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Financial development and patterns of industrial specialization: Regional evidence from China

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Abstract

The paper investigates the influences of financial development on patterns of industrial specialization across China's regions. We find that industrial sectors reliant on access to external finance are found to concentrate in regions with developed financial markets. Both foreign direct investment (FDI) and informal financing channels are shown to play significant roles in shaping patterns of industrial specialization in China. In contrast, proxies for formal financial markets, e.g. the banking system and capital markets have few effects on regional industrial agglomeration. The role of financial development remains robust to instrumental variable estimation and controlling for other traditional determinants of regional specialization.

Qing He, corresponding author. School of Finance & China Financial Policy Research Center, Renmin University of China. Beijing, China. Phone: +86 10 82500500, fax: +86 10 82509260, email: qinghe@ruc.edu.cn.

Chang Xue, School of Finance & China Financial Policy Research Center, Renmin University of China

Chenqi Zhu, Department of Economics, The Chinese University of Hong Kong

1   Introduction

The benefits of industrial specialization are well understood. Since Adam Smith, numerous theories and empirical analyses have been advanced to explain the international and regional agglomeration of economic activities.[1] While under-specialization is now seen as a salient feature of emerging market countries (Lu and Tao, 2009), most of the literature still focuses on factors that lead to spatial concentration of industrial production in the developed economy context.

Recent studies suggest several factors may influence the limited industrial agglomeration seen in emerging economies. Bai et al (2004) find that government invention and local protectionism create trade barriers tend to reduce the extent of specialization. Levchenko (2007) shows that legal and property rights may help determine a region or country's productivity and comparative advantage. Weak legal and property rights in emerging countries also remove some of the incentives that spur trade and specialization. Using firm level data, Lu and Tao (2009) find that local protectionism obstructs the process of regional concentration of manufacturing industries.

The pioneering work of Rajan and Zingales (1998) establishes that the presence of a well-developed financial market has a positive effect on industries or firms heavily dependent on external finance. This view is backed by subsequent research (Cetorelli and Gambera, 2001; Beck, 2002, 2003; Svaleryd and Vlachos, 2005) that finds financial market development can influence patterns of production, trade, and even international competitiveness for industries reliant on access to external finance. Notably, financial development as a determinant of industrial specialization in the context of emerging economies has yet to garner much attention. Not only is access to finance a challenge in most emerging market countries but also weak legal systems and local protectionism tend to make financial resources largely immobile across regions. Drawing on empirical evidence that suggests a developed financial sector can be a source of comparative advantage and determinant of specialization, we ask how this might apply in the Chinese context.

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[1] Marshall (1920) suggests that external economies could lead to regional specification of industries. Ohlin (1933) emphasizes the importance of resource endowments across countries or regions on geographic concentration of production. Krugman (1991, 1995) shows industries with increasing returns to scale are more likely to have production clustered in a few places.

Using a panel data of 30 China's regions over the period of 1998 to 2010,[2] we empirically examine how financial development might affect concentration of regional economic activities. China is an appropriate case for investigation for at least four reasons. First, the features of the Chinese economy are typical for many emerging economies. Understanding China therefore helps in understanding of the role of financial development in industrial specialization in emerging markets more generally. For example, as in most emerging economies, the extent of regional specialization in China is much lower than in developed economies. Second, China offers unique perspectives not available in countries with mature financial markets and highly efficient allocation of financial resources. As in many emerging market countries, China's regulators are still struggling to get basic supervisory measures in place amidst a weak legal system with poor property protections. Partly because China's formal financial markets are underdeveloped and inefficient, alternative financing channels such as trade credit and informal financing arrangements are huge contributors to growth (Allen et al., 2005). Thus, the relationship between informal finance and specialization provides an intriguing, potentially valuable, area to explore. Third, financial development across China's regions differs substantially. Over the past three decades, Chinese economic development and financial markets have witnessed widening regional disparities (Chan et al., 2011). Studying such disparity may help us better grasp the relationship between uneven regional financial development and patterns of industrial specialization. Finally, unlike in most industrialized nations, foreign direct investment (FDI) remains a focal point of policy in emerging economies. Thus, the role of FDI in Chinese industrial specialization deserves consideration as well.

We start our analysis by measuring the demand for external financing in specific industries. We next consider a wide array of financial indicators to assess the size and quality of financial sectors to be able to compare the relative importance of various financial markets for specialization. In line with Rajan and Zingales (1998), we find that financial dependence of industries varies substantially across Chinese provinces and municipalities. Industries reliant on access to external finance develop disproportionately faster in regions with more developed financial markets. On the other hand, the formal financial sector

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[2] Mainland China consists of 27 provinces and four municipalities directly under the central government. To maintain data consistency, we exclude Tibet. Our final sample thus includes 30 administrative regions: Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Heilongjiang, Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong, Henan, Hubei, Hunan, Guangdong, Guangxi, Hainan, Chongqing, Sichuan, Guizhou, Yunnan, Shaanxi, Gansu, Ningxia, and Xinjiang.

seems to play a relatively minor role in shaping patterns of industrial specialization. Indeed, we find a negative relationship between the banking sector and level of industrial specialization. The development of the capital market also only plays a modest role in the industrial specialization. In contrast, informal financing channels such as trade credit and self-raised funds are important drivers of geographic concentration of manufacturing industries. We also find that FDI is important for specialization and comparative advantage, and that a robust legal and institutional environment can amplify the effect of informal financing channels that leads to geographic concentration of industries.

To address the potential endogeneity problems, we employ distinct and separable instrumental variables for informal finance and FDI. Specifically, we use private non-enterprise entities as an instrument for informal financing channels. For FDI, we use the ratio of foreign marriages to total marriages. We also control for other traditional determinants of regional specialization, as well as fixed effects for industry, year, and region. Our results regarding the positive role of informal financing and FDI on specialization remain essentially unchanged.

This study augments the extensive literature on determinants of industrial specialization. Numerous studies have examined the effects of resource endowments, externality, knowledge spillover, and other factors on specialization (Audretsch and Feldman, 1996; Kim, 1999; Rosenthal, 2001).[3] The contribution here comes from focusing on the impacts of financial markets on patterns of industrial specialization an emerging economy setting. The study also contributes to the growing literature on the effects of informal financing channels. Allen et al. (2005) suggest that informal financing channels are crucial in determining economic outcomes, especially in countries with weak legal systems and poor property right protections. However, few studies provide direct evidence on the role of informal financial channels on economic performance. Through investigating the effects of informal financing channels on specialization, this paper bolsters the argument that a well-functioning informal financing system can encourage industries heavily reliant on access to finance to specialize production, and that this, in turn, results in efficiency gains for the overall economy.

The rest of the paper proceeds as follows. We present theories of regional industrial specialization and set forth several hypotheses based on them in Section 2. In Section

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[3] Duranton and Puga (2004) provide a review of theoretical and empirical studies on industrial agglomeration.

3, we describe our data set, research design, and summary statistics for key variables. In Section 4, we investigate the determinant of China's regional industrial specialization with a focus on the impact of financial development. Robust analysis is provided in Section 5. Section 6 concludes.

2   Theories and hypotheses

Studies related to industrial specialization originate with the resource endowment theory of international specialization (Ohlin, 1933), whereby regions differ in their natural and human resource endowments. Differences in comparative advantage of regional production arise such that each region can specialize production as long as trade across regions is possible. Implicitly, a factor's immobility across regions is required for it to be a source of comparative advantage.

If a financial market is fully integrated, capital obviously cannot be a source of comparative advantage as capital mobility has equalized asset return across regions (Wood, 1994). However, persisting information asymmetries and conflicts between creditors and debtors assure financial markets remain far from perfect. Indeed, there is considerable anecdotal evidence to suggest financial services are surprisingly immobile geographically. It is even often difficult in many emerging market countries even to trade across domestic regions (Jayaratne and Strahan, 1996). Pagono et al. (2001) note that geography is an important aspect of financing for local firms. Compared with developed countries, markets remain highly segmented in most emerging economies, and China is no exception (Allen et al., 2005). Numerous restrictions and local protections discourage interregional movement of capital in China (Young, 2000; Lai et al., 2013).[4] Markets are poorly integrated and the level of financial development needed for local growth opportunities and consumption risk-sharing is lacking (Du et al., 2011). Financial intermediaries are in a position to evaluate projects, as well as monitor and disseminate information, making them uniquely capable of mitigating the negative effects of financial market friction. Moreover, a well-functioning financial market should in theory provide firms easy access to lower-cost financial resources (Rajan and Zingales, 1998; Cetorelli and Gambera, 2001; Beck, 2002, 2003; Levchenko, 2007). As industries differ in their financing needs (Rajan and Zingales,

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[4] Lai et al. (2013) show that, despite a slight improvement in capital market integration in China, segregation among regions remains considerable.

1998), the development of robust local financial market could be a source of comparative advantage that attracts to the region industries that must rely heavily on financing to specialize production. This gives us our basic hypothesis:

> **Hypothesis 1**: *Industries that rely heavily on external finance are more likely to concentrate geographically in regions with well-developed financial systems.*

Similar to most emerging market countries, China has a formal and an informal financial sector. Banks dominate the formal financial sector in China. Measures of Allen et al (2005) indicate the bank credit ratio to GDP in China is 1.11, which is much higher than any other country in the world (the global weighted average is 0.73). However, this banking system is malfunctioning. Most formal credit is issued by China's state-owned banks to state-owned enterprises (SOEs)[5], while small and median sized enterprises (SMEs) are difficult to obtain bank credits. Executives at state-owned banks are appointed by the central government, rather than selected by a corporate board or shareholders. The government strictly regulates bank operations, using them to control the economy (Pistor, 2009). The Chinese government's dual role as a regulator and as majority stakeholder diminishes its effectiveness in running state-owned banks and supervising the sector (Allen et al., 2012). On the other hand, the government can use state-owned banks to pursue its social agenda, i.e. social stability and high employment, rather than seek profit maximization or enhanced efficiency. This social aspect may add to further market distortions to the fund allocation through formal banking system. It lowers the possibility of industries dependent on access to external finance that might otherwise specialize their production from concentrating in a specific geographic location. As a corollary of our basic hypothesis, we obtain:

> **Hypothesis 1a**: *Industries dependent on external financing sources are less likely to concentrate in regions with large formal banking sectors.*

Although corporate bonds were first issued in China in 1986, the bond market remained in a fairly primitive state for decades. At the end of 2012, the market value of newly issued

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[5] The first major effort at banking reform was initiated in the mid-1990s, when the central government decided to set up a market-oriented banking system. The reform has allowed private banking services and financial liberalization to gain a foothold in recent years. However, state-owned banks still account for over 50% of total assets held by the banking sector in 2013

bonds in China amounted to just 1.74% of GDP. Of the overall number of bonds in China, the percentage of corporate bonds was only 11.19%.

The newly established Shanghai Stock Exchange and Shenzhen Stock Exchange have enjoyed a rapid expansion since their inception in 1990. Measured by total market capitalization, both stock exchanges ranked among the top 10 globally at the end of 2011. Still, compared to the Chinese banking sector, these exchanges are relatively small.[6] The securitization rate (ratio of total market capitalization to GDP) in China was 51.5% in 2011, much lower than that in the US. Despite rapid growth, the two stock exchanges suffer major malfunctions from time to time. Insider trading and wild speculation are pervasive. The turnover volumes on the Shanghai and Shenzhen stock exchanges in 2011 were 178.5% and 344.3%, respectively. This is considerably higher than that in most mature financial markets, indicating large amounts of purely speculative trading (Allen et al, 2012). Securities markets are basically inefficient; their prices are not driven by the fundamental value of corporations (Morck et al., 2000).

The establishment of the two stock exchanges was initially intended as part of reforms in the state-enterprise sector. The exchanges were supposed to provide a new source of funding to SOEs and reduce the financial burden on the government to bail out SOEs in financial distress. Up to 2005, 80% of listed enterprises in China, more than 1,100, were former SOEs. Despite state dominance, most shares held by the government or state-owned legal entities are non-tradable, i.e. treasury stock that cannot be put back in circulation.[7] The government plays dual roles of regulator and holders in the stock market, weakening the effectiveness of the market as to resource allocation and risk diversification. This brings us to our second corollary hypothesis:

Hypothesis 1b: *The development of capital markets only modestly shapes patterns of industrial specialization.*

With the banking sector and capital markets primarily serving the funding needs of SOEs, the private-sector and non-state-sector entities find it difficult to access financing from the formal financial sector (Allen et al., 2012; He et al., 2013). However, growth of private

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[6] At the end of 2010, the market capitalization of Chinese stock markets was RMB 62.5 trillion. Total assets of the banking sector exceeded RMB 110 trillion.

7 On the eve of the completion of the tradable shares reform in 2009, non-tradable shares still constituted 53% of all shares in A- and B-share markets (Allen et al, 2012).

sector is much higher than in the state sector, and the largest contributor to China's overall economic growth. Allen et al. (2005) suggest that the most successful part of the financial system is a sector of alternative financing channels such as trade credit and money from friends or family members, rather than the banking sector or capital markets. These alternative or informal financing channels, which are built upon reputation in the community and long-term relationships, have supported the rapid expansion of the non-state sector and provided much of the economy's growth. A well-functioning informal financing system, in turn, can overcome problems of asymmetric information and lack of contractual relations. It is a good substitute for standard financing channels. As informal finance is mainly locally based due to its relationship-based nature, it is reasonable to expect regions with well-functioning informal financial systems to have a comparative advantage in attracting industries that depend on access to financing and have the potential to specialize their production. This gives our third corollary hypothesis:

> **Hypothesis 1c:** *Geographic concentration of industries that depend on access to external finance is high in regions with well-functioning informal financial systems.*

FDI, which is central to financial globalization, could potentially affect the pattern of industry specialization within a country. FDI can be seen as a form of equity financing that alleviates financial constraints (Harrison et al. 2004). Foreign investors are also often more experienced and more likely to be market-oriented in their investment decisions. They are less likely to be influenced by local political and government factors. Hence, FDI may serve as a tool to mitigate the negative effects of market distortions, and allow industries that rely heavily on external financing to concentrate in a certain area and specialize production. Applying the same logic to Chinese regions, we expect that FDI inflows can relieve the capital shortages in industries highly dependent on external financing and thus benefit industrial specialization. With the "open door" policy since 1978, China has become one of the world's top FDI recipients (Prasad and Wei, 2007). Such investment is expected to facilitate the process of regional industrial specialization. Therefore, we make our fourth corollary hypothesis:

Hypothesis 1d: *Industries that are heavily reliant on external financing are more likely to locate in regions with large FDI stocks.*

Financial sectors alone cannot mitigate the negative effects of market distortions. La Porta et al. (2000) find that robust legal and institutional environments lead to better outcomes for the financial systems. They can effectively protect the investor and creditor rights, and therefore increase the effectiveness of the governance mechanism. Healthy institutional environments can also strengthen the governance mechanisms based on reputation and relation. First, good institutional environments encourage citizens to participate in business and other economic activities. Second, less government intervention allows greater competition in markets for products and inputs (Acemoglu and Johnson, 2005). The reputation effect matters most when the firm seeks to raise funds and contract with business partners. It leads to a more effective governance mechanism based on reputation and relationships. We summarize this with our second basic hypothesis .

Hypothesis 2: *The positive effect of financial systems on industrial specialization is larger in regions with more robust legal and institutional environments.*

3 Research design and variable construction

3.1 Research design

To see how financial development affects industrial specialization, consider industrial production that requires external financing. A well-functioning financial system can alleviate external costs of financing and reduce the information asymmetry between creditors and debtors. This cost advantage increases the greater the need for external financing in production of the final good. It follows that regions with better financial systems have a comparative advantage in the industrial production relies extensively on external financing. We test our hypothesis by estimating the following equation:

$$Int_{ik} = \alpha_i + \alpha_k + \beta_0 FIN_i \times fdp_k + \beta_1 Z_i \cdot v_k + \varepsilon_{ik} \,, \tag{1}$$

$$Int_{ik} = \frac{Output_{ik}/Output_i}{Output_k/Output_{total}} \qquad (2)$$

$Output_{ik}$ is the gross industrial production of industry i of province k. $Output_i$ is the national gross industrial production of industry i. $Output_k$ is the province k's total gross industrial production of all industries. $Output_{total}$ is the national gross industrial production of all industries. If *Int* is larger than one, then province k has a higher proportion of industry i than proportion of total industrial output to national total output. Similarly, if *Int* is less than 1, then province k has a lower proportion of industry i than total industrial output.

3.2.2 Financial dependence and financial development

As the actual use of external financing at the industry level is typically unavailable, Rajan and Zingales (1998) investigate the external financing needs of US-listed firms and use the industry median as the measure of industrial financial dependence. *China Statistical Yearbook* provides the data of financial conditions of each industry. Following Rajan and Zingales (1998), we estimate financial dependence of an industry as:

$$FIN_i = \frac{Capital\_Exp_i - Cash\_Flow_i}{Capital\_Exp_i} \qquad (3)$$

$Capital\_Exp_i$ denotes the capital expenditure in industry i, and $Cash\_Flow_i$ is the measure of operational cash flow. To smooth fluctuations, we use the average value from 1998 to 2010 as the measure of industrial financial dependence. However, industry's financial dependence may be correlated with the development of financial markets. Rajan and Zingales (1998) suggest that large listed firms in the US face the least restrictions in accessing finance, so external financing demand for these firms is more likely to be a pure measure of external financial dependence. We therefore conduct a robust analysis using the industry's financial dependence based on US-listed firms as a proxy for China's industries.

To evaluate impacts of financial sectors on industrial specialization, five indicators are used in our analysis. We use three indicators to proxy the activities of standard financial sectors. *Loan* is the ratio of total banking institution loans to regional GDP. This measures the overall size of the banking sector. For the capital market, the direct measure of capital market activity is the amount of funds actually raised through the stock market

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and bond market. Following Du et al. (2011), we estimate the ratio of new equity issues and non-financial corporate bonds (long-term and short-term) to GDP in each region, as an indicator of the size of capital market (*Issuance*). Rajan and Zingales (1998) suggest that mature firms are less likely to raise money, so stock market capitalization may also be a good measure of financing availability. Thus, we use the ratio of the stock market capitalization of listed firms registered in each province to the GDP of that province (*Capitalization*), which captures the depth of its capital markets, as an alternative indicator of capital market size. Corporate bond data are drawn from the annual issues of the *Almanac of China's Finance and Banking* (ACFB) and CSMAR Database. Equity issuance and market capitalization data are collected and summarized from annual issues of the *Statistics Yearbook of Shanghai Stock Exchange*, the *Statistics Yearbook of Shenzhen Stock Exchange*, and the CSMAR Database.

As noted, informal financing channels and FDI are also important for the growth of Chinese economy. Allen et al. (2005) suggest that most self-raised funds or other financial resource are raised from alternative financing channels. Following Guariglia and Poncet (2008), we use the ratio of funds that are self-raised or raised by other non-specified channels to total fixed investment as a measure of informal finance (*Informal*). As China is among the world's top FDI recipients, FDI can act as an important source of equity financing. We use the ratio of FDI stock to GDP to measure the effect of foreign direct investment. The data are drawn from *China Statistical Yearbook*.

3.2.3   Institutional variables and other endowments

Regional disparities in economic institutions and governance quality profoundly affect the level of socioeconomic development and the progress of marketization in different provinces. Two direct measures of regional institutional environments are used to test whether regional institutions exert an influence on the relationship between industrial specialization and financial development. *Marketization,* proposed by Fan et al. (2011), is a comprehensive index measuring the overall quality of regional institutions. A larger value is associated with a more robust institutional environment. *Intervention* is an index measuring the extent of intervention of local government, defined by the proportion of fixed investment coming from state sector over total fixed investment. A smaller value is associated with less government intervention.

The next set of variables is related to other input endowments. Following the literature, other endowments include physical capital, human capital, and natural resources. To measure the input requirements of physical capital, we use the physical capital per worker as a proxy for the capital endowment of each region (*stcap*). The physical capital intensities of production are calculated as capital formation to value-added in each industry (*CAP*). The data of industrial dependence on physical capital stock are drawn from *China Statistical Yearbook* and *China Industry Economy Statistical Yearbook*. The provincial physical capital is drawn from Li (2003) and updated using the standard perpetual inventory approach. The percentage of population with a secondary school education or higher to total population is used as a proxy for the regional human capital endowments (*sthc*). Human capital intensities are calculated as the average ratio of workers with secondary school educations or higher to the overall employments in each industry (*SKL*). We obtain the data from *China Statistical Yearbook* and *China Economic Census Yearbook*. To capture the effects of natural resources endowments, the stock of agricultural (*stagr*) and mineral (*stmine*) resources per worker is are also employed. The intensities of the former are measured as the ratio of agricultural inputs to intermediate inputs in each industry. The latter is calculated using the ratio of mineral inputs to intermediate inputs in each industry. Detailed definitions of variables and data resources are reported in Appendix 1.

3.2.4   Summary statistics

Table 1 reports the external financing dependence of industries in China from 1998 through 2010. We see large variations in the external financing dependence across manufacturing industries, ranging from -4.926 (Tobacco processing) to 1.15 (Chemical fibers). Consistent with the evidence of Rajan and Zingales (1998), the industry of tobacco processing (industry code 16) is least dependent on external finance, followed by metal products (industry code 34) and Processing of petroleum, Coking and nuclear fuel (industry code 25). Chemical fibers (industry code 28), which is highly competitive, uses the most external finance. Interestingly, we find that most measures of financial dependence are negative, consistent with the evidence that firms are difficult to raise external finance in China (Allen, et al., 2005)

Table 2 reports the summary statistics of financial development and other control variables.

Table 1   Financial dependence by industry in China

Industry code	Industry name	*FIN*	Industry code	Industry name	*FIN*
13	Food Processing	−0.806	27	Medical & Pharmaceutical Products	−0.526
14	Food Production	−0.930	28	Chemical Fibers	1.150
15	Beverage Production	−1.768	29	Rubber Products	−0.358
16	Tobacco Processing	−4.926	30	Plastic Products	−0.634
17	Textile Industry	−0.515	31	Nonmetal Mineral Products	−0.320
18	Garments & Other Fiber Products	−0.932	32	Smelting & Pressing of Ferrous Metals	−0.600
19	Leather, Furs, Down & Related Products	−1.218	33	Smelting & Pressing of Non-ferrous Metals	−0.362
20	Timber Processing, Bamboo, Cane, Palm Fiber & Straw Products	−0.465	34	Metal Products	−4.118
21	Furniture Manufacturing	−0.189	35	Machinery & Equipment Manufacturing	−0.789
22	Papermaking & Paper Products	−0.263	36	Special Equipment Manufacturing	−0.985
23	Printing & Record Pressing	−1.057	37	Transportation Equipment Manufacturing	−0.535
24	Stationery, Educational & Sports Goods	−0.518	39	Electric Equipment & Machinery	−1.114
25	Petroleum Processing, Coking Products, & Gas Production & Supply	−2.656	40	Electronic & Telecommunications	−0.332
26	Raw Chemical Materials & Chemical Products	−0.446	41	Instruments, Meters, Cultural & Official Machinery	−0.841

This table reports industry averages of financial dependence for 28 manufacturing industries in China from 1998 through 2010. Industrial classifications are obtained from *Industrial Classification for National Economic Activities* (GB/T4754-2002). The external financial dependence is measured as capital expenditures, minus operational cash flow, divided by capital expenditure (*FIN*).

Table 2   Summary statistics for financial development and control variables

Variable	Obs.	Mean	Median	Std. Dev.	Min.	Max.
Loan	390	1.0378	0.9999	0.2991	0.5454	2.2522
Capitalization	390	0.4624	0.2494	1.0673	0.0583	16.4842
Issuance	390	0.0093	0.0035	0.0219	0.0000	0.3042
Informal	385	0.7279	0.7213	0.1263	0.3934	1.1888
FDI	390	0.0273	0.0181	0.0246	0.0007	0.1343
Stcap	390	1.7258	1.7773	1.2778	0.0984	12.8875
Sthc	390	0.1980	0.1823	0.0881	0.0614	0.5496
Stagr	390	0.2944	0.2531	0.1505	0.0921	0.9456
Stmine	390	0.1495	0.0631	0.2262	0.0000	1.6418

This table reports the descriptive statistics of key explanatory variables. The definitions and data sources of all variables are presented in Appendix 1.

Before turning to our regression analysis, we check to see whether financial development affects regional comparative advantage. Here, we ask whether regions with more developed financial markets have a heavier average demand for financing from industrial producers. The average industrial financial dependence of region k is calculated as $\overline{FIN_{kt}} = \sum_i \omega_{ikt} \cdot FIN_i$, where ω_{ikt} is the weight of the output of industry i of province k in year t, and Fin_i is the financial dependence of industry i.

The estimation results are reported in Table 3. Column 1-5 report the estimated relationship between average industrial financial dependence and each financial indicator. All coefficients are positive and have the expected signs. Only the variables for FDI and informal financing channels have a statistically significant difference from zero. We include all financial indicators in our specifications in Column 6-8. The primary results remain unchanged. It implies that regions with better financial developments tend to specialize in goods for which external finance is most important. Both FDI and informal financing significantly affect the ability of a region to attract industries that rely heavily on external financing.

Table 3　　　　Financial dependence and financial development

	(1)	(2)	(3)	(5)	(4)	(6)	(7)	(8)
Loan	0.0275					−0.00684	0.0216	0.00710
	(0.0302)					(0.0380)	(0.0366)	(0.0402)
Capitalization		0.00796				0.0101		
		(0.00521)				(0.00690)		
Issuance			0.285					−0.142
			(0.311)					(0.504)
Informal				0.289*			0.445***	0.426**
				(0.174)			(0.182)	(0.187)
FDI					2.451***	2.482***	2.901***	2.931***
					(0.546)	(0.550)	(0.541)	(0.542)
Constant	−1.061***	−0.992***	−0.990***	−1.295***	−1.121***	−1.116***	−1.474***	−1.448***
	(0.0770)	(0.0159)	(0.0159)	(0.0861)	(0.0796)	(0.0873)	(0.142)	(0.149)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	390	390	390	385	390	390	385	385
R-squared	0.071	0.071	0.083	0.083	0.092	0.093	0.114	0.113

This table reports the relation between average industrial financial dependence and each financial indicator. The dependent variable is the average industrial financial dependence of each province, weighted by industry output. Each column reports the correlation between financial dependence and the specific financial sector. Robust standard errors clustered at the industry-province level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively. The definitions and data sources of all variables are presented in Appendix 1.

4   Regression analysis

We now examine how different financial sectors can shape patterns of industrial speciali-zation across regions. Table 6 shows our results from estimation of Equation 1. Four out of the six interactions between financial dependence and financial development have a posi-tive effect on industrial specialization. This implies that regions with relatively stronger financial markets can better serve industries heavily reliant on external finance in specializ-ing their production.

Column 1-6 reports the effects of specific financial indicator on the pattern of in-dustrial specialization. All coefficients have the expected signs. The development of bank-ing sector (*Loan*), is of importance, but has a significantly negative effect on specialization. This result implies that industries reliant on access to external finance find it more difficult to access credit in a region with a relatively large formal banking sector. As the banking sector is highly regulated and directly controlled by government, most credit flows to inef-ficient SOEs or serves other government purposes. Forming a firm-creditor relationship may even be damaging to a firm's prospects; it can distort the firm's incentives to invest. Consistent with Lu and Tao (2009), our results imply that government regulation of credit markets is detrimental to industrial specialization among China's regions.

The coefficients on both capital market indicators (*Capitalization*, *Issuance*) are not significantly different from zero, implying that capital markets are not important sources of comparative advantage for industries heavily reliant on access to external fi-nancing. Given the inefficiency of resource allocation through capital markets, it is not surprising that both bond markets and stock markets have few effects on the specialization pattern.

Our informal finance index (*Informal*), which proxies for the development of al-ternative financing channels, is important both statistically and economically. Consistent with Allen et al. (2005), informal financing channels may substitute for standard financing channels and allocate financial resources efficiently. As a result, industries that depend heavily on access to external financing tend to concentrate geographically in regions with robust informal financial systems.

FDI, an indicator of oversea assets available to a regional economy, is also an im-portant determinant of patterns of industrial specialization. The coefficient of the interac-tion between FDI and financial dependence is statistically significant at the 1 percent level.

As foreign investors are profit-oriented, their financial resources are more likely to allocate to industries or firms that could create most benefits. Meanwhile, FDI is less influenced than standard financial systems by local government. This facilitates effective resource allocation and leads to a positive effect on the generation of external financing.

To determine the relative importance of specific financial development for industrial specialization, we include different interactions between financial dependence and financial development in Column 6-9. As *Capitalization* and *Issuance* is highly correlated, we include the two indicators separately in our specifications. The results indicate that bank systems still have a negative effect on the specialization. Capital market indicators are positive and significant in several specifications, implying that the capital market may play a modest role in attracting industries heavily reliant on access to external financing. Both FDI and informal financing channels are important, and dominate other indicators in all specifications. The implication here is that FDI and informal financing channels, rather than the formal financial system, are the most important determinants of regional specialization patterns in China.

Turning to other endowments, most interaction variables are positive as expected. Notably, the interaction of human capital (*SKL×sthc*) is significantly negatively correlated with the patterns of industrial specialization. Given the large scale of labor migration across provinces since the mid-1990s, it is hardly surprising that human capital is not crucial to patterns of regional production.[9]

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[9] Deng Xiaoping's tour of South China in 1992 launched a new round of industrialization and urbanization. Since then, an increasing number of migrant workers have flowed from rural areas into China's large cities, particularly those in coastal areas. The National Census reports that there were more than 200 million migrant laborers in 2006.

Table 4   Financial development and industrial specialization

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Loan×FIN	−0.104**					−0.167***	−0.143**	−0.170***	−0.144***
	(0.0500)					(0.0588)	(0.0557)	(0.0573)	(0.0546)
Capitalization×FIN		0.00450				0.0186***	0.00289		
		(0.00548)				(0.00722)	(0.00749)		
Issuance×FIN			0.0855					0.959**	0.172
			(0.412)					(0.433)	(0.524)
Informal×FIN				0.463***			0.453***		0.451***
				(0.152)			(0.154)		(0.160)
FDI×FIN					3.674***	3.874***	3.900***	3.897***	3.905***
					(0.589)	(0.623)	(0.626)	(0.626)	(0.626)
stcap×CAP	−0.0101	−0.0131	−0.0126	−0.0204**	−0.0139*	−0.0136	−0.0192**	−0.0141	−0.0193**
	(0.00908)	(0.00873)	(0.00888)	(0.00799)	(0.00833)	(0.00858)	(0.00806)	(0.00860)	(0.00804)
sthc×SKL	−2.107***	−1.435**	−1.490**	−0.950*	−1.137**	−1.661**	−1.293*	−1.645**	−1.286*
	(0.780)	(0.636)	(0.666)	(0.566)	(0.562)	(0.704)	(0.665)	(0.720)	(0.673)
stmine×MINE	3.181***	3.092***	3.092***	3.205***	3.103***	3.249***	3.332***	3.254***	3.332***
	(0.553)	(0.548)	(0.548)	(0.549)	(0.522)	(0.529)	(0.530)	(0.530)	(0.530)
stagr×AGR	3.180***	2.946***	2.955***	3.181***	3.104***	3.417***	3.626***	3.438***	3.629***
	(0.481)	(0.470)	(0.469)	(0.468)	(0.458)	(0.471)	(0.476)	(0.472)	(0.476)
Constant	0.538***	0.630***	0.632***	0.819***	0.692***	0.533***	0.746***	0.527***	0.744***
	(0.124)	(0.117)	(0.117)	(0.144)	(0.120)	(0.126)	(0.149)	(0.126)	(0.153)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,920	10,920	10,920	10,780	10,920	10,920	10,780	10,920	10,780
R-squared	0.120	0.119	0.119	0.122	0.129	0.132	0.135	0.132	0.135

This table reports the relation between industrial specialization and financial development. The dependent variable is industrial specialization (*Int*) estimated using the Hoover (1936) index. The independent variables of interest are the development of financial sectors, including banking system, stock market, informal finance and FDI, interacted with industrial financial dependence. Other control variables include the interaction of industrial agricultural dependence and provincial agriculture endowment, the interaction of natural resource dependence and provincial natural resource endowment, the interaction of physical capital dependence and provincial physical capital stock and the interaction of human capital dependence and provincial human capital stock. Year dummies, industry dummies, and region dummies are also included. Robust standard errors clustered at the industry-province level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively. The definitions and data sources of all variables are presented in Appendix 1.

5   Robustness

5.1   Institutional environment

La Porta et al. (1997) find that legal and institutional environments are crucial to national financial and economic "outcomes." Robust legal and institutional environments can protect the interests of minority shareholders and improve access to external financial markets, which in turn increases the efficiency of the financial system in allocating funds. Allen et al (2005), however, hold up China as a counterexample of need for a robust legal system and developed financial system to foster high economic growth. Despite its fairly rudimentary legal and financial systems, China has been one of the world's fastest growing economies for the past three decades. Informal financing channels have substituted the standard financial system and contributed the most economic growth. To examine effects of institutional environment on financial markets and industrial specialization in China, we employ the marketization index of Fan et al. (2011), which provides a comprehensive measure the extent of marketization across China's provinces. As Lu and Tao (2009) suggest that the behavior of local government is an important determinant of industrial agglomeration, we further use the proportion of fixed investment coming from the state sector over total fixed investment to proxy for the effect of local government intervention.

We compare the effects of financial markets on specialization across regions in the lowest, middle and highest quintiles by marketization index. Panel A of Table 5 reports the results for the first, second, and third quintiles, respectively. Each column shows the estimates for the interactions between financial dependence and specific financial indicators. For regions with the lowest marketization, the development of banking sectors is related negatively significantly to specialization (column 1). Only FDI has a significantly positive effect on the pattern of industrial specialization. For regions with the highest marketization, however, the effect of banking sector has a statistically insignificant difference from zero and the capital markets have positive effects on specialization. We also find that both informal financing and FDI are important determinants of specialization. These results suggest that institutional environments are important for the functioning of both standard and informal financial systems. A possible explanation here might be that the absence of a robust formal institutional environment, informal social institutions based on reputa-

tion in the community and relationships can provide sufficient checks and monitoring for alternative financing channels to work.

Panel B of Table 5 reports the results across regions in the lowest, medium, and highest quintiles by local government intervention. Each column shows the estimates for the interactions between financial dependence and specific financial indicators. Consistent with our expectations, the effects of banking sectors on specialization for regions with extensive government interventions is significantly negative. Only FDI plays a positive role on shaping the patterns of regional specialization. In contrast, most financial indicators have positive and significant effects on specialization in those regions with the lowest levels of government intervention. Consistent with Lu and Tao (2009), our results suggest that government intervention impacts the efficiency of China's financial systems. Where there is less government intervention, financial systems can allocate financial resources according to the market supply and demand. As a result, well-developed financial markets in a region can attract industries that must rely heavily on external financing to specialize their production.

Table 5   Institutional environment

Panel A: Marketization

Proxy for financial development:	(1) Loan	(2) Capitalization	(3) Issuance	(4) Informal	(5) FDI
Lowest: fin×FIN	−0.291***	−0.0305	−1.354	0.114	2.733**
	(0.0718)	(0.0477)	(1.841)	(0.181)	(1.290)
Medium: fin×FIN	−0.179**	0.0203	−3.544	0.320**	4.079***
	(0.0912)	(0.127)	(5.447)	(0.153)	(0.865)
Highest: fin×FIN	−0.0712	0.00580	0.343	0.398**	3.643***
	(0.0518)	(0.00536)	(0.283)	(0.158)	(0.569)
Endowment control	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes
Region fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	10,920	10,920	10,920	10,780	10,920
R-squared	0.131	0.119	0.119	0.130	0.129

Panel B: Intervention

Proxy for financial development:	(1) Loan	(2) Capitalization	(3) Issuance	(4) Informal	(5) FDI
Lowest: fin×FIN	0.0466	0.0409*	1.978**	0.329**	3.896***
	(0.0387)	(0.0211)	(0.826)	(0.151)	(0.608)
Medium: fin×FIN	−0.0294	0.00436	0.286	0.209	3.614***
	(0.0399)	(0.00530)	(0.302)	(0.154)	(0.763)
Highest: fin×FIN	−0.178***	−0.0565	−2.882	−0.0210	2.478***
	(0.0584)	(0.0386)	(2.105)	(0.172)	(0.667)
Endowment control	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes
Region fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	10,920	10,920	10,920	10,780	10,920
R-squared	0.131	0.119	0.119	0.130	0.129

This table reports the role of institutional environment on the relation between industrial specialization and financial development. The dependent variable is industrial specialization (*Int*). The independent variables of interest are the interactions of financial development (*fin*) and industrial financial dependence (*FIN*). We compare the effects of financial markets on specialization across regions in the lowest, medium, and highest quintiles by marketization index in Panel A. Panel B reports the results across regions in the lowest, medium, and highest quintiles by local government intervention, which is measured as the proportion of fixed investment coming from state sector over total fixed investment. The endowment control variables (e.g. interaction of industrial endowment dependence and provincial endowment stock) are included, but not reported. Robust standard errors clustered at the industry-province level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

5.2   Sensitivity analysis

Ellison and Glaeser (1997) suggest the Hoover index measure may bias estimation of industrial agglomeration as it does not take into account the impact of industrial structure.[10] To test the robustness of our results, we re-estimate the equation (1) using alternative measure of regional industrial specialization, i.e. the indicator used by Kalemli-Ozcan et al. (2003):

$$\left(\frac{Output_{ik}}{Output_k} - \frac{1}{K-1} \sum_{k \neq p} \frac{Output_{ip}}{Output_{total}} \right)^2 .$$

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[10] To address this problem, Ellison and Glaeser (1997) construct a model-based index of geographic concentration. The EG index uses both the geographic and intra-industrial distribution of employment, and provides an overall measure of the spatial concentration of industries. The EG index *does not* provide the measure how an industry specializes its production in a typical region. Hence, it is inappropriate for our investigation.

$Output_{ik}$ is the gross industrial production of industry i of province k. $Output_i$ is the national gross industrial production of industry i. $Output_k$ is province k's total gross production of all industries. $Output_{total}$ is the national gross production of all industries. Panel A of Table 6 reports the estimation results using the alternative measure of industrial specialization. The primary results remain qualitatively unchanged and strongly support our hypotheses. Only FDI and informal financial systems are important determinants on specialization.

Rajan and Zingales (1998) suggest that actual use of external financing is inappropriate to measure an industry's financial dependence as it may reflect the equilibrium between supply and demand for external financing. As listed firms on US stock markets face the least frictions in accessing finance, the external finance used by these firms provides the best benchmark for foreign firms in the same industry (Manova, 2013). To check robustness, we use the data on the external financing and capital expenditures of US exchange-listed firms.

Financial dependence is estimated as an average value from 1998 through 2010, and industry values are calculated as medians. Panel B of Table 6 reports the results by using the alternative measure of financial dependence based on US data. The results are virtually identical to those in Table 4. Thus, positive effect of FDI and informal financing channels on the patterns of industrial specialization is not due to the different measure of industrial financial dependence.

Cull et al. (2009) show that trade credit likely provides a substitute for bank loans for firms shut out of formal credit markets. Hence, trade credit is an important alternative financing channel. If our hypothesis is correct, industries that need access to external finance should develop rapidly in regions with well-function systems of trade credit. To obtain region-level measures of trade credit use, we consider the ratio of accounts receivable to total assets (Receivable), the same measure of trade credit employed by Cull et al. (2009). To obtain a value of each region, we take average of the ratios over all firms in this region in the relevant time period. Panel C of Table 6 reports the results by using Receivable to measure the development of informal financial market. All the coefficients of Receivable are positive with statistically significant differences from zero. This suggest that trade credit can alleviate financial constraint and has a positive effect on regional industrial specialization.

Table 6   Sensitivity analysis

Panel A: Alternative measures of industrial specialization

	(1)	(2)	(3)	(4)
Loan×FIN	0.00994	–0.0108	0.00815	–0.0154
	(0.0229)	(0.0231)	(0.0237)	(0.0240)
Capitalization×FIN	0.00648	0.00692		
	(0.00508)	(0.00514)		
Issuance ×FIN			0.352	0.459
			(0.330)	(0.338)
Informal ×FIN	0.337***	0.336***	0.335***	0.329***
	(0.0708)	(0.0703)	(0.0718)	(0.0710)
FDI ×FIN		2.136***		2.148***
		(0.431)		(0.432)
Constant	0.278**	0.294***	0.274**	0.284**
	(0.112)	(0.113)	(0.115)	(0.115)
Endowment control	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Region fixed effect	Yes	Yes	Yes	Yes
Observations	10,920	10,780	10,920	10,780
R-squared	0.132	0.132	0.132	0.135

Panel B: Financial dependence on U.S.

	(1)	(2)	(3)	(4)
Loan×FIN_US	–0.0164	0.0264	–0.0112	0.0370
	(0.0475)	(0.0429)	(0.0468)	(0.0421)
Capitalization×FIN_US	0.0137*	0.00525		
	(0.00814)	(0.00848)		
Issuance ×FIN_US			0.121	–0.0153
			(0.117)	(0.140)
Informal ×FIN_US		0.0651*		0.0691*
		(0.0385)		(0.0400)
FDI ×FIN_US	0.631***		0.635***	
	(0.175)		(0.175)	
Constant	0.644***	0.681***	0.646***	0.688***
	(0.118)	(0.130)	(0.117)	(0.130)
Endowment control	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Region fixed effect	Yes	Yes	Yes	Yes
Observations	10,920	10,780	10,920	10,780
R-squared	0.125	0.123	0.125	0.123

Panel C: Trade credit

	(1)	(2)	(3)	(4)
Trade_Credit×FIN	2.280***	2.523***	2.292***	1.158*
	(0.638)	(0.701)	(0.639)	(0.615)
Loan×FIN		−0.159***		
		(0.0613)		
Capitalization×FIN			0.00702	
			(0.00564)	
FDI×FIN				3.456***
				(0.592)
CAP×cap	−0.0106	−0.00688	−0.0118	−0.0129
	(0.00911)	(0.00984)	(0.00913)	(0.00889)
SKL×skl	−1.480**	−2.372***	−1.329**	−1.132*
	(0.620)	(0.845)	(0.631)	(0.588)
AGR×agr	2.584***	2.893***	2.563***	2.886***
	(0.508)	(0.501)	(0.510)	(0.488)
MINE×mine	2.719***	2.823***	2.717***	2.896***
	(0.539)	(0.540)	(0.539)	(0.529)
Constant	0.914***	0.794***	0.911***	0.814***
	(0.157)	(0.145)	(0.157)	(0.150)
Endowment control	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Region fixed effect	Yes	Yes	Yes	Yes
Observations	10,080	10,080	10,080	10,080
R-squared	0.127	0.130	0.127	0.133

This table reports sensitivity analysis on the relation between industrial specialization and financial development. Panel A reports the estimation results by using the industrial specialization measure of Kalemli-Ozcan et al. (2003). Panel B of Table 6 reports the results by using the alternative measure of financial dependence based on US data. Panel C of Table 6 reports the results by using accounts receivable over total assets (Receivable) to measure the development of informal financial market. The endowment control variables (e.g. the interaction of industrial endowment dependence and provincial endowment stock) are included, but not reported. Year dummies, industry dummies, and region dummies are included. Robust standard errors clustered at the industry-province level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

5.3   Endogeneity

The relationship between financial development and pattern of specialization may be endogenously determined. Industries that rely extensively on external finance may also demand a well-functioning financial system. In this sense, regions that serve financially dependent industries may have strong incentive to develop their financial system. Thus, we apply use distinct and separate instruments to isolate the effects of informal financing and FDI.

Guiso et al. (2004) find that social capital plays an important role in the degree of financial development, especially in regions with poor law enforcement. Where law en-

forcement and the institutional environment are weakest, the informal financing channel based on reputation and relationships dominates China's financial system (Allen et al., 2005). Social capital persists over time, and can build trust and reputation between agencies – an intrinsic feature of the informal financial system. Thus, we expect that access to informal financing correlates positively with the influence of local social capital. However, as noted by Svaleryd and Vlachos (2005), industry structure has little direct impact on social capital. We thus use the number of people-run non-enterprise units per 10,000 residents (*Pni*) as an indicator of regional social capital,[11] and construct the interaction variable (*Pni×FIN*) as an instrument[12] for *Informal ×FIN*.

To isolate the causal impact of FDI on patterns of regional industrial specialization, we rely on the percentage of foreign-related marriages over total marriages.[13] Our rationale here is that foreign investors face great uncertainty when investing in mainland China. Marriage ties with local citizens could mitigate information asymmetry and help attract foreign capital. As it is hard to believe that industry structure can influence the foreign-related marriages, we contrast the interaction variable (*Fm×FIN*) as an instrument for *FDI ×FIN*.

Column 1-3 of Table 7 reports the two-stage-least-squares (2SLS) results for informal finance. Panel B of Table 7 reports the results from the first-stage regressions. Here, we see that *Pni×FIN* is significantly positively correlated with *Informal ×FIN*. If the *F*-statistic of the instrument indicates a significant effect on informal financing channels, we avoid weak instrument bias. The second-stage results are reported in Panel A of Table 7. Here, we see that the point estimates for *Informal ×FIN* are more significant and larger than the OLS estimation results in Table 4. Consistent with our expectation, these results indicate that access to informal financing is important for industries that rely heavily on external financing. Column 4-6 of Table 7 reports the results for FDI. The *F*-statistics here are sufficiently large to alleviate concerns of a weak instrumental variable, and confirms

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[11] According to Provisional Regulations for the Registration Administration of People-Run Non-Enterprise Units, promulgated by Decree No. 251 of the State Council of the People's Republic of China on October 25, 1998, people-run non-enterprise units are defined as enterprise institutions, societies, or other social forces or social organizations established with non-state-owned assets by individual citizens to provide non-profit social services.

[12] We also use initial levels of *Pni* (the value of *Pni* in 1998) as alternative measure of instrument. It turns out that our primary results remain qualitatively unchanged.

[13] Under Article 147 of the General Principles of the Civil Law of the People's Republic of China, foreign-related marriage is a marriage in China between a foreigner and a Chinese citizen or between two foreigners. To avoid possible endogeneity, we use the three-year lagged *Fm* to construct our instruments.

that the instrument (*Fm×FIN*) has a significant effect on *FDI ×FIN*. Even if the significance levels are relatively lower, the second-stage results reported in Panel A of Table 7 present point estimates that are still large and have a positive effect on regional specialization.

Table 7   Instrumental variable estimations

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Second Stage, Dependent Variable: Int_{ikt}						
Loan×FIN		−0.137**	−0.137**		−0.0873	−0.0833
		(0.0590)	(0.0586)		(0.0617)	(0.0613)
Capitalization×FIN		0.00276			−0.0463***	
		(0.00750)			(0.0145)	
Issuance ×FIN			0.142			−2.195***
			(0.529)			(0.755)
Informal ×FIN		0.453***	0.453***	2.294***	1.977***	1.954***
		(0.154)	(0.160)	(0.440)	(0.396)	(0.392)
FDI ×FIN	3.010**	3.274***	3.294***		4.108***	4.064***
	(1.208)	(1.250)	(1.260)		(0.746)	(0.742)
Endowment control	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10920	10780	10780	9436	9436	9436
R-squared	0.129	0.135	0.135	0.073	0.105	0.106
Panel B: First Stage, Dependent Variable: fin×FIN						
Pni×FIN				0.0547***	0.0528***	0.0535***
				(0.00437)	(0.00436)	(0.00442)
Fm×FIN	0.669***	0.657***	0.655***			
	(0.0644)	(0.0622)	(0.0621)			
F-test	146.3	150.6	143.1	3054.7	3255.9	3317.65
Hausman Test (p)	0.457	0.482	0.498	0.000	0.000	0.000

This table reports two-stage-least-squares estimation on the relationship between industrial specialization and financial development. The upper panel presents the results of the second-stage regression. The dependent variable is industrial specialization (*Int*). The independent variables of interest are proxies for financial sectors, including banking system, stock market and FDI, interacted with industrial financial dependence (*FIN*). The endowment control variables (e.g. the interaction of industrial endowment dependence and provincial endowment stock) are included, but not reported. Panel B reports the result of the first stage regression. The instrument variable for informal finance is the number of people-run non-enterprise units per 10000 residents. We use the percentage of foreign-related marriages over total marriages (*Fm*) as the instrument variable for FDI. Robust standard errors clustered at the industry-province level are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

6   Conclusions

This paper considered the effects of financial development on industrial specialization in an emerging-economy context, a question still largely unstudied question in the empirical literature. Using a panel data of 29 manufacturing industries in 30 Chinese regions from 1998 through 2010, we examined how financial development might shape patterns of industrial specialization. We find that industries that rely heavily on access to external financing tend to specialize in regions with developed financial systems. However, standard financial sectors such as banking and capital markets play relatively minor roles in determining patterns of specialization across Chinese regions. Informal financing channels and FDI seem to be the important determinants of specialization patterns and are sources of regional comparative advantage. Moreover, good institutional environments appear to strengthen the positive effects of financial sectors on specialization patterns. Our results remain robust after controlling for traditional specialization determinants, alternative measures of variables, and the possibility of reversal causality.

It is often asserted that the rapid growth of China's private sector is due to the availability of informal financing channels and FDI. Consistent with this argument, our results provide evidence that access to alternative financing channels and FDI are central to encouraging regional industrial specialization. Although standard financial sectors such as credit and capital markets have enjoyed a rapid expansion, China's repressive financial policies and government intervention leave these financial sectors on the sidelines when it comes to setting the industrial specialization agenda. Given the low levels of industrial specialization across Chinese regions, perhaps the best way forward for China is to speed up reform of traditional financial sectors, as well as promote a well-functioning legal system and robust institutions.

References

Acemoglu, D., and S. Johnson (2005). Unbundling Institutions. Journal of Political Economy, 113(5), 949–995.

Allen, F., J. Qian, and M. Qian (2005). Law, Finance and Economic Growth in China. Journal of Financial Economics, 77(1), 57–116.

Allen, F., J. Qian, C. Zhang, and M. Zhao (2012). China's Financial System: Opportunities and Challenges. NBER Working Paper 17828.

Audretsch, D.B., Feldman, M.P. (1996). R&D spillovers and the geography of innovation and production. American Economic Review, 86(3), 630–640.

Bai, C.E., Y. Du, Z. Tao, and S.Y. Tong (2004). Local Protectionism and Regional Specialization: Evidence from China's Industry. Journal of International Economics, 63(2), 397–417.

Beck, T. (2002). Financial Development and International Trade: Is There a Link? Journal of International Economics, 57(1), 107–131.

Beck, T. (2003). Financial Dependence and International Trade. Review of International Economics, 11(2), 296–316.

Chan, K. S., V.Q. Dang, J.T. Lai, and I.K. Yan (2011). Regional capital mobility in China: 1978–2006. Journal of International Money and Finance, 30, 1506–1515.

Cetorelli, N., and M. Gambera (2001). Banking market structure, financial dependence and growth: International evidence from industry data. Journal of Finance, 56(2), 617–648.

Cull, R., L.C. Xu, and T. Zhu (2009). Formal finance and trade credit during China's transition. Journal of Financial Intermediation, 18(2), 173–192.

Du, J., Q. He, and O.M. Rui (2011). Channels of Interprovincial Risk Sharing in China. Journal of Comparative Economics, 39(3), 383–405.

Duranton,G., and D. Puga (2004). Micro-foundations of urban agglomeration economies. Handbook of Regional and Urban Economics, 4, 2063–2117.

Fan, G., X. Wang, and H. Zhu (2011). NERI INDEX of Marketization of China's Provinces 2011 Report （Chinese）. Beijing: Economic Science Press.

Guiso, L., P. Sapienza, and L. Zingales (2004). Do Local Financial Developments Matter? Quarterly Journal of Economics, 119(3), 929–969.

Guariglia, A., and S. Poncet (2008). Could Financial Distortions Be No Impediment to Economic Growth After All? Evidence from China. Journal of Comparative Economics 36, 633–657.

Harrison, A.E., I. Love, and M.S. McMillan (2004). Global capital flows and financing constraints. Journal of Development Economics, 75(1), 269–301.

He Q., P.H. Leung, and T.T.L. Chong (2013). Factor-Augmented VAR Analysis of the Monetary Policy in China. China Economic Review, 25(2), 88–104.

Jayaratne, J., and P. Strahan (1996). The Finance-Growth Nexus: Evidence from Bank Branch Deregulation. Quarterly Journal of Economics, 111(3), 639–670.

Kalemli-Ozcan S., B.E. Sørensen, and O. Yosha (2003). Risk Sharing and Industrial Specialization: Regional and International Evidence. American Economic Review, 93(3), 903–918.

Kim, S. (1999). Regions, resources, and economic geography: Sources of U.S. regional comparative advantage, 1880–1987. Regional Science and Urban Economics, 29(1), 1–32.

Krugman, P. (1991). Increasing Returns and Economic Geography. Journal of Political Economy, 99(3), 483–499.

Krugman, P., and A.J. Venables (1995). Globalization and the Inequality of Nations. Quarterly Journal of Economics, 110(4), 857–880.

La Porta, R., F. Lopez-de-Silanes, A. Shleifer, and R.W. Vishny (1997). Legal Determinants of External Finance, Journal of Finance, 52(3), 1131–1150.

La Porta, R., F. Lopez-de-Silanes, and A. Shleifer (2000). Investor protection and corporate governance. Journal of Finance, 58(1–2), 3–27.

Lai, J.T., P.D. McNelis, and I.K.M. Yan (2013). Regional capital mobility in China: Economic reform with limited financial integration. Journal of International Money and Finance, 37(3), 493–503.

Levchenko, A.A. (2007). Institutional Quality and International Trade, Review of Economic Studies, 74(3), 791–819.

Li, K.W. (2003). China's capital and productivity measurement using financial resources. Yale University Economic Growth Center Discussion.

Lu, J., and Z. Tao (2009). Trends and determinants of China's industrial specialization. Journal of Urban Economics 65(2), 167–180.

Manova, K. (2013). Credit Constraints, Heterogeneous Firms, and International Trade. Review of Economic Studies 80, 711–744.

Marshall, A. (1920). Principles of Economics: An Introductory Volume (8th ed.). London: Macmillan.

Morck, R., B. Yeung, and W. Yu (2000). The information content of stock markets: Why do emerging markets have synchronous stock price movements? Journal of Financial Economics, 58(1–2), 215–260.

Nunn, N. (2007). Relationship-specificity, Incomplete Contracts, and the Pattern of Trade. Quarterly Journal of Economics, 122(2), 569–600.

Ohlin, B. (1933). Interregional and International Trade. Cambridge: Harvard University Press.

Pistor, K. (2009). The Governance of China's Finance. NBER conference paper.

Prasad, E., and S.J. Wei (2005). The Chinese approach to capital inflows: patterns and possible explanations. In: International Capital Flows, Sebastian Edwards (ed.), Chicago: University of Chicago Press, 421–480.

Rajan, R.G., and L. Zingales (1998). Financial dependence and growth. American Economic Review, 88(3), 559–586.

Romalis, J. (2004). Factor proportions and the structure of commodity trade. American Economic Review, 94(1), 67–97.

Rosenthal, S.S. (2001). The Determinants of Agglomeration, Journal of Urban Economics, 50(2), 191–229.

Svaleryd, H., and J. Vlachos (2005). Financial Markets, the Pattern of Industrial Specialization and Comparative Advantage: Evidence from OECD countries. European Economic Review, 49(1), 113–144.

Wood, A. (1994). Give Heckscher and Ohlin a chance! WeltwirtschaftlichesArchiv 130: 20–49.

Young, A. (2000). The Razor's Edge: Distortions and Incremental Reform in the People's Republic of China. Quarterly Journal of Economics, 115(4), 1091–1135.

Appendix 1 Variable definitions and data resources

Most data are taken from annual issues of the China Statistical Yearbook published by the National Bureau of Statistics (NBS). We provide a description and data source for each indicator below.

Variable	Definition	Source
Financial Variables		
FIN	Dependence on external financing, industry-level means of the ratio of capital expenditures minus cash flow over capital expenditures	China Statistical Yearbook, various years
Loan	Ratio of financial institutional loans to GDP	China Statistical Yearbook, various years
Capitalization	Ratio of stock market capitalization to GDP	Statistics Yearbook of Shanghai Stock Exchange, Statistics Yearbook of Shenzhen Stock Exchange, various years
Issuance	Ratio of funds raised by issuing equities and non-financial corporate bonds to GDP	China Securities and Futures Statistical Yearbook, various years
Informal	Ratio of funds self-raised or raised by other non-specified channels to fixed investment	China Statistical Yearbook, various years
FDI	Ratio of FDI stock to GDP	China Statistical Yearbook, various years
Receivable	Average ratio of accounts receivable over total assets for firms in a region	China Statistical Yearbook and China Industry Economy Statistical Yearbooks, various years
Control Variables		
CAP	Ratio of net value of fixed asset to value added in industry	China Statistical Yearbook and China Industry Economy Statistical Yearbooks, various years
Stcap	Per capita physical capital	Li (2007) and authors' calculations
SKL	Average ratio of workers with above-secondary schooling to overall employment in each industry	China Economic Census Yearbook in 2004 and 2008
Sthc	Ratio of population with at-least-secondary schooling to the total population	China Statistical Yearbook
AGR	Average ratio of agricultural inputs to intermediate inputs in industry	Input-Output Table of China in 1997, 2002 and 2007
Stagr	Per capita agricultural output	China Statistical Yearbook, various years
MINE	Average ratio of mineral inputs to intermediate inputs in industry	Input-Output Table of China in 1997, 2002 and 2007
Stmine	Per capita mineral output	China Statistical Yearbook, various years
Grow	Real growth of per capita GDP, discounted by CPI	China Statistical Yearbook, various years

Institutional variables   35

| Marketization | Comprehensive index measuring the overall quality of regional institutions | Index of Marketization in China (Fan et al., 2011) |
| Intervention | Proportion of fixed investment coming from state sector over total fixed investment | China Statistical Yearbook, various years |

Instrument Variables

| Fm | Share of foreign-related marriages over total marriages | China Civil Affairs' Statistical Yearbook, various years |
| Pni | Number of people-run non-enterprise units per 10,000 residents | China Social Statistical Yearbook, various years |

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