^* \right) \end{aligned} \quad (13)$$

In this paper, it is helpful to improve the generalization ability of SVM if the kernel function is the Gauss kernel, and if the distribution of the data set is in agreement with the Gauss distribution. However, the distribution characteristics of the sample data are mostly unknown [15, 16]. If the distribution characteristics of some algorithms can be constructed to approximate the distribution characteristics of the sample data sets, then it is helpful to optimize the selection of SVM kernel function. Generalized Gaussian distribution (GGD) is a class to Gaussian distribution and Laplacian distribution as a special case, to function and uniform distribution is a limiting form of symmetric distribution, in many areas have wide application. GGD probability density function (GGDPDF) see formula (14):

$$\begin{aligned} f(\mu; \alpha, \beta) &= [\alpha / (2\beta \cdot \Gamma(\alpha^{-1}))] \\ \exp \left\{ - [\mu / \beta]^T \right\}; \quad (\alpha > 0, \beta > 0) \end{aligned} \quad (14)$$

Type (13): α for the shape parameter, β for the scale parameter, $\Gamma(x) = \int_0^{+\infty} e^{-t} t^{x-1} dt$ for the Gamma Γ function.

Given a set of training samples $S = \{(x_1, y_1), \dots, (x_l, y_l)\}$, determine whether the

Gauss distribution of the steps are as follows:

Step 1. In the plane, take $m = k$, the real axis is divided into $k + 1$ intervals.

Step 2. Considered α, β as an unknown parameter, then the statistic is $V' = \sum_{i=1}^{m+1} [(v_i - \hat{l}p_i')^2 / (\hat{l}p_i')]$, v_i which indicates the number of ($i = 1, 2, \dots, m + 1$) random samples fall into the i segment, p_i' the probability of falling into the i segment, l for the total number of random samples.

Step 3. Firstly, using the maximum likelihood estimation method to get the estimated value of $\hat{\alpha}, \hat{\beta}, p_i'$ of the resulting estimate is \hat{p}_i' , and then calculate the statistics is V' . If the 1 approximation is subject to a distribution,

Step 4. If the V' distribution of $m - 2$ is the approximate obedience i^2 , then the training samples are subject to GGD, on the contrary, the data to be measured is not subject to GGD.

4. Research design

4.1. Political connection and credit financing constraints

Ma Rui pointed out that corporate political connection is its important social capital. Social capital is a kind of new capital, it is the investment made by the subject in social relations to expect return. According to the definition of social capital made by Lin Nan, enterprise-government relations can be seen as an investment behavior to obtain convenient financing, they are also social relation resources. This relationship can help enterprises to obtain the trust of banks, improve the relationship between banks and enterprises, and break the bottleneck of private enterprises development [8]. Domestic scholars studied the financing effect of political connection combined with China's specific situation. Based on China's special national conditions, Ning Yuxin and Ke Dagang found that the political connection of China's private enterprises plays a hidden guarantee role in the credit financing. Due to the information asymmetry between banks and enterprises, banks can not fully understand the business situation and debt levels, and will give priority in lending to the enterprises with a political background [13]. Yao Dequan and Zhang Jianhui further considered the impact of the political connection level on loan financing, the

results show that the higher the level of political connection, the more the accumulation of social capital, the stronger the political influence [14]. Ma Rui pointed out that a considerable part of corporate bank loans is obtained through connections, and compared with non political related enterprises, private enterprises with political connection are more able to lower the cost of loans to obtain large-scale and long-term loan funds, and the greater the political connection, the greater the financing effect. Based on the above analysis, the following assumptions are put forward:

H1a: political connection has a significant positive effect on the satisfaction degree of the credit demand.

H1b: political connection has a significant positive impact on loan term.

H1c: political connection has a significant positive impact on loan cost.

4.2. *Political connections and corporate charitable donation behavior*

The existing research on the impact of political connection on corporate charitable donations is mostly based on the theory of resource dependence. The theory of resource dependence emphasizes that any organization or institution needs to obtain the resources from the external environment to maintain its survival and development, resulting in a strong dependency of the resource demand side on the resource control side [15]. In the process of China's economic transition, the decisive role of the market has not yet been fully played, the government still controls the allocation of the majority of resources. In order to obtain the necessary resources for enterprise development, private enterprises often chose charitable donations and reciprocal exchange with the government [16]. Dai Yiyi et al used the theory of resource dependence to explore the impact of the municipal party committee replacement on corporate charitable donations. The results show that enterprises tend to increase charitable donations significantly in order to obtain the government's favor after the replacement of the party committee. Sui Wenjuan held that when the government departments encountered bottlenecks in the development of public welfare undertakings and public services, private enterprises are willing to actively participate in charitable donations and other public welfare activities to help undertake some government tasks. In the

exchanges with the government, a non-contractual reciprocal relationship can provide necessary policy support for the future development. In China, the impact of political connections on corporate charitable behavior is also affected by its political connection level [19]. The higher the level of corporate political connection, the greater the willingness to donate more assets to improve corporate reputation and social impact. Moreover, enterprises with a higher level of political connection has a greater political impact, and can get more resources from the government, such as financing convenience, policy support, government subsidies and investment opportunities. Based on the above analysis, the following assumptions are put forward:

H2a: political connection has a significant positive impact on donation motivation.

H2b: political connection has a significant positive impact on donation amount.

H2c: political connection has a significant positive impact on donation effect.

4.3. *Corporate charitable donations and credit financing constraints*

Fazzari et al. suggested that the financing constraints were due to the imperfect external capital market, the asymmetry of information and the presence of transaction costs, and the cost of internal financing was significantly higher than the external financing costs. However, the signal transmission theory can reduce the degree of information asymmetry to a certain extent. Signal transmission theory refers to that in market information asymmetry, enterprises tend to transmit information that are not known by the public through various forms of signals in order to improve the financial performance, increase people's understanding of the real situation of enterprises, and reduce the turbidity of market information [20]. Charitable donation behavior indicates that the enterprise has bright prospects and reliability of heir products. Therefore, most private enterprises regard charitable donations as a signal device. This paper selected donation motivation, donation amount, donation effect as the three dimensions to characterize corporate charitable donations. The impact of each dimension feature on credit financing constraints is analyzed below.

4.4. *Donation motivation and credit financing constraints*

Credit financing constraints are the main manifestation of corporate cultural constraints, and reducing the information asymmetry between capital supply and demand has become the key to ease credit financing constraints. According to the signal transmission mechanism, the market will respond to the voluntary disclosure of information to reduce the degree of information asymmetry between the two sides of the transaction. In view of this, companies will take the initiative to implement a number of strategic initiatives to the capital supplier to send out a positive signal and accumulate reputation [21]. First, the charitable donations made by enterprises motivated by shaping a good social image and expanding social influence can form valuable intangible resources - corporate reputation. It conveys the social reputation of an enterprise, improves the cooperation and extensive contacts between bank/other financial institutions and enterprise, improves the transparency, reduces the degree of information asymmetry between banks and enterprises, gets access to financial institutions' trust, and eases corporate credit financing constraints. Sun Zheng et al. pointed out that the capital supplier deems that the enterprises with higher credibility will be honest to fulfill the debt contract, and at a relatively low costs. Peng Zhen and Dai Yiyi took private enterprises as a sample, and found that corporate disclosure of donation information to the public passes their economic strength and sustainable development and other signals, the creditors' uncertainty with the company's forecast will reduce, and creditors are more willing to provide loans at lower interest rates. Second, the political drive of private enterprise donation in China is also very significant [22]. Many private enterprises see charitable donations as a means of gaining political resources and reputation, so as to get better access to government resources, expand credit channels, and obtain financing facilities (such as obtaining a lower loan cost or a longer loan term). In addition, in the imperfect market, the government's political connection conveys a lower risk of default in its loan default, making it easier to obtain bank credit support. Based on the above analysis, the following assumptions are put forward:

H3a: donation motivation has a significant positive impact on enterprise satisfaction degree of the credit demand.

H3b: donation motivation has a significant positive impact on corporate loan term.

H3c: donation motivation has a significant positive impact on corporate loan cost.

4.5. *Donation amount and credit financing constraints*

Donation amount refers to the amount of the enterprise's annual donation, including the absolute amount and the relative amount. According to the signal transmission theory, the disclosure of the level of charitable donations can increase the transparency of the business situation and reduce the uncertainty of the current operating income and risk assessment of the bank creditors so as to ease credit financing constraints. Shapira [24] based on signal transmission theory, pointed out that the level of charitable donation limit is a signal released by the enterprise to the bank [23]. If the amount of corporate donations is large, indicating that corporate cash flow is more adequate, with a low degree of financial constraints. Therefore, the banks are more willing to provide credit support for such enterprises. The active donation of the corporate assets is conducive to the business development, and enterprise prospects are not only reflected in the good performance indicators, but also may enable enterprises to get more preferential loan conditions [24]. Li Zhigang et al. found that compared to the enterprises that did not disclose the donations information, the enterprises that disclosed obtained a lower bank borrowing rate, a longer period and a larger amount. In companies that disclosed donations information, the higher the level of donation, the more favorable the bank borrowings [27]. Further research has found that this relationship is only maintained in private enterprises and enterprises with a shorter time-to-market. Based on the above analysis, the following assumptions are put forward:

H4a: donation amount has a significant positive impact on enterprise satisfaction degree of the credit demand.

H4b: donation amount has a significant positive effect on corporate loan term.

H4c: donation amount has a significant positive impact on corporate loan cost.

4.6. Donation effect and credit financing constraints

Enterprise's charitable donations effect refers to the impact on society and the enterprise itself through corporate charitable donations, which generally produce two effects. One is the impact on external stakeholders, that is, social effects [28]. The other is the various influences to the enterprise itself, namely economic effect. From the social effects, the active donation of the companies on the one hand improves the status of recipients, meets the public expectations of corporate social responsibility, and the public will therefore have a higher and more positive evaluation of the enterprise. This is all-important to improve the corporate image [29]. A good corporate reputation is good for companies to obtain large-scale bank loans at a lower cost, especially for state-owned banks and municipal commercial banks. On the other hand, corporate donations help the government to relieve task, get the government's recognition and appreciation, this in turn will not only enjoy financial or economic preferential policies, but also get the trust of stakeholders in corporate contracts with the government appreciation, such as reducing the trading costs between enterprises and debt creditors. From the economic effects, the active participation in philanthropy can increase the company's sales, improve the financial performance of enterprises [30]. Corporate financial performance is an important basis for investors to make investment decisions, especially banks, financial institutions and other investment subjects. Menz found that the bank's credit policy is more concerned about the company's financial performance and credit rating, the higher the score, the easier to get loans. Shapira used signal transmission theory, found that corporate charity behavior highlights the financial strength and development prospects of enterprises in the field of credit to enable enterprises to obtain greater concessions. Zhao Hongjian et al. pointed out that China's enterprises generally have not formed a mature charitable donation mechanism, enterprises with good financial performance and strong business capacity can effectively reduce the degree of information asymmetry, it is possible to make enterprises with lower financing costs get more long-term loans. Based on the above analysis, the following assumptions are put forward:

H5a: donation effect has a significant positive impact on enterprise satisfaction degree of the credit demand.

H5b: donation effect has a significant positive impact on corporate loan term.

H5c: donation effect has a significant positive impact on corporate loan cost.

5. Research design

5.1. Data sources

The research team collected data from companies in Jiangsu, Zhejiang and Shanghai in March-July 2016. The questionnaire was divided into two phases. The first stage is the exploratory research stage, questionnaire pre-test was carried out after the first draft, further modifications were made according to the feedback and suggestions. The second stage is the anonymous questionnaire. With the MBA training courses of Jiangsu and Zhejiang universities and e-mail questionnaires, a total of 806 were issued, recycled 506, the recovery rate of 62.78%. The invalid questionnaires with the same answer and blank were removed, a total of 432 valid questionnaires, the questionnaire efficiency of 85.37%. After the questionnaire information is sorted, Excel, SPSS19.0 and AMOS17.0 were used to process the data.

5.2. Variable measure

(1) On the basis of previous studies, the political connection is defined as: If among the directors of the enterprise (excluding independent directors), supervisors and senior management personnel, at least one person is the current or a former government official, CPPCC member or NPC member, the private enterprise has political connection. Refer to the research of Jia Ming and Zhang Zhe (2010). This paper chooses the political connection presence (PL1) and the level of political connection (PL2) as two dimensions to characterize the political connection variable. Where, political connection presence is a dummy variable, if the enterprise has a political connection, it is defined as 1, otherwise 0; the level of political connection is a sorting variable, the central level is set to 5, the provincial level is set to 4, the municipal level is set to 3, the district or county level is set to 2, below the district or county level is set to 1. (2) Charitable donation behavior (DB): Select donation motivation (DM), donation amount (DA), donation effect (DE) characterize corporate charitable donations. (3) Credit financing constraints (FC): satisfaction degree of the credit demand (CDS), loan

term (LP) and loan cost (LC) measure the degree of credit financing constraints.

The Likert5 scale method is used to measure the charitable donation behavior, credit financing constraints and other dimensions. Numbers 1-5 in turn express totally disagree, disagree, generally agree, agree, and agree very well. The value of each dimension is the simple arithmetic mean of the sum of the scores of each measurement item.

6. Empirical analysis

6.1. Variable reliability and validity analysis

Since the two indicators measuring political connection are the presence of political connection, which is a dummy variable, and the level of political connection, which is a sequencing variable, so it is not suitable to use Cronbach's α reliability coefficient method. The political connection measuring indicators in this paper referred to the practice of Jia Ming and Zhang Zhe (2010), the reliability and validity test on political connection can be omitted. In this paper, Cronbach's α coefficient method and factor analysis are used to test the reliability and validity of charitable donation behavior and credit financing constraints. It can be seen from Table 1 that the coefficient of the measuring variables of each latent variable reaches 0.75 or above, indicating that the scale has high reliability; KMO sample measure is $0.841 > 0.700$, the significance probability of χ^2 in Bartlett's Test is $0.000 < 0.001$, indicating that the sample data is suitable for factor analysis. The three factors of charitable donation behavior and of financing constraint are extracted after orthogonal rotation by the maximum quadratic method, with the post-rotation factor load > 0.5 as the standard. This result is basically the same as the indicator structure in indicator setting, indicating that the scale setting has high structural validity.

Table 1
Results of variable reliability, KMO and Bartlett's Test

Variable category	Variable	Cronbach's α	KMO	Bartlett's Test	
				X2	Sig
DB	DM	0.771	0.855	2975.015	0.000
	DA	0.878			
	DE	0.842			
FC	CDS	0.908	0.841	2701.318	0.000
	LP	0.877			
	LC	0.953			

6.2. The basic situation of sample enterprises

From the nature of property rights, private enterprises accounted for 48.84% of the surveyed enterprises, providing a sufficient sample size for this study. From the total assets and the main business income at the end of 2015, the size of the surveyed enterprises is relatively large. From the age of the enterprises, enterprises more than 5 years accounted for about 80.09% of the samples, we can see that most of the surveyed enterprises have entered a mature stage of development. Sample enterprises are more widely distributed in the industry, all over the financial and insurance, machinery manufacturing, chemical and textile, transportation, medicine, real estate and so on.

6.3. Descriptive statistics and related analysis of major variables

As can be seen from Table 3, the average of political connection presence 0.365, indicating that 36.5% of the samples established contacts with the government; the average of political connection level is 2.767, we can see the political connection level of private enterprises is mostly municipal level. The average of enterprise donation motivation is 3.317, indicating that the donation behavior of private enterprises is not entirely out of bona fides, rather a corporate strategy. The average loan term value is 2.881, which indicates that the bank loans obtained by the sample enterprises are mostly short-term loans. The average loan cost is 3.178, we can see private enterprises face higher loan costs. From the Pearson correlation coefficient matrix, we can see that the correlation coefficients of political connection and credit financing constraints are positive and statistically significant. There is a significant positive correlation among the donation motivation, donation amount, donation effect and credit financing constraints, and yet the correlation coefficients of donation amount and satisfaction degree of the credit demand are not significant. The correlation analysis shows that the relationship between variables satisfies the needs of fitting structural equations.

6.4. Analysis of structural equation model

On the basis of correlation analysis, we used the structural equation model to further explore the influence path between variables. The optimal separating hyperplane as show in Fig. 1. And Overall situation of the surveyed sample enterprises as show in Table 2.

Table 2
Overall situation of the surveyed sample enterprises

Item	Option	Frequency	Percentage (%)	Item	Option	Frequency	Percentage (%)
Business location	Jiangsu	145	33.56	enterprise ownership	State-owned	112	25.93
	Zhejiang	129	29.86		private	211	48.84
	Shanghai	158	36.58		Foreign	109	25.23
Total assets by the end of 2015 (RMB 10,000)	<500	35	8.10	Main business Revenue in 2015 (RMB 10,000)	<500	25	5.79
	500-1000	51	11.81		500-1000	52	12.04
	1000-5000	89	20.60		1000-5000	84	19.44
	>5,000	257	59.49		>5,000	271	62.73
Establishment time	<5	86	19.91	Industry	Manufacturing	148	34.26
	5-15	138	31.94		Agriculture, forestry and fisheries	98	22.69
	15-25	95	21.99		Service industry	112	25.93
	>25	113	26.16		Other	74	17.12

Table 3
Descriptive statistics of major variables and Pearson correlation coefficient matrix

Variable	PL1	PL2	DM	DA	DE	CDS	LP	LC
Mean	0.365	2.767	3.317	3.012	2.982	2.703	2.881	3.178
Std.	0.450	1.276	0.736	0.910	0.612	0.881	0.946	0.585
PL1	1							
PL2	0.898**	1						
DM	0.319**	0.354**	1					
DA	0.356**	0.381**	0.049	1				
DE	0.672**	0.736**	0.408**	0.223**	1			
CDS	0.426**	0.444**	0.311**	0.096	0.426**	1		
LP	0.109*	0.168*	0.409**	0.116*	0.101*	0.440**	1	
LC	0.642*	0.729**	0.338**	0.175**	0.113*	0.380**	0.462**	1

Note: * and ** are significant at 5% and 1% levels; the significance of correlation coefficients adopts bilateral test.

- (1) Setting of the initial structural equation model
According to the conceptual model of research, we constructed the initial structural equation model, and set 15 initial hypothetical paths, as shown in Fig. 2.
- (2) Fitting results and evaluation of the initial structural equation model

To verify the adaptability of the theoretical model, it is necessary to evaluate and select the model according to the evaluation indicators. The commonly used model fitness assessment statistic is the chi-square value (CMIN), but the CMIN can fluctuate with the sample size and must be referenced by other fitness indicators. The statistic ratings provided by AMOS include: CMIN/DF (specific value of chi-square value and degrees of freedom), RMR (residual root mean square), AGFI (adjusted goodness of fit index), GFI (goodness of fit index), CFI (comparison fit index), NFI (norm fitting index). Schreiber, Stage and King suggested that RMR, GFI and CFI indicators must be presented, so that CMIN/DF, RMR, GFI, CFI are selected as the fitness indicators of the model fitness. In addition, when

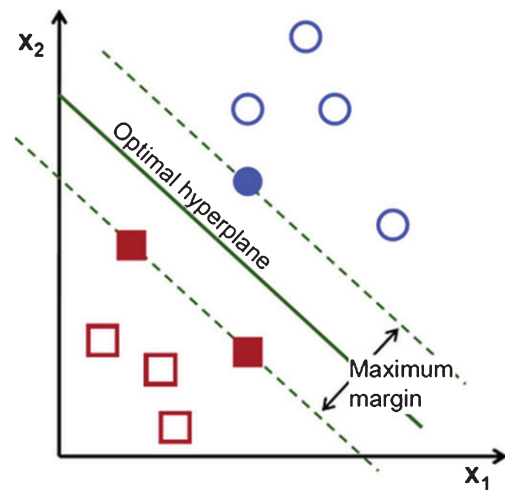


Fig. 1. The optimal separating hyperplane.

the critical value ratio (C.R.) >1.96, it indicates that the corresponding path coefficient is significant at the level of $p < 0.050$.

According to the SEM initial path graph, the first iteration operation is carried out by introducing the data. From the result of the

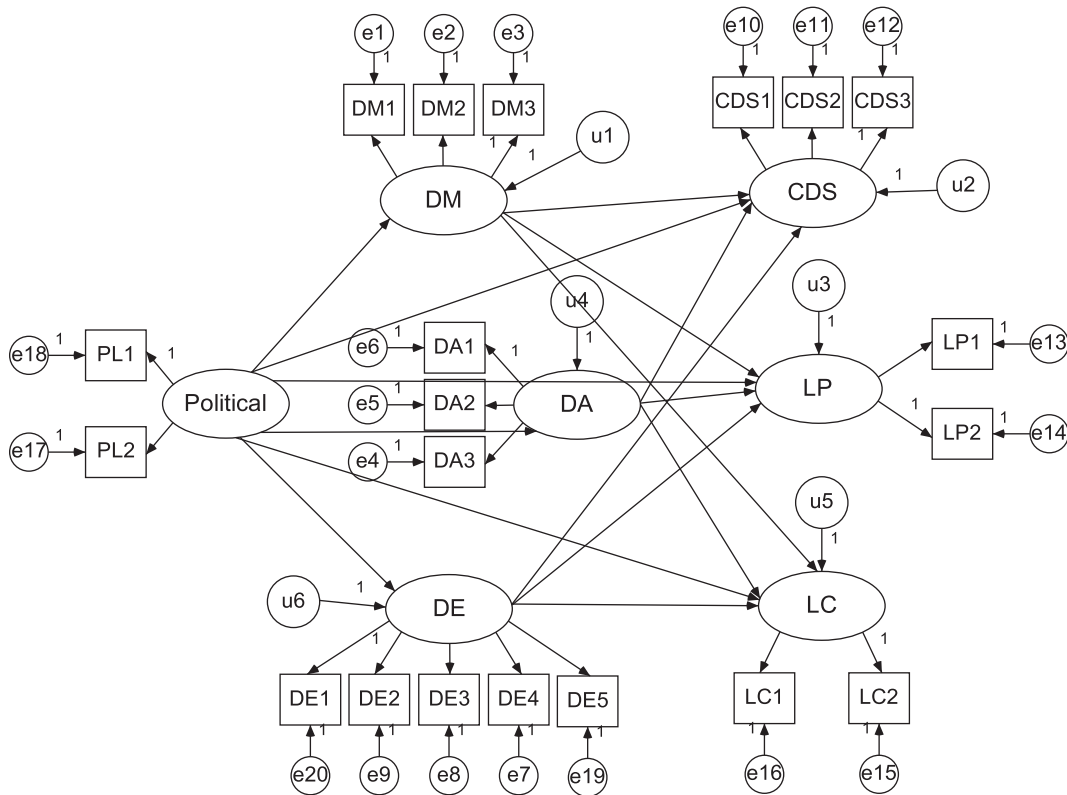


Fig. 2. The initial structural equation model.

operation, the statistics of fitness assessment of the initial model is $CMIN/DF = 2.913 < 3$; $RMR = 0.046 < 0.050$, $GFI = 0.872 < 0.900$; $CFI = 0.914 > 0.900$, within the substantially acceptable range. It can be seen from Table 4 that the most C.R. > 1.96 and are significant at the 5% level. Only five paths (CDS \leftarrow DA, LP \leftarrow DA, LP \leftarrow DE, LC \leftarrow DE, LP \leftarrow Political) failed to not meet the fitting requirements. Therefore, the initial model needs to be amended.

(3) Model correction

According to the correction index M.I of the initial model fitting result (as shown in Table 5), the model is first corrected by adding the covariance between u_4 and u_6 (the difference of model CMIN reduction is the greatest), and the data is input for an AMO fitting operation.

The first corrected $CMIN/DF = 2.861$, $RMR = 0.040$, $GFI = 0.902$, $CFI = 0.947$, the model fitness evaluation index has improved, which shows that the model fitting effect is improved. In addition, the two paths LC \leftarrow

Table 4
Estimation of path parameters for the initial SEM

Path	Standardized path coefficient	Path coefficient	C.R.	P
DM \leftarrow Political	0.357	0.591	6.856	***
DA \leftarrow Political	0.833	1.744	19.952	***
DE \leftarrow Political	0.634	1.334	14.055	***
CDS \leftarrow DM	0.319	0.400	7.167	***
LP \leftarrow DM	0.342	0.394	6.534	***
LC \leftarrow DM	0.108	0.133	2.949	0.003
CDS \leftarrow DA	0.091	0.075	1.201	0.230
LP \leftarrow DA	0.156	0.081	1.926	0.054
LC \leftarrow DA	0.525	0.502	7.595	***
CDS \leftarrow DE	0.239	0.236	4.583	***
LP \leftarrow DE	0.084	0.077	1.397	0.162
LC \leftarrow DE	0.079	0.076	1.768	0.077
CDS \leftarrow Political	0.290	0.603	3.348	***
LP \leftarrow Political	0.173	0.330	1.710	0.087
LC \leftarrow Political	0.387	0.787	5.124	***

Table 5
Covariance correction indicators

Path	M.I.	Par Change
$u_4 \leftrightarrow u_6$	56.138	0.174
$u_2 \leftrightarrow u_3$	48.400	0.184
$e_7 \leftrightarrow u_1$	50.108	0.161
$e_8 \leftrightarrow e_9$	44.790	0.113

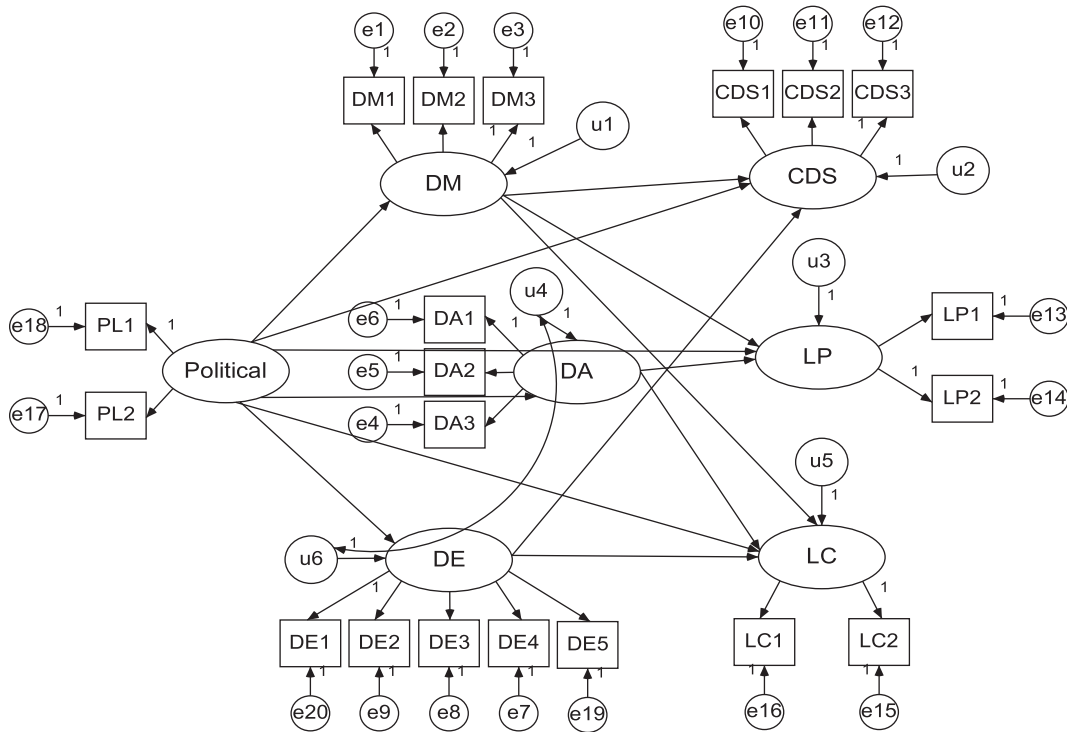


Fig. 3. Final structural equation model.

DE and LP ← Political that did not pass the test in the initial model were C.R.>1.96, and significant at the 5% level, indicating that the two paths passed significance test. But paths CDS← DA, LP← DA, LP← DE still have not passed the test. As for paths CDS ← DA and LP ← DE, not only the critical ratio value <1.96, and the path coefficient is largely difference from that of LP ← DA, far from the standard reference fitting coefficient. Therefore, paths CDS ← DA and LP ← DE are omitted for the second correction of the model.

After the second correction, CMIN/DF = 2.794, RMR = 0.032, GFI = 0.917, CFI = 0.954, indicating that the theoretical model and the sample data are fitted well, and the C.R. of all path coefficients in the structural equation model are greater than 1.96, and are significant at the 5% level.

(4) Model confirmation

After two corrections, the final structural equation model is as shown in Fig. 3, the estimated path parameters of the final model are shown in Table 4.

Table 6
Estimation of path parameters for the final model

Path	Standardized path coefficient	Path coefficient	C.R.	P
CDS ← Political	0.290	0.603	3.348	***
LP ← Political	0.192	0.354	2.261	0.024
LC ← Political	0.387	0.787	5.124	***
DM ← Political	0.357	0.591	6.856	***
DA ← Political	0.833	1.744	19.952	***
DE ← Political	0.634	1.334	14.055	***
CDS ← DM	0.319	0.400	7.167	***
LP ← DM	0.342	0.394	6.534	***
LC ← DM	0.108	0.133	2.949	0.002
LP ← DA	0.212	0.191	2.497	0.013
LC ← DE	0.525	0.502	7.595	***
CDS ← DE	0.239	0.236	4.583	***
LC ← DE	0.118	0.114	2.328	0.020

According to Table 6, we can see that the other assumptions are validated in addition to the assumptions 4a and 5b, indicating that the more assets donated by the enterprise may not lead to more credit financing. The reason may be that although the enterprise donation amount is large, other aspects have poor performance, such as low profitability, thus increasing the possibility of default, so banks and other financial institutions may not want to provide credit support to such enterprises. Assumption 5b is

not validated, which shows that the effect of corporate donation does not significantly extend the loan term. There may be two reasons: First, the sample coverage is relatively narrow and can not effectively validate the theoretical assumptions. Second, the socio-economic effects of donation may not be sustainable, so banks and other financial institutions are reluctant to provide long-term credit support to such enterprises.

7. Conclusions and applications

A large number of studies have explored the economic effects of political connections in private enterprises. However, little attention has been paid to how political connections can alleviate financing constraints. The empirical study of this paper indicates the following results: (1) Political connections can help private enterprises to maximize the lower cost loans to meet the credit financing needs, namely the political connection can ease the credit financing constraint to a certain extent. Moreover, the higher the level of political association, the more significant the effect of reducing the financing constraints. (2) Compared with non political related enterprises, the strategic motivation of charitable enterprises with political connections is more significant, the amount of donations is greater, and the donation effect is better. In addition, the higher the level of political connections, the higher the enthusiasm of enterprises to participate in philanthropy. (3) The motivation of philanthropy has a significant positive impact on the credit demand satisfaction, loan maturity and loan cost. There is a significant positive relationship between the amount of donation and the maturity of the loan and the cost of the loan. However, the positive impact of the amount of donation on the satisfaction of credit demand and the effect of the donation on the maturity of the loan is not significant. (4) Charitable donation behavior has partial mediating effect in the mechanism of political connection to ease credit financing constraint.

Although the existing research framework has been improved, the following shortcomings still exist: (1) The collected data has certain geographical characteristics. Although it is typical, it lacks universality, which restricts the general applicability of the conclusion to a certain extent. Whether the conclusions are applicable to enterprises in other areas still needs further testing. (2) There is a certain subjectivity in variable measure index. Although this method

is proved to be reliable and valid, it is undeniable that the subjective judgment method may still affect the accuracy of the data and even the conclusions of the study. In future studies, designing relatively more objective indicators to measure variables will help to improve the effectiveness of the study. (3) It mainly analyzes the correlation mechanism between political connections, charitable donations and credit financing constraints, and does not reveal comprehensively the relationship between government and enterprises. From the perspective of game theory, the future research can fully and deeply explore whether the political connection is the political resource or the rent-seeking behavior of the government. According to the research conclusion, this paper puts forward some suggestions to promote the healthy development of private enterprises from three aspects of enterprise, government and financial system. First of all, private enterprises should implement the strategy of political and charitable development scientifically. The study finds that corporate political connections and charitable donations are a strategic activity of reciprocity with the government in order to seek financial resources. However, some private enterprises have unreasonable ways of establishing political connections, and their motives are not unitary, and this kind of charitable behavior with the aim of obtaining financial resources is not persistent. Therefore, enterprises should strengthen the supervision of senior managers and evaluate their decisions. In addition, private enterprises should improve their moral consciousness as an enterprise citizen and strengthen their inner drive to participate in philanthropy, so as to ensure the scientific nature of enterprise's political strategy and charity strategy. Secondly, we should give full play to the role of the government's helping hand. During the economic transformation of China, private firms are uniformly discriminated against in the political system and in the credit markets, causing private banks to be constrained by bank loans. In order to solve this problem, it is urgent to speed up the process of transformation, decentralization and construction of service-oriented government, so as to give full play to the decisive role of the market in the allocation of resources, and create a market environment of fair competition. Third, improve the financial market system, and create a fair atmosphere for financing environment. Although political connections can alleviate the constraints of enterprise credit financing to some extent, the acquisition and maintenance of political identity often requires enterprises to bear higher political

costs. Moreover, relying too much on political capital is prone to social problems such as collusion and corruption. Therefore, to improve the financial market system and create a fair financing environment for private enterprises is the fundamental measure to optimize the allocation of financial resources. First, adjust the credit policy of state-owned commercial banks for private enterprises, and give full play to the main channel function of financing for private enterprises. Second, actively promote the market-oriented reform of interest rates, release the government's control over interest rates, create a fair competitive market environment, and effectively allocate credit resources according to price competition mechanism. Finally, the government should guide enterprises, the public and the mass media to pay great attention to philanthropy, give publicity to the spirit and deeds of philanthropic work, and arouse the enthusiasm of enterprises to participate in philanthropy. Change philanthropy ideas and foster charitable preferences by educating charities. That is, by carrying out various activities, inheriting, promoting and popularizing the charity culture, people can set up the concept of charity, form a charity preference and guide charity behavior.

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