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Bank Competition, Financing Constraints and Enterprise Innovation

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Abstract

In recent years, the innovation behavior of enterprises has attracted more and more attention. Our study proves that encouraging bank competition can promote enterprise innovation. The study found that there is a negative correlation between the bank concentration index in county areas and the innovation output of local enterprises in China. At the same time, we find that bank competition can more effectively improve the financing constraints of private enterprises and small enterprises, thus promoting enterprise innovation.

JEL classification numbers: G21,O31,O32.
Keywords: Bank Competition; Financing Constraints; Enterprise Innovation; Credit Discrimination.

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1. Introduction

This study explores how the reform of China's banking industry affects the innovation behavior of enterprises. The typical feature of China's financial system is that banks occupy a dominant position, and obtaining bank credit is still one of the most important financing sources for enterprises. Since 2003, China's banking system has accelerated market-oriented reform and the competition in the banking industry has been strengthened. Inspired by Cai and Dong (2017), we collected the geographical data of bank branches, constructed static and dynamic indicators at the county level to measure the change of the banking competition pattern, and found that bank competition has played a role in promoting enterprise innovation by easing the financing constraints of enterprises.

In recent years, the innovation behavior of enterprises has attracted more and more attention. Hall and Lerner (2010) believe that enterprises face serious financing constraints in innovation. A large number of literatures analyze how to promote enterprise innovation from the perspective of pecking order theory or bank-enterprise relationship, but ignore the change of the important external institutional environment of banking reform. Cornaggia et al. (2015) discuss how the deregulation of US banks affects corporate innovation behavior, but there are large differences between China and the United States. Fu (2021) pays attention to the relationship between the change of bank competition pattern and enterprise innovation activities in China, but using listed companies as the research object is not representative. Dai et al. (2020) use the data of industrial enterprises from 2005 to 2007 to discuss how banking competition in China affects enterprise innovation, but it is not detailed to the county areas.

The research is a useful supplement to the theory of financial development and the theory of enterprise innovation. It is the first study to construct the static and dynamic indicators to measure the changes of banking competition pattern in China at the county level and apply them to the study of enterprise innovation behavior in recent years.

1.1 Overview of China's banking reform

In 2003, China accelerated the market-oriented reform of the banking industry, and in 2006, the restrictions on banks to set up branches across regions were further eased. At the same time, local governments represented by county-level areas have strong intervention in local credit resources, making the bank credit allocation relatively independent among counties. The data of bank branches are crawled from the website of China Banking and Insurance Regulatory Commission, including the name, type, location, establishment time and other main information of institutions of different bank categories.

1.2 Related Literature

The existing literature mostly analyzes the factors affecting innovation from the perspective of enterprise characteristics and industry market characteristics, but

there are few empirical studies on the development of financial markets and financial intermediaries. In fact, for enterprises, innovation is essentially a high-risk and long-term investment activity, which has the characteristics of large capital investment, long R&D time, and uncertainty of future output and so on, and also needs the support of a large number of stable funds (Hsu et al., 2014). Relying on internal financing alone is not enough to support the capital needs of enterprises' R&D activities. Therefore, external financing channels are an important source of capital for enterprises' R&D investment (Hall and Bagchi-Sen, 2002). Generally speaking, it is difficult for enterprises to innovate. From this perspective, in the current situation that the development of China's direct financing market is not sufficient, the banking system is still an important way for enterprises to obtain external financing, so the change of bank financing environment is bound to have an impact on the innovation of enterprises.

In response to the problem of "how does bank competition affect enterprise innovation", an important channel is that enterprises will face external financing constraints when developing, and bank competition will alleviate the financing constraints of enterprises by improving credit supply, so as to improve enterprise innovation. According to MM theorem, when there is no friction in the external financing environment, the external financing cost of the enterprise is consistent with the internal financing cost, so the enterprise can obtain external financing funds according to future investment opportunities. However, in fact, due to information asymmetry, credit discrimination and other reasons, enterprises will have external financing friction, which makes it difficult for enterprises to obtain external financing funds, and shows insufficient investment and financing constraints, hindering enterprise innovation and growth. In fact, due to the characteristics of high risk, uncertain output and difficult to accurately measure the value of innovation activities, the existing information asymmetry is more serious, which makes the financing constraints faced by innovative enterprises more serious (Brown et al., 2009; Ju, 2013; Hall and Lerner, 2010).

Can bank competition promote enterprise innovation by alleviating the financing constraints of enterprises? Answering this question can not only clarify the financial system factors that affect enterprise innovation and provide a basis for formulating more effective policies to promote enterprise innovation in the future, but also further supplement the relevant literature on how financial intermediaries affect the growth of the real economy in the theory of financial development and financial structure, and provide empirical support and literature supplement at the micro level for relevant academic research fields.

Domestic research on bank competition and enterprise innovation in China mostly focuses on the macro level or listed companies, and it is found that the reform and development of the banking industry can promote enterprise innovation. For example, Fang and Cai (2016) used the micro data of industrial enterprises from 1999 to 2007 to investigate the impact of bank competition on enterprise growth at the provincial level, and believed that bank competition would promote enterprise

growth by easing the financing constraints of enterprises. Xie and Fang (2011) took the listed companies from 2002 to 2006 as the research objects and found that the market-oriented reform of banks can promote enterprise innovation.

2. Variable Construction and Data Description

2.1 Variable Construction

2.1.1 Bank competition indicators at the county level

We mainly consider the three main banking organization forms of state-owned banks, joint-stock banks and urban commercial banks, and use Herfindahl index to express the degree of static banking competition in one county:

$$HHI_{jt} = \sum_{i=0}^{N_{jt}} (X_{ijt}/X_{jt})^2 = \sum_{i=0}^{N_{jt}} {S_{ijt}}^2$$

Where, X_{ijt} is the number of branches of class i banks (state-owned banks, joint-stock banks and urban commercial banks) in county j in year t; X_{jt} refers to the total number of branches of three types of commercial banks in county j region in year t; $S_{ijt} = X_{ijt}/X_{jt}$ represents the proportion of class i bank outlets in county j in year t; N_{jt} is the number of specific three types of bank branches in county j in year t. The smaller the HHI index, the lower the degree of monopoly of the banking industry and the higher the level of competition.

We also consider the dynamic change characteristics of bank branches:

$$BankEntr_{jt} = \begin{cases} 1, CCbank_{jt} = 1 \text{or } JSbank_{jt} = 1 \\ 0, CCbank_{jt} = 0 \text{ and } JSbank_{jt} = 0 \end{cases}$$

Where, $CCbank_{jt}$ is a dummy variable that equals to one when a new city commercial bank enters in year t, and zero otherwise; $JSbank_{jt}$ is a dummy variable that equals to one when a new joint-stock bank branch enters in year t, and zero otherwise.

2.1.2 Innovative behavior at the company level

Considering the change of statistical caliber, Chen (2018) believes that merging the data in 2011 and after 2011 with the data before 2011 will bring great errors. Considering the lack of innovation variables in 2010 data, this paper uses the industrial enterprise data disclosed by China Bureau of statistics from 2003 to 2009 to effectively cover two important reform time in 2003 and 2006. We use the ratio of the output of new products to the total output to measure the innovation output (Dai et al., 2020).

2.1.3 Other explanatory variables

The following variables are commonly used in related literature (e.g., Zhang, 2017). *ROA, FAasset, Size, Age, KL, Export, IndusCon, Subsidy* mainly include enterprise profitability, fixed assets, total assets, age, capital intensity, proportion of export output value, industry concentration, government subsidies and other variables. *State, Collect, Private, Foreign and HMT* represent the property rights characteristics of different enterprises. *GDPper, GDPg*rt represent per capita GDP and GDP growth at the county level.

Table 1: Variable definitions and symbols

Variable	Definition
NewProdt	Dependent variable, the output value of new products / total output value
HHI	Main independent variable, see section2.1.1 for the construction method
Size	Natural logarithm of total assets
Age	Natural logarithm of business duration
FAasset	Fixed assets / total assets
ROA	Operating profit / total assets
Export	export products of enterprises/total output value
Subsidy	Government subsidies / total assets
KL	Natural logarithm of net fixed assets / employment
IndusCon	Industry concentration (the concentration of the top five companies in the industry at the provincial level by sales revenue)
Indus	Industry category
AccNet	(accounts payable - accounts receivable) / total assets
State	1 is state-owned and 0 is non-state-owned
Collective	1 is collective holding, 0 is collective holding
Private	1 is legal person holding, 0 is non legal person holding
HMT	1 is Hong Kong, Macao and Taiwan holding, 0 is non Hong Kong, Macao and Taiwan holding
Foreign	1 is foreign capital holding, 0 is non foreign capital holding
GDPper	Natural logarithm of per capita GDP
GDPgrt	Growth rate of regional total production

2.2 Data Description

2.2.1 Data samples

We select the data of industrial enterprises from 2003 to 2009 for research. The indicators for measuring the competitiveness of banks mainly come from the disclosure of relevant information on financial licenses by the China Banking and Insurance Regulatory Commission on its official website. According to the practice of mainstream literature, after adjusting, identifying and matching the industrial enterprises in different years, this paper matches the industrial enterprises with the above bank competition indicators that have been constructed in this paper according to the prefecture level administrative divisions and cities above where the

business is located (Nie et al., 2012; Brandt et al., 2012; Chen, 2018).
Finally, this paper also refers to the common practice of literature, and makes the following screening and processing of the matched data: first, the data with outliers are eliminated, including the cases that the asset items are less than 0, the liability items are less than 0, the paid in capital is less than or equal to 0, the asset liability ratio is greater than 1, the number of employees is less than 10, and the interest expenditure is negative; Second, considering the authenticity of the sample and the need to construct variables with a corresponding lag of one period, this paper only retains enterprise data with observations of two years or more in the processing of industrial enterprise database.

2.2.2 Descriptive Statistics

In this paper, there are 735506 observations in the enterprise dimension. The descriptive statistical results of variables are shown in Table 2 below.
The mean value of the main explanatory variable "new product output value / total industrial output value" NewProdt is 3%, the minimum value is 0, and the maximum value is 98%. From the perspective of the main explanatory variables, the mean value of HHI index of bank competition is 0.23, the median value is 0.21, and the minimum and maximum values are 0.074 and 0.781 respectively.
From the perspective of main control variables, the average commercial net credit value of industrial enterprises is -4%, the average return on assets is 10%, the average proportion of fixed assets is 35%, the average asset size is 94.51 billion yuan, the average operation time is 8.2 years, the average export scale accounts for 16%, and the average government subsidy accounts for 0.2% of total assets. In terms of the proportion of enterprises with different property rights, state-owned holding enterprises account for 5%, collective holding enterprises for 7%, private enterprises for 69%, Hong Kong, Macao, Taiwan and foreign-funded holding enterprises account for 8% and 8% respectively, and legal person holding enterprises account for 3%.
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Table 2: Descriptive Statistics

Variable	# of Obs	Mean	Std.	Min	Median	Max
NewProdt	735506	0.029	0.139	0	0	0.980
HHI	735506	0.229	0.065	0.074	0.211	0.781
ROA	735506	0.100	0.166	-0.147	0.045	0.902
FAasset	735506	0.348	0.218	0.007	0.317	0.913
Size	735506	9.866	1.365	7.373	9.679	14.60
Age	735506	1.940	0.750	0	1.946	4.094
KL	735506	0.386	0.130	0.032	0.390	0.760
IndusCon	735506	0.294	0.117	0.201	0.250	0.780
AccNet	735506	-0.043	0.204	-0.617	-0.027	0.565
Subsidy	735506	0.002	0.009	0	0	0.069
Export	735506	0.342	0.855	0	0	4.789
State	735506	0.048	0.213	0	0	1
Collect	735506	0.073	0.255	0	0	1
Private	735506	0.690	0.459	0	1	1
Foreign	735506	0.077	0.284	0	0	1
HMT	735506	0.080	0.279	0	0	1
GDPgrt	735506	0.186	0.075	0	0.184	0.515
GDPper	735506	10.18	0.665	7.662	10.24	11.43

3. Econometric Specification and Results

3.1 Impact of bank competition on Enterprise Innovation

The benchmark regression model we used is as follows:

$$Innovation_{\mathrm{ijt}} = \beta_0 + \beta_1 HHI_{j,t-1} + \gamma_1 Control_{ij,t-1} + \gamma_2 YearFE + \gamma_3 \mathrm{R}egionFE + \gamma_4 IndustryFE + \varepsilon_{ijt} \quad (1)$$

Where, $Innovation_{\mathrm{ijt}}$ is the innovation output of the *i* th enterprise in county *j* in year *t* and $HHI_{j,t-1}$ indicates the bank competition level of county *j* in year (*t-1*). $Control_{ij,t-1}$ is the set of control variables of the *i* th enterprise in county *j* in year (*t-1*) mentioned above in Section 2.2.2. $YearFE$, RegionFE , $IndustryFE$ represent the fixed effects of year, city and industry respectively. Continuous variables are winsorized at the 1% and 99% levels. The t-statistics are all based on the heteroscedasticity-consistent standard errors corrected for clustering at the firm level.

3.2 Baseline Results

In Table 3, the first column shows that the bank competition index HHI decreased by 1% and the level of enterprise innovation output increased by 2.2%. In the second column, we introduce the HHI index of other counties with the closest administrative territorial relationship and close per capita GDP as the instrumental variable of HHI index of a county to solve the endogenous problem (Zhang, 2017).

Table 3: Baseline Results of bank competition on Enterprise Innovation

	(1)	(2)
	Baseline	**IV(2SLS)**
HHI	-0.022***	-0.070***
	(-8.72)	(-4.88)
ROA	0.017***	0.018***
	(5.82)	(5.98)
FAasset	-0.009**	-0.008*
	(-2.09)	(-1.89)
Size	0.014***	0.014***
	(7.54)	(7.63)
Age	-0.003***	-0.003***
	(-6.28)	(-6.47)
KL	0.003	0.002
	(0.47)	(0.26)
IndusCon	0.002	0.002
	(0.51)	(0.47)
Subsidy	0.082	0.082
	(1.35)	(1.38)
Export	0.005***	0.005***
	(6.62)	(6.64)
State	0.017***	0.017***
	(3.32)	(3.38)
Collect	-0.006***	-0.006***
	(-2.73)	(-2.84)
Private	-0.005***	-0.005***
	(-2.76)	(-2.72)
Foreign	-0.012***	-0.012***
	(-4.27)	(-4.39)
HMT	-0.016***	-0.016***
	(-6.00)	(-6.11)
GDPgrt	-0.004	-0.004
	(-1.01)	(-0.99)
GDPper	0.003	0.003
	(1.31)	(1.12)
cons	-0.146***	-0.146***
	(-5.20)	(-5.19)
Observations	735506	735506
R-squared	0.080	0.118
YearFE	YES	YES
IndustryFE	YES	YES
RegionFE	YES	YES

*, **, or *** indicates that the coefficient is statistically significantly different from zero at the 0.10, 0.05, or 0.01 level using a two-tailed t-test, respectively.

3.3 Can bank competition alleviate the financing constraints during enterprise innovation?

An important issue of concern in this paper is whether bank competition can promote enterprise innovation by easing the financing constraints of enterprises. In this regard, this paper uses indicators such as the profitability of enterprises and the financing level of commercial credit to construct the financing constraint level of enterprises, so as to reflect the dependence of enterprises on external credit financing. The indicator construction is shown in table 4 below:

Table 4: Definitions for financing constraints

ROA	**Total profit of main business / total assets**
AccNet	(accounts payable - accounts receivable) / total assets
FinConst	Grouped according to the company's internal and commercial credit financing: Define FinConst=0. If ROA>0 and AccNet>0, it means that the enterprise has strong endogenous financing and commercial financing capabilities, light financing constraints, and low dependence on bank credit; Define FinConst=1. If ROA<0 or AccNet<0, it means that the enterprise has more serious financing constraints and is relatively more dependent on bank credit

Table 5 shows that the coefficient before *HHI*×*FinConst* is significantly less than 0. Compared with enterprises with less financing constraints, bank competition can significantly promote the innovation of enterprises with more financing constraints and more dependence on bank credit funds.

Table 5: Bank competition, financing constraints and enterprise innovation

	$\mathbf{NewProdt}_{t+1}$
HHI	-0.016***
	(-2.89)
FinConst	0.003**
	(2.52)
HHI*FinConst	-0.009**
	(-2.24)
ROA	0.017***
	(5.84)
FAasset	-0.009**
	(-2.07)
Size	0.014***
	(7.56)
Age	-0.003***
	(-6.30)
KL	0.003
	(0.43)
IndusCon	0.002
	(0.52)
Subsidy	0.080
	(1.32)
Export	0.005***
	(6.61)
State	0.017***
	(3.32)
Collect	-0.006***
	(-2.74)
Private	-0.005***
	(-2.75)
Foreign	-0.012***
	(-4.28)
HMT	-0.016***
	(-6.00)
GDPgrt	-0.004
	(-1.00)
GDPper	0.003
	(1.32)
cons	-0.148***
	(-5.26)
YearFE	YES
IndustryFE	YES
RegionFE	YES
N	735506
adj. R^2	0.079

*, **, or *** indicates that the coefficient is statistically significantly different from zero at the 0.10, 0.05, or 0.01 level using a two-tailed t-test, respectively.

3.4 Analysis of credit discrimination

In a state-owned bank-dominated financial system, bank credit has the phenomena of "ownership discrimination" and "scale discrimination" against private enterprises and small enterprises. Will the market-oriented reform of China's banking system help to improve the financing environment of small enterprises and private enterprises? We further divide enterprises into two groups: "private enterprises" and "state-owned enterprises", "small enterprises" and "large and medium-sized" enterprises.

Table 6: Regression results of bank competition and credit discrimination

	(1)	(2)	(3)	(4)
	Private	**State-owned**	**Small**	**Large & Medium**
HHI	-0.021***	0.003	-0.012***	-0.038***
	(-5.89)	(0.26)	(-3.67)	(-3.13)
HHI×FinConst	-0.007**	0.021*	-0.017***	0.037**
	(-2.39)	(1.69)	(-3.87)	(2.40)
Controls	YES	YES	YES	YES
Observations	512967	34943	653216	82290
R-squared	0.076	0.188	0.064	0.157
YearFE	YES	YES	YES	YES
IndustryFE	YES	YES	YES	YES
RegionFE	YES	YES	YES	YES

*, **, or *** indicates that the coefficient is statistically significantly different from zero at the 0.10, 0.05, or 0.01 level using a two-tailed t-test, respectively. Results of control variables are not detailed due to space constraints.

In Table 6, it can be seen that the regression coefficients before *HHI×FinConst* are significantly less than 0 both in "private enterprises" and "small enterprises", indicating that the entry of joint-stock banks and urban commercial banks can more significantly promote the innovation and development of private enterprises and small enterprises by bank competition.

3.5 How dynamic bank establishment and withdrawal affect enterprise innovation?

In the banking system dominated by state-owned banks, the banking system will hold a more conservative credit attitude towards enterprise innovation, which is manifested in its preference for low innovation enterprises (Wang and Pan, 2015). Cai and Dong (2017) believe that with the emergence of banks with different property rights and sizes, enterprises have more opportunities to obtain bank credit support, and the cost of credit capital has decreased, which is conducive to

promoting enterprise innovation.

The existing literature believes that due to the "ownership discrimination" and "scale discrimination" against private enterprises and small and medium-sized enterprises in China's "big banking system" and financial repression and other financial environments, private enterprises and small and medium-sized enterprises are faced with more stringent financing thresholds and higher financing costs, which makes private enterprises and small and medium-sized enterprises face more serious external financing constraints, And then hinder its growth and innovation. According to the optimal financial structure theory proposed by Lin and Jiang (2006), the development of small and medium-sized banks can better meet the financing needs of small and medium-sized enterprises.

Table 7: Regression results of bank competition and credit discrimination

	(1)	(2)	(3)	(4)	(5)
	Full sample	**Private**	**State-owned**	**Small**	**Large & Medium**
HHI	-0.006*	-0.008**	0.025***	-0.007***	-0.013
	(-1.67)	(-2.58)	(3.93)	(-2.73)	(-1.22)
HHI×BankEntr	-0.054***	-0.058***	-0.043	-0.056***	-0.008
	(-6.93)	(-9.63)	(-1.33)	(-10.63)	(-0.36)
Controls	YES	YES	YES	YES	YES
Observations	735506	512967	34943	653216	82290
R-squared	0.080	0.076	0.188	0.064	0.156
YearFE	YES	YES	YES	YES	YES
IndustryFE	YES	YES	YES	YES	YES
RegionFE	YES	YES	YES	YES	YES

*, **, or *** indicates that the coefficient is statistically significantly different from zero at the 0.10, 0.05, or 0.01 level using a two-tailed t-test, respectively. Results of control variables are not detailed due to space constraints.

In the benchmark regression, we introduce the cross term of bank static competition HHI index and bank structure dynamic change index *BankEntr* to discuss the impact of bank branches establishment and withdrawing on enterprise innovation behavior. In Table 7, column (1) shows that the regression coefficient before *HHI×BankEntr* is significantly less than 0, indicating that the establishment of joint-stock commercial banks and urban commercial banks can further strengthen the promotion effect of bank competition on enterprise innovation output. In Table 7, column (2)–(5) show that the regression coefficients before *HHI×BankEntr* are significantly less than 0 both in "private enterprises" and "small enterprises", indicating that the entry of joint-stock banks and urban commercial banks can more significantly promote the innovation and development of private enterprises and small enterprises by bank competition.

4. Conclusions

Bank competition can improve enterprise innovation by alleviating enterprise financing constraints. It still exists in the samples of private enterprises and small industrial enterprises, but it has not been verified in state-owned enterprises and large and medium-sized industrial enterprises. Encouraging the development of non-state-owned banks can also further improve the role of bank competition in promoting enterprise innovation.

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