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Finance and Cluster-Based Industrial Development in China

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ABSTRACT

The traditional literature emphasizes the causal role of finance in promoting industrial growth. China's rapid industrialization over the past several decades, which has occurred in the absence of well-functioning financial markets, seems to defy the conventional wisdom. By studying a cashmere sweater cluster in China, this paper argues that rural industrial clustering, as a new business model, lowers the entry barriers of initial capital investment through the division of labor. Within these clusters, enterprises can often acquire trade credits from upstream or downstream firms and obtain informal financing from friends and relatives, and use these funds to mitigate constraints of working capital. These findings help explain China's rapid industrialization in the absence of an efficient financial market.

Keywords: industrialization, cluster, finance, China, growth

ABBREVIATIONS AND ACRONYMS

CNBS: China National Bureau of Statistics
IV: Instrument variable
OLS: Ordinary linear square
SMEs: Small and medium enterprises
TVEs: Town and village-owned enterprises
VPCs: Virtual production coordinators

1. INTRODUCTION

A financial system that effectively mobilizes national savings and facilitates foreign capital inflow is widely accepted as being necessary for industrialization and economic growth (Goldsmith, 1969; McKinnon, 1973; King and Levine, 1993; Rajan and Zingales, 1998, Ayyagari, Demirgüç-Kunt, and Maksimovic, 2006). However, while there is general agreement that economic and financial development are positively related, there is a growing challenge to the hypothesis that financial-institutional development is causal to growth (Lamoreaux and Rosenthal, 2004; Cull *et al*. 2005; Fergusson, 2006).

In particular, the rapid economic growth and industrialization of China in the post-Mao era challenges the necessity of a formal financial system. When China started its reform, rural areas and farmers lacked financial services; in theory, this should have prevented investments in machinery and other assets required for nonfarm production. However, vast rural areas in coastal China have become industrialized at an unprecedented speed. As pointed out by Summers (2007), over the past two to three decades, China has experienced the same degree of industrialization that took two centuries to occur in Europe.

During the course of industrialization in China, small and medium enterprises (SMEs) have been the most dynamic driving force (Che and Qian, 1998). However, very few SMEs have received credit support from state-owned banks (Lin and Li, 2001; Yu, 2002; Wang and Zhang, 2003; Lin and Sun, 2005) for several reasons. First, high transaction costs and therefore lower profitability reduce the incentives of formal banks to provide small loans to SMEs. Second, large banks lack information on the operational details of the SMEs. Third, SMEs are typically incapable of providing collateral and building borrowing relationships with banks, exacerbating information problems and credit rationing. These problems are ubiquitous, existing not only in China, but also in many developing countries,[1] and even in developed countries at early stages of industrialization.[2] Finally, although China has gradually shed its long-standing prejudice against private business, state-bank loans are still primarily directed to state-owned enterprises. Thus, China's financial system is not well-developed by existing standards, and it is not particularly friendly to SMEs (Allen, Qian, and Qian, 2005).

It is unclear how small and medium enterprises (SMEs) have achieved such rapid growth despite credit constraints. One common explanation is that although China's formal finance sector is still in its infancy, informal finance may have played a substitute role in the development of SMEs (Zhang and Li, 1990; Shi, Sun, and Yan, 1998; Guo and Liu, 2002; Allen, Qian, and Qian, 2005; Lin and Sun, 2005). However, at the onset of China's reform in the late 1970s, a large proportion of rural people were poor (Ravallion and Chen, 2007), meaning that local savings would have been rather limited for informal financing. This suggests that other factors may have contributed. We argue herein that industrial clustering plays a key role in the ability of SMEs to overcome credit constraints.[3]

[1] Bigsten *et al*. (2003) show that SMEs face higher credit constraints than large firms in African countries.

[2] According to Cull *et al*. (2005), SMEs in the North Atlantic Core rarely obtained credits from large banks early in their history.

[3] Porter (1990, p.18) defines a cluster as a "geographic concentration of interconnected companies and institutions in a particular field." However, this definition masks the key role of clustering in the division of labor among the enterprises in the cluster (Marshall, 1920). In particular, it does not distinguish between the Detroit style agglomeration with large firms and the Chinese style clusters (which consist of many SMEs). In this paper, following Pyke and Sengenberger (1990), we define a cluster more narrowly as a production system involving numerous enterprises in a certain location engaged in producing a wide range of

Lack of financial development is more common than not in developing countries. Under this circumstance, it is a great challenge to promote the development of SMEs (Haggblade, Hazell, and Reardon, 2006). Therefore, a careful case study of a successfully industrialized rural area that lacked a well-developed financial system will provide key insights into the policy debate on rural industrialization in other developing countries. Here, we use the Puyuan cashmere sweater cluster, a typical industrial cluster in rural Zhejiang Province, as an example to demonstrate our perspective.

The remainder of the paper is organized as follows: Section 2 presents literature review and a theoretical model on how clustering lowers the barriers to entry and mitigates working capital constraints; Section 3 reviews the history of Puyuan's cashmere sweater cluster and explains the survey design; Section 4 analyzes our data and shows how clustering reduces the capital barriers to entry through the division of labor; Section 5 examines ways to ease working capital requirements; and Section 6 concludes.

stages. This definition fits better with the situation in Puyuan and other specialty cites or towns in China as described in the media, in articles such as: "In Roaring China, Sweaters Are West of Socks City" in the New York Times (http://www.nytimes.com/2004/12/24/business/worldbusiness/24china.html), and "China's Instant Cities" in National Geographic (http://ngm.nationalgeographic.com/ngm/0706/feature4/index.html).

2. LITERATURE REVIEW AND A THEORETICAL MODEL

The division of labor is an essential part of Classical Economics. For instance, in the first chapter of *The Wealth of Nations*, Adam Smith(1776) uses a pin factory as an example to show how division of labor improves productivity. Young (1928) argues that increasing returns depend upon the progressive division of labor. Marshall (1920) posits that clustering, as an important way of increasing the division of labor, could enhance enterprises' competitiveness for three reasons: labor pooling, easy access to suppliers, and quick dissemination of knowledge. However, deepening the division of labor within a cluster may involve high coordination costs due to the increased number of transactions among more parties (Williamson, 1975; Becker and Murphy, 1992).

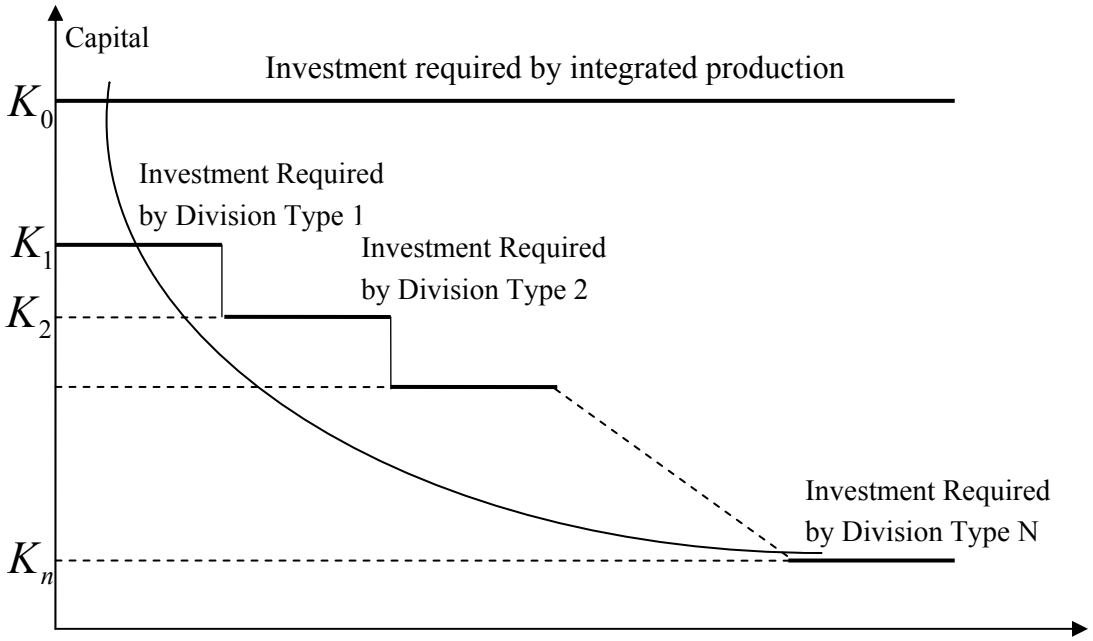
Despite the potential higher coordination cost, industrial clusters may be found in both developed and developing countries (Schmitz and Nadvi, 1999; Sonobe and Otsuka, 2006). Historically speaking, the business model of clustering is not new, as it rather resembles the "putting-out" system widespread in Western Europe prior to the Industrial Revolution. Under the putting-out system, a merchant-employer obtained market orders and subcontracted production to nearby farmers or skilled workers, who usually performed the work in small family workshops (Hounshell, 1984). The putting-out system was also observed in the textile industry in nineteenth-century Japan and early twentieth-century China (Nakabayashi, 2006; Feng, 2005).

Empirical studies on industrial clusters (Schmitz, 1995; Sato, 2000; Yamamura, Sonobe, and Otsuka, 2003; Sonobe and Otsuka, 2006) generally support Marshall's hypotheses on information spillover, market linkage and labor pooling. However, relatively few studies have examined industrial clusters in the context of finance. Hayami, Kikuchi, and Marciano (1998) and Schmitz and Nadvi (1999) are two exceptions. They briefly comment that clustering lowers the capital requirement for new entrants. However, they do not elaborate on these arguments with solid empirical evidence.

In developing countries, very few entrepreneurs possess large amounts of capital, and many SMEs struggle with credit constraints (Bigsten *et al*., 2003). Due to these financial constraints, it is generally difficult for an SME to build a large factory and integrate the various production processes under one roof. Thus, both theory and practice call for improvements in formal banking and removal of financial constraints as a means to generate employment and achieve industrialization. The widely-promoted micro finance program (Murduch, 1999) is a notable example of such efforts.

In this paper, we argue that clustering may be an effective organizational response to the financial constraints experienced by SMEs in China. Figure 1 presents a hypothetical model illustrating this point. The horizontal axis has two meanings: On the one hand, it represents a chain of production processes according to the required capital investment, while on the other hand, it captures the cumulative distribution of the population based on available financial resources. The smooth curve is equivalent to the standard cumulative distribution function if the horizontal and vertical axes are switched. The steps on the horizontal axis represent the requirement of fixed capital for each production process. The vertical axis represents the amount of capital that can be afforded by the corresponding share of population on the horizontal axis.

Figure 1. Individuals choosing divisions according to different amounts of capital



Note: The horizontal axis stands for division type in descending order of capital investment and cumulative distribution of population according to available capital (with a value from 0 to 1). The population is arranged in a descending order in according to available capital.

As shown by the top horizontal line in the figure, an integrated production process requires a high amount of initial fixed investment, K_0, meaning that only a small share of the population can afford to enter the business. If we suppose that the integral production process can be divided into N incremental steps, the capital investment requirement for each step is lowered, and ranges from K_1 to K_N. This makes the pieces of the production process more accessible for a larger number of entrepreneurs, although individuals with access to only minimal capital (those on the right of the horizontal axis) may end up with production type N. This leads to our two related hypotheses:

Hypothesis I: The capital requirement for enterprises engaged in vertical division of labor is lower than that for an integrated production process.

Hypothesis II: Within a cluster having a fine division of labor, entrepreneurs can choose their production process according to their financial resources or credit access.

There is a key assumption here, namely that the production process can be segmented. The degree of segmentation is likely to be industry specific. For example, Zhang and Li (1990) documented that even the production of a simple badge in Cangnan (Zhejiang Province) could be divided into 13 stages that were carried out by different family workshops in a village, forming a virtual production line. Some labor-intensive industries such as garment making, footwear production, hardware crafting, and metal work are particularly suitable for clustered-based production.

In this paper, we use the Puyuan cashmere sweater industrial cluster as an example to test the above two hypotheses.

3. REVIEW OF THE PUYUAN CASHMERE SWEATER INDUSTRIAL CLUSTER

3.1. A Brief History of the Puyuan Cluster and the Role of Local Government

Puyuan Township is located in northern Zhejiang Province, between Hangzhou and Shanghai. Historically, Puyuan was an important silk production center. In 1976, a collectively owned enterprise, the Puyuan Tanhua (Weaving) Production Cooperative, purchased three hand-shaken weaving machines and began to produce cashmere sweaters. Its gross output value soared from 28,000 *yuan* to 300,000 *yuan* in just one year. As a result, the cooperative had devoted all of its production capacity to cashmere sweaters by the end of 1977 (Chen, 1996).

This firm's huge success prompted farmers in nearby villages and workers from the township and village-owned enterprises to set up other cashmere sweater production workshops. Meanwhile, market demand for clothes surged suddenly after the success of rural reform in the mid-1980s; this increasing demand greatly stimulated production. Because most entrepreneurs had little in the way of savings, most initially worked from home using a few secondhand weaving machines, and sold the sweaters along a main road linking Shanghai and Hangzhou. However, large crowds often gathered at these points of sale, blocking traffic. In April, 1988 the township government and the local administration for industry and commerce responded to this issue by raising 580,000 *yuan* from different sources and constructing a cashmere sweater marketplace. Located on the southern side of the main road, this marketplace initially comprised over 4,300 squared meters of building area and more than 50 rooms. Both local merchants and those from other regions of Zhejiang Province quickly moved into the marketplace and began doing business. The openness of the marketplace deepened the division of labor, because merchants often put-out the production to different workshops in Puyuan after receiving market orders. In 1990, the township produced over 2.8 million sweaters, and approximately 90% of the households in Puyuan Township and its peripheral villages were engaged in the production of cashmere sweaters.

Around 1990, the Puyuan Administration for Industry and Commerce decided to levy higher management fees from the merchants in the market. The nearby Honghe Township seized the opportunity by opening a similar marketplace with reduced fees. In response, many merchants moved to Honghe. In 1992, facing the pressure of an eroding tax base, the local government of Puyuan lobbied the upper-level government to transfer the head of Puyuan Administration for Industry and Commerce (which is vertically administered under China's governance structure) elsewhere, and this policy was reversed.

In the aftermath of this reversal, the Puyuan market rebounded. Between 1992 and 1994, the local government further raised nearly 100 million *yuan* from the Puyuan Township government, the Puyuan Administration for Industry and Commerce (*Puyuan Zhen Gongshangsuo*), the Puyuan General Company of Agriculture, Industry and Commerce (*Puyuan Nonggongshang Zong Gongsi*), the Tongxiang City Goods and Materials Company (*Tongxiangshi Wuzi Gongsi*), the Tongxiang Supply and Sale Cooperative (*Puyuan Gongxiaoshe*), various banks, and others sources. Using these resources, the local government built 11 more marketplaces with more than 3,000 shops for cashmere sweaters and their intermediate inputs. Once again, the new marketplaces were very popular, and they were quickly filled by merchants from all around China. With easy market access, transportation and marketing costs were also reduced.[4]

[4] Sonobe, Hu, and Otsuka (2002), in a study of a garment cluster in Zhejiang Province, China, detail how the

The cashmere sweater production industry recorded explosive growth during this period. As of 1994, Puyuan's sweater output reached as many as 10 million pieces with market sales exceeding two billion *yuan*, making it the largest production center of cashmere sweaters in China.

As the production grew rapidly, so did the volume of transportation into and out of Puyuan. Initially there were many small, private logistics companies, each operating only one or two routes. It was not economical for each transportation company to build separate loading docks and parking lots, meaning that trucks often blocked the streets when loading goods. Moreover, some of these companies even hired thugs to fight for the most lucrative routes. To reduce the chaos and improve efficiency, in 1995 the local government intervened by organizing 27 private logistics and transport companies into a shareholding company with the local government as the largest shareholder. The company invested 40 million *yuan* to build a logistics business center, a loading dock, a 150,000 sq m warehouse, and a parking lot. The company has auctioned off 109 routes to over 140 major cities in China to private investors. However, although the company would seem to have a natural local monopoly, shipping costs through the Puyuan logistics center have decreased since the company's inception. This may be due to the competition from the neighboring Honghe Township's logistics center.

During the period of 1995-1997, the market for the textile industry reached a low point. To compete in these harsh market conditions, some enterprises in Puyuan started using cheap materials at the expense of product quality. This greatly damaged the reputation of Puyuan's cashmere sweater industry. In response, Puyuan Township Government promulgated two decrees in 1997: the "Quality Control and Inspection System in Cashmere Marketplaces in Puyuan, Tongxiang (Tongxiangshi Puyuan Yangmaoshan Chanpin Zhiliang Jiandu Jiancha Zhidu)" and the "Product Quality Guarantee Stipulation in Cashmere Sweater Marketplaces (Yangmaoshan Shichang Chanpin Zhiliang Baozheng Guiding)." The Administrative Committee of Puyuan Marketplace was asked to earnestly enforce these two regulations, and came up with three specific measures to achieve these aims. First, the Puyuan Administration for Industry and Commerce was invited to set up a branch office in the main marketplace to help enforce product quality. Second, one marketplace was earmarked specifically for the sale of high-end sweaters. Third, the Zhejiang Jingwei Notarization and Inspection Company was invited to set up a quality inspection center in Puyuan, in order to provide third-party quality certification.

Due to the ease of imitation within the cluster, it was difficult for a given company to establish its own brand when intellectual property was not securely protected. In 2000, the local government set up an industrial park of 2,245 *mu* (0.067 hectare), and sought to attract well-established enterprises with famous brands from elsewhere in China by granting preferable land, tax, and credit policies. In addition, local enterprises with high growth potential were encouraged to settle in the park, where they could expand production and establish their brands.[5]

In addition to developing marketplaces and the logistics center, the local government has also provided many other public goods and services over time. For example, the past several years have seen intensification of street patrols, in an effort to ensure security in the marketplaces. An information system connecting the local police station and hotels was established to screen out business people with false IDs,

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establishment of standardized markets helped lower the entry barriers for new business.

[5] The three major criteria used to determine growth potential are: 1) registered trademarks, 2) sound brand name, (3) sufficient investment.

who would be more likely to commit fraud. In 2000, the local government devoted three million *yuan* to advertisements aimed at promoting the cluster, and ever since 2003, the annual government-supported Puyuan International Textile Exhibit has sought to attract merchants from both China and overseas. These generic promotion efforts have enhanced Puyuan's image and decreased the marketing costs for the individual enterprises.

As of 2004, over 3,900 enterprises and family workshops in Puyuan Township were engaged in the production of a variety of cashmere sweaters, and there were more than 6,000 sweater shops in the market. Over 50,000 people worked in the various stages of cashmere sweater production in this cluster, accounting for 38% of the total population and 65% of the total labor force.[6] The market transaction turnover topped 10 billion *yuan* and the business volume amounted to nearly 500 million pieces.

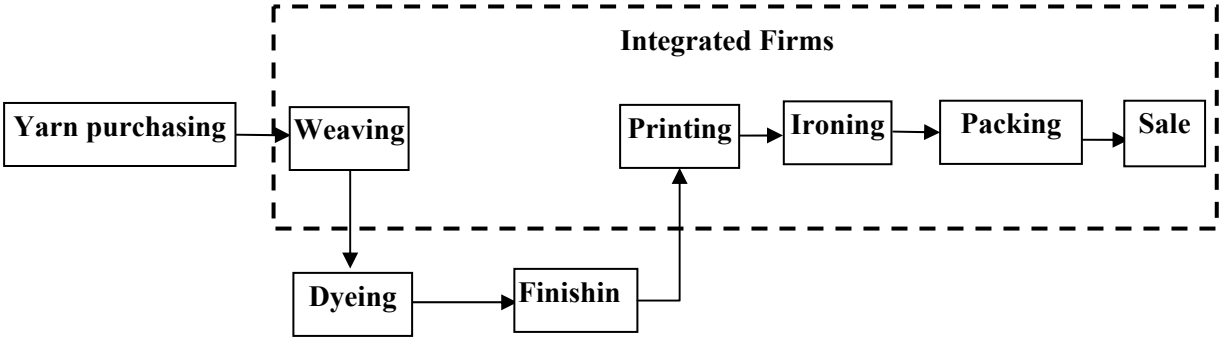
Overall, the evolution of Puyuan cluster resembles the "Wenzhou Model" (Liu, Yia-Ling, 1992; Parris, 1993; Huang, Zhang, and Zhu, 2008). The footwear cluster in Wenzhou studied by Huang, Zhang, and Zhu (2008) and the sweater cluster in Puyuan share many similarities. Both of them started from a small group of entrepreneurs and grew from there. As the clusters increased, they attracted more attention from the local governments, which then adopted various measures to promote their further development, such as opening land for development, forming industrial parks, doling out tax benefits, and developing roads and other infrastructures.

3.2. Two Business Models of Production

The production of the cashmere sweaters in Puyuan consists of eight major steps: yarn purchasing, weaving, dyeing, finishing, printing, ironing, packing and sale. There are two major business models that may be used to organize this production. Figure 2 depicts the first business model, which has a core of integrated enterprises. This organizational chart consists of four entities: large integrated manufacturing factories, yarn dealers, dyeing factories, and finishing factories. Most of these integrated enterprises are located in the industrial park. They purchase yarn from marketplace yarn dealers or directly from yarn factories elsewhere, and complete the weaving process in-house. They then outsource the semi-finished goods to specialized dyeing factories and finishing factories. After this process, the products are ironed, sorted and packaged inside the factory before being ultimately shipped out to the national market through the logistics center.

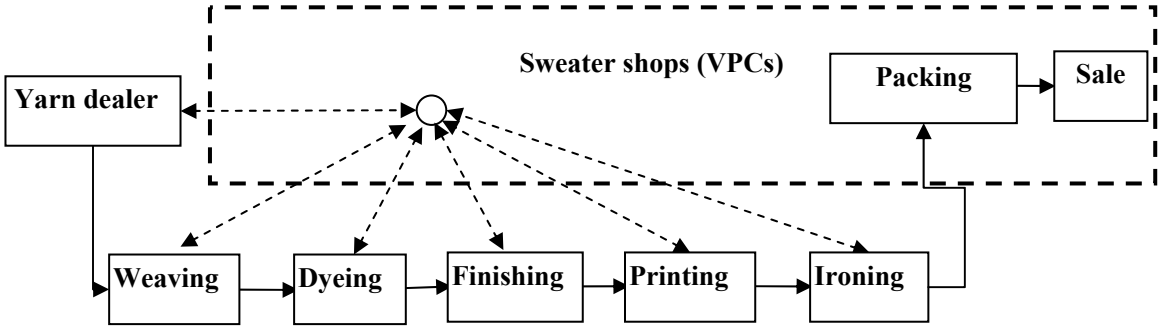
[6] According to the Tongxiang Statistical Yearbook (2005), Puyuan Township had a registered population of about 44,000, excluding migrants. The Puyuan Public Security Bureau estimated that the total number of migrant workers was about 90,000 in 2005. The *China Population Census 2000* (CNSB, 2001) published population data by age at the county level. In Tongxian City, which includes Puyuan Township, the share of working-age individuals in the total population was 71%. We used this ratio as a proxy to estimate the size of the labor force in Puyuan.

Figure 2. Integrated production organization



Note. The dashed-line represents the production process of the big factory, and the arrows show the flow route of the raw material and semi-finished goods in the manufacturing process.

Figure 3. Virtual enterprise organization



Note. The dashed-line represents the production processes of sweater shops. The solid arrows denote the actual flow route of the raw materials and semi-finished goods, and the dashed arrows show information exchange among the entities. Raw materials, semi-finished goods and final products are mainly transported by a specialized group of workers using three-wheeled electric carts. Although they are not shown in the figure, the three-wheelers are analyzed as a separate production stage in the previous tables.

Figure 3 illustrates the second business model, a virtual enterprise model in which sweater merchants, acting as a group of "virtual" production coordinators (VPCs), play a key coordinating role. These VPCs either rent or own shops in the township's designated sweater marketplaces. More often than not, they imitate the designs of big companies or those seen in fashion magazines, using them to guide production of sample sweaters, which they display in their shops. As Puyuan is the largest cashmere sweater market in China, many merchants visit the shops in the marketplaces. When the VPCs receive orders or believe that a certain style will sell well, they purchase raw materials from the marketplace and have them delivered to family weaving workshops down the production chain. The generated semi-finished goods are sent to dyeing, finishing, printing, and ironing enterprises, and the VPCs (merchants) perform quality inspections and package the final products in their shops. If any quality problems are identified, they are traced back to the sources of production and the VPC resolves the issue with the

responsible party. In this business model, the raw materials and intermediate products are frequently transported from one processing point to another by a number of couriers who use electric or man-powered three-wheeled vehicles. After going through this "assembly line," the final products are transported to other markets through the Puyuan logistics center. In essence, this business model is similar to the putting-out system that was widespread in the United Kingdom prior to the Industrial Revolution.

3.3. Sampling Method

We will now move away from the introductory material and discuss the survey design. In August and December of 2005, we surveyed 140 enterprises and gathered 126 complete questionnaires. Based on detailed field interviews and observations, we then designed a sampling scheme. Table 1 shows the total number of enterprises and our sample size by production process. There are two types of yarn dealers: the sales agents of big yarn manufacturers who earn commissions on the basis of sale volume, and the buyers who purchase yarns from different places and sell them in the store. We selected about the same numbers of yarn stores representing each type. There are also two types of sweater stores: those specializing in low-end products targeting the mass market, and those focusing on high-quality products. We randomly selected representative shops in proportion to the total number of stores of each type. In terms of three-wheelers, although regulations require that they be registered and have a legal license plate, in reality at least half of the three-wheelers do not have a legal plate. We randomly sampled both types of three-wheeler drivers according to the total number of registered and non-registered three-wheel vehicles provided by the Puyuan Administration for Industry and Commerce. Most family weaving workshops were concentrated in two villages; the same number of family weaving workshops was sampled from each village. The dyeing, finishing, printing and ironing factories or workshops were concentrated in certain designated areas. We randomly picked samples from those areas. Most of the large manufacturing factories were located in the industrial park. We randomly selected 14 of them from the complete list provided by the Administrative Committee of Puyuan Industrial Park.

Table 1. The number of enterprises by type in 2005

Types	Sample	Total	Sample proportion (%)	Main Characteristics
Yarn dealers	11	250	4.40	Yarn market shop required
Family weaving workshops	32	3,518	0.91	Leased family workshop, small equipment, small-lot production required
Dyeing factories	5	23	21.74	Factory building, large size equipment, governmental pollution control required
Finishing factories	6	42	14.29	Factory building, big equipment, governmental pollution control required
Printing workshops	5	100	5.00	Family workshop, certain amount of equipment, mass production required
Ironing workshops	3	100	3.00	Family workshop, certain amount of equipment, mass production required
Sweater shops (VPCs)	39	5,750	0.67	Shop required
Three-wheeler drivers	10	2,000	0.50	Electric or man-powered tricycles required
Integrated enterprises	14	121	11.57	Factory building, assembly line, mass production required, multiple stages of production
Logistics company	1	1	100.00	Big parking ground, loading ground, a transport team, large investment and capability of coordination required
Total	126	11,905		

Source: Puyuan Township Statistical Center, Administrative Committee of Puyuan Industrial Park and Administrative Committee of Puyuan Marketplace.

4. CAPITAL INVESTMENT

4.1. Starting Capital

Table 2 details the sources of start-up capital for all surveyed enterprises, both integrated companies and those engaged in vertical division of labor. For production enterprises (e.g. integrated enterprises, family weaving workshops, dyeing factories, finishing factories, printing workshops, and ironing workshops), we collected information on both the starting capital and current capital stock. For yarn dealers and VPCs, we did not distinguish between starting and current capital, as these entities did not need to buy machines when starting their business. We counted total capital investment as the sum of the current annual rents, tax payments and working capital for inventory.[7] For three-wheelers, we asked about the purchase date and price of their transportation vehicles. Since our survey included the year of starting the business, we were able to convert a given enterprise's initial capital investment into its 2005 price level, using a national fixed asset price index.[8]

Table 2. Source of starting capital

	Average amount (10,000 yuan)	Founder (%)	Relatives or friends (%)	Banks (%)	Others (%)
Yarn dealers	12.45	83.21	16.79	0.00	0.00
Family weaving workshops	7.31	81.46	15.64	2.91	0.00
Dyeing factories	340.07	47.50	31.87	20.63	0.00
Finishing factories	177.82	29.91	34.14	25.68	10.27
Printing workshops	10.60	77.36	22.64	0.00	0.00
Ironing workshops	3.83	88.26	11.74	0.00	0.00
Sweater shops (VPCs)	12.74	80.58	12.47	6.94	0.00
Three-wheeler drivers	0.54	63.28	36.72	0.00	0.00
Logistics company	4000.00	50.00	0.00	50.00	0.00
Integrated enterprises	263.84	59.59	19.28	21.13	0.00

Source: Survey by authors.

As shown in Tables 1 and 2, the numbers and sizes differ greatly among the 10 types of enterprises in the cluster. The logistics company requires large areas for storage, parking and loading, and therefore represents a significant amount of fixed investment. It is centrally managed by a single company, with the local government as its largest shareholder.

The average investment for a family weaving workshop exceeds 70,000 *yuan*, but the output volume varies greatly among weaving workshops. Entrepreneurs with small amounts of capital may buy a

[7] Utility and wage bills were not included because they are recurrent expenditures on a monthly basis.

[8] China did not publish a fixed asset price index until 1992. Based on *China GDP History Data 1952-1995* (CNBS, 1997), Mingxiu Liu and Qi Zhang computed the index prior to 1992 and posted it on the Forum for Economic Development at http://www.fed.org.cn/. We used Liu and Zhang's price index for the period of 1985 to 1991. The index since 1992 was obtained from the *China Statistical Yearbooks* (CNBS, various issues).

single secondhand machine for only around 2,000 *yuan*, while those with deeper pockets may buy a larger number of new machines.

Dyeing and finishing factories requires large equipment and are suitable for mass production. Furthermore, they are subject to stringent pollution control by the government. These factors raise the bar of entry, with the result that there are relatively few such factories in Puyuan; there were only 23 dyeing and 42 finishing factories present within the cluster in 2005.

The equipment for printing workshops costs more than100,000 *yuan*. On average, an ironing workshop requires about 40,000 *yuan* of investment. Due to government regulations, ironing workshops are standardized and concentrated in a designated zone of the industrial park, where natural gas is centrally supplied. It would be extremely expensive for a single enterprise to equip its own heating system. With the centrally supplied natural gas, the size of an ironing workshop is largely reduced. This group of enterprises is rather homogeneous.

The yarn dealers, VPCs, family weaving workshops, and three-wheelers are far more numerous than the other categories, likely because of the lower threshold of investment. If yarn is sold on a commission basis, dealers do not bear the risk of maintaining an inventory. However, if dealers purchase the yarn outright, the required working capital for inventory will be much higher. There are two types of three-wheelers: the electric ones may cost several thousand *yuan*, while the man-powered ones are less than 1,000 *yuan*. Because the required investment for a three-wheeler is minimal, this profession is almost totally open to entry. Most three-wheeler drivers are migrants from the less-developed Henan and Anhui provinces; these individuals tend to be young, physically strong, and hard working.

The integrated firms often either have their own brands or engage in OEM (original equipment manufacturer) production for other manufacturers. In order to ensure better quality control, these firms often keep multiple stages of production in-house. Therefore, they usually own factory buildings in the industry park. With an average investment of over 2.6 million *yuan*, only a few investors can afford to enter the industrial park. At the time of survey in 2005, there were 121 such integrated firms.

As shown in Table 2, the capital-intensive enterprises (e.g. dyeing, finishing, logistics, and integrated firms), received more than 20% of their starting capital from banks. The other, more labor-intensive enterprises acquired only a negligible share from banks, and primarily relied on founders, relatives and friends for start-up capital.[9]

4.2. Comparison of Enterprises Prior to and After Cluster Formation, As Well as Within and Outside Clusters

In order to test the first hypothesis proposed in Section 2 that vertical division of labor lowers capital barriers, we first compare the major statistics of the non-integrated cashmere sweater enterprises in the Puyuan cluster with those of the integrated enterprises that existed in Puyuan prior to cluster formation. There is relatively little information available on the history of local rural industry prior to its clustering. However, a book entitled *History of Puyuan Township* (*Puyuan Zhenzhi*; Chen, 1996) provides information about seven collectively-owned, textile production-related enterprises in Puyuan in the early

[9] Prior to 2004, there were only state banks. In March 2004, Jiaxing Commerical Bank, a locally-owned shareholding company, set up a branch office in Tongxiang City, about 20 kilometers from Puyuan Township. In 2005, the first pawnshop opened in Puyuan Township.

1980s, prior to cluster formation. The book includes information on the employment and building areas of these enterprises. Although the book does not contain any capital investment data, factory building areas and employee numbers can be used to largely capture an enterprise's size. Table 3 compares building areas and employment between the seven pre-cluster enterprises and the sample average of clustered enterprises in our survey. The factory area of the TVEs (Town and village-owned enterprises) observed in the 1980s was 12 times larger than the average among clustered enterprises in 2005, and the employment sizes of the pre-cluster enterprises averaged five times that observed in our cluster-based sample.[10]

Table 3. Comparison of enterprise sizes in Puyuan between the 1980S and 2005

Enterprises	Year of data	Building area (square meters)	Number of workers
Enterprise sizes, 1980s			
Tongxiang Wool Weaving Limited Company	1981	33,965	91
Tongxiang County Silk and Dyeing Factory	1985	56,713	334
Kaixing Cashmere Sweater Factory	1981	4,535	71
Puyuan Silk Factory	1981	13,412	218
Tongxiang No. 1 Cashmere Sweater Factory	1981	7,615	107
Puyuan Garment Factory	1981	631	50
Zhonghua Cashmere Factory	1981	3,200	162
Average size of the above seven enterprises		17,153	148
Enterprise sizes, 2005			
Average size of enterprises in the Puyuan sample		1,292	30

Note: The seven enterprises from the 1980s are taken from the *History of Puyuan* (Chen, 1996).

Next, we examine the fixed investments of the integrated enterprises in the Puyuan industrial park and elsewhere (Table 4). The data regarding the integrated enterprises in Puyuan come from two different data sources: 14 integrated enterprises in the industrial park from our own 2005 survey, and 136 cashmere sweater production-related enterprises examined by the Administrative Committee of Puyuan Industrial Park in 2006.[11]

[10] It is likely that local governments provided subsidized land to the TVEs; the building areas of the pre-cluster TVEs might have been smaller in the absence of subsidies.

[11] The industrial park expanded from 2005 to 2007. When we conducted our survey in 2005, the park had 121 firms.

Table 4. Required investment for different types of enterprises

	No. of Obs	Max	Min	Mean	Median
Comparison groups					
Langfang, Hebei Province, 1985	30	2,663.9	6.8	192.5	60.4
Inner Mongolia, 2006	99	104,024.3	32.9	3,345.6	321.7
Integrated enterprises in the Puyan industrial park, 2006	136	15,353.0	20.0	1,228.0	862.0
Integrated enterprises in Puyan, 2005	14	1,628.6	105.6	731.7	712.8
Integrated enterprises in Puyan, at the year of starting up	14	863.4	11.1	263.8	220.4
Puyuan cluster					
By division of production					
Yarn dealers	11	30.0	3.0	12.5	10.0
Family weaving workshops	32	43.0	0.2	7.3	4.5
Dyeing factories	5	876.8	68.5	340.1	200.0
Finishing factories	6	548.0	55.5	177.8	65.3
Printing workshops	5	20.0	6.0	10.6	10.0
Ironing workshops	3	4.5	3.0	3.8	4.0
Three-wheeler drivers	10	1.2	0.1	0.5	0.5
Sweater shops	39	50.0	2.0	12.7	10.0
Logistics company	1	4,000.0	4,000.0	4,000.0	4,000.0
Total (excluding the logistics company)	111	876.8	0.1	59.2	10.0
p-value of *t*-test for the difference between firms engaged in vertical division of labor and:					
Langfang, Hebei Province, 1985			0.0007		
Inner Mongolia, 2006			0.0018		
Integrated enterprises in the Puyan industrial park, 2006			0.0000		
Integrated enterprises in Puyan, 2005			0.0000		
Integrated enterprises in Puyan, at the year of starting up			0.0000		

Note: The unit is 10,000 *yuan*. The figures have been adjusted to the 2005 level based on the national fixed asset price index (see endnote 8). The data for Langfang are from the *Second National Industrial Census of China: Directory of Industrial Enterprises with Independent Accounting System in Langfang* (Langfang Diqu Gongye Pucha Lingdao Xiaozu Bangongshi, 1985). The data on enterprises in Inner Mongolia are from the *Directory of China's Textile Industry* published by Shanghai Mengtai Information Limited Inc. The 136 enterprises were identified through the Administrative Committee of Puyuan Industrial Park.

It is a more challenging task to find comparison groups elsewhere. We managed to obtain various sources that discuss enterprise-level information from different time points. In the 1980s, integrated cashmere sweaters factories were operated in a number of places in China; most of these sweater enterprises were either collectively or state owned. Although the complete firm-level data from the *Second Industrial Census of China* in 1985 is not publicly available, the Langfang Prefecture of Hebei Province has posted census data on the web. Based on the firm names and products, we identified 30 firms related to sweater or garment production

In the new millennium, cashmere sweater production in China has become more concentrated in a fewer places, mainly in Zhejiang and Inner Mongolia Province. China's first economic census, conducted in 2004, was supposed to record the most comprehensive enterprise-level information. However, the

released data contained only information about firms above a certain scale of production, preventing us from using the firms as a comparison group. In order to obtain contemporary information of cashmere sweater firms elsewhere, we purchased a directory of China's textile industries from Shanghai Mengtai Information Limited Inc. (2007). From this information pool, we identified 99 cashmere sweater firms in Inner Mongolia Province. Most of the enterprises in Inner Mongolia are integrated, as opposed to the clusters seen in Puyuan.

It is apparent from Table 4 that the average, minimum, and median values of the fixed assets for enterprises in the non-integrated production process in the Puyuan cluster are much smaller than those outside the cluster.[12] The bottom panel presents a simple *t*-test on the null hypothesis that the mean values of investment for the cluster-based enterprises engaged in the vertical division of labor are equal to those in any of the comparison groups (integrated firms both inside and outside the cluster). The small *p*-values strongly reject the null hypotheses and provide good support for our first hypothesis, indicating that the capital barriers for enterprises engaged in vertical division of labor are lower than those integrated firms.

4.3. Econometric Analyses

In the next step, we examine whether individuals within a cluster choose appropriate production types according to their financial resources or access to credits as suggested by the second hypothesis. Using the survey data on the firms involved in the different production stages in the cluster, we respectively regress starting capital, current capital, and the ratio of current capital, each with regard to a set of variables. Table 5 reports the estimation results. We include two dummy variables on the right-hand side to measure the degree of credit access.

[12] Excluding the logistics company.

Table 5. Access to credits and organization choice of production

	OLS			IV			Ordered probit
	Starting capital	Current capital	Current capital/labor	Starting capital	Current capital	Current capital/labor	Type of production
Having access to formal credits when starting the current business	2.157	2.121	0.300	2.325	2.736	1.080	0.989
	(4.05)***	(3.83)***	(0.66)	(1.91)*	(1.9)*	1.14	(2.58)***
Dummy for residency (1=local and 0=other province)	1.451	1.792	1.464	1.434	1.729	1.384	1.553
	(4.99)***	(5.28)***	(5.76)***	(4.68)***	(4.77)***	(5.77)***	(6.16)***
Age	0.037	0.046	0.025	0.038	0.048	0.029	0.040
	(1.72)*	(1.87)*	(1.52)	(1.99)**	(2.16)***	(1.94)*	(2.54)**
Gender (female = 1; male =0)	-0.251	-0.351	-0.095	-0.247	-0.336	-0.077	-0.021
	(-0.82)	(-0.93)	(-0.33)	(-0.73)	(-0.84)	(-0.29)	(-0.08)
Years of schooling	0.173	0.229	0.085	0.176	0.243	0.102	0.189
	(3.12)***	(3.19)***	(2.11)**	(2.67)***	(3.1)***	(1.98)**	(4.50)***
Having experience related to sweater production prior to the year of entry	1.066	1.071	0.703	1.069	1.080	0.715	0.571
	(4.33)***	(3.59)***	(3.49)***	(4.12)***	(3.52)***	(3.52)***	(3.00)***
R-squared	0.44	0.43	0.43				0.22

Note: Robust t statistics in parentheses. The symbols *, ** and *** represent significance levels at 10%, 5%, and 1%, respectively.

The first variable is whether or not an enterprise received bank loans when starting the current business. This variable may be endogenous for two reasons: First, it is likely that individuals with better access to bank credits will choose capital-intensive enterprises. Second, it is possible that some of them might secure bank credits by mortgaging their fixed assets when expanding their current business.[13] To overcome the potential endogeneity problem of this variable, we conduct instrument variable (IV) estimations using a set of dummy variables for the current firms' years of establishment as instruments. China's bank lending follows a cyclical nature, with 1993, 2002 and 2003 standing out as years of notable monetary expansion (Shih, 2008). These three years also correspond to the establishment of the marketplaces and industrial park in Puyuan. Local governments may have pushed the local branches of

[13] In this case we only asked about their current business, although some of the firms have changed their locations and expanded their businesses several times since their establishment.

state banks to extend credits to finance firms during the cluster expansion. The amount of loans received in these three years alone accounted for 73% of the total loan amounts obtained from 1988 to 2004 by the companies in our sample.

When we separately regress the three outcome variables on these instrumental variables, none of the coefficients for the year dummy variables are significant. If we use credit as a dependent variable (1 as yes and 0 as no) and run a probit model, the coefficients for the year dummy variables are jointly significant with a *p*-value less than 0.01, suggesting that the instruments have additional explanatory power. The commonly used instrumental variable estimation technique applies to continuous endogenous variables. However, because the credit variable is discrete, it is more appropriate to use a probit model to predict this endogenous variable in the first step. We use the "treatreg" procedure in STATA to estimate the two-step model.

The second variable measures an entrepreneur's *Hukou* (residency registration).[14] When financial markets are not fully functioning, the residency of an entrepreneur may matter for two reasons. First, at the time of our survey the local residents were richer and had more of their own sources of capital compared to migrants. Second, local residents were more likely than migrants to have local friends or relatives who had capital they were willing to lend. An empirical study on the knitted garment industry in Tirupur, India (Banerjee and Munshi 2004) showed that local residents had better access to capital than outsiders. In other words, when staring a business, a local resident might face a lower cost of capital compared to a migrant. As such, we examine whether residency influences production process choices.

We also include control variables such as age, gender, years of schooling, and having experience related to the cashmere sweater industry prior to the year of entry. In addition to three ordinary linear square (OLS) and three instrument variable (IV) estimations, Table 5 also presents an ordered probit model on the eight major types of production processes and integrated enterprises.

Our results reveal that the coefficient for the credit variable is significantly positive in most regressions, indicating that entrepreneurs with better access to bank loans tend to choose the more capital-intensive production processes in the cluster. When we control for endogeneity, the results hold. The dummy variable for local residency is significant in all seven regressions, indicating that local residents are more likely to set up capital-intensive enterprises. Among the labor-intensive enterprises, most owners are migrants from elsewhere. As the status of residency largely reflects the difference in the opportunity cost of capital, the result seems to support our second hypothesis that entrepreneurs with more available financial resource tend to select more capital-intensive modes of production.

The coefficients for years of owners' schooling and industry-related work experience prior to the year of entry are significant and positive in all regressions. People with higher levels of human capital, as represented by education levels and relevant skills, are more likely to engage in capital-intensive production. Gender plays an insignificant role in determining the mode of production.

[14] Residency is defined as 1 if the entrepreneur's residency registration is in Zhejiang Province, and 0 if otherwise.

5. CONSTRAINTS OF WORKING CAPITAL

5.1. Major Ways to Finance Working Capital

Apart from capital barriers to entry, enterprises may also encounter credit constraints in the course of daily operation. In our survey, we asked about the most common financing instruments the various entities used upon encountering credit constraints of working capital. Table 6 shows the proportion of entities using each of four different financing strategies, broken down by production process. The logistics company and production-related enterprises (e.g. dyeing factories, finishing factories and integrated manufacturing factories) are more likely to receive bank loans compared to the labor-intensive enterprises, primarily because the former can use their fixed assets (e.g. buildings and machines) as collateral to apply for bank credits.

Table 6. The most important financing source when facing working capital problems

Types of Division	Borrowing from relatives and friends (%)	Borrowing from state-owned banks (%)	Trade credits (%)	Other channels (%)
Yarn dealers	63.60	0.00	27.30	9.10
Family weaving workshops	53.00	0.00	47.00	0.00
Dyeing factories	40.00	60.00	9.10	0.00
Finishing factories	33.33	50.00	16.67	0.00
Printing workshops	60.00	0.00	40.00	0.00
Ironing workshops	66.67	0.00	33.33	0.00
Sweater shops (VPCs)	56.40	7.70	33.30	2.60
Three-wheeler drivers	100.00	0.00	0.00	0.00
Logistics company	0.00	100.00	0.00	0.00
Integrated enterprises	50.00	42.90	0.00	7.10

Source: Survey by authors.

The small enterprises rely more on “relatives and friends” as their major means of informal finance. In the cluster, the three-wheeler drivers, who are engaged in the most labor-intensive profession, sought help solely from relatives and friends when facing credit crunches. Yarn dealers, family weaving workshops, printing workshops, ironing workshops, and sweater shops also depended heavily on relatives and friends to ameliorate their working capital constraints. This underscores the important role of social networks in providing informal financing and mitigating the constraints of working capital, in particular for SMEs.

In addition to formal and informal finance, enterprises in the cluster also rely on credit support from upstream or downstream enterprises. Trade credits are ranked as the second or third most popular way to deal with working capital crunches, depending on the type of business (Table 6).

With repeated close interactions within a cluster, the members of upstream and downstream enterprises get to know each other very well, often building a certain level of trust. This trust forms a basis for a given enterprise to acquire trade credit support from the upstream or downstream enterprises.

In the Puyuan industrial cluster, capital credits start from the stage of yarn purchasing. When a yarn dealer makes a first purchase from a yarn manufacturer, the trade generally does not involve credit. However, after a number of transactions have occurred and mutual trust has been established, the yarn dealers can often order yarn with delayed payment.

When a VPC organizes production, it will first purchase raw materials in the yarn marketplace, usually from the same yarn dealers, so as to acquire credit support. Similarly, when the VPC sends raw materials or semi-finished goods to family weaving workshops, dyeing factories, finishing factories, printing workshops and ironing workshops for processing, the payment of processing fees can often be postponed until after the products are sold. With the availability of trade credits, therefore, the VPCs can typically organize production with a rather low level of working capital.

The yarn manufacturers, which are usually large state-owned enterprises, often enjoy generous support from state banks. Through bank loans, part of the capital pressure is passed from SMEs in the cluster to the state-owned commercial banks. This kind of credit transfer along the production chain enables many SMEs to indirectly access credit. In this way, the trade credit arrangements among upstream and downstream enterprises largely alleviate the constraints of working capital. However, this mode of operation also carries potential risks: If a large financial crisis occurs, credit collapses will likely spill over to downstream enterprises along the chain and adversely impact numerous SMEs.

5.2. Flexible Payment Schedule

Flexible payment is another feature in the Puyuan cluster. At least four methods of payment settlement are prevalent in the Puyuan cluster. The first one is to make a payment every given period of time (e.g. every month, quarter, half year, or year). The second is to settle the payment once the accrued amount reaches a predetermined threshold (e.g. 100,000 *yuan*). The third approach is a flexible settlement according to the financial status of the debtor and creditor enterprises. In this system, the debtor enterprises pay off their debts once they have sufficient capital; however, if the creditor enterprise is in urgent need of capital (e.g. for meeting employee salaries), debtor enterprises must make partial payments to help the creditor enterprise. The fourth settlement method is to issue payments following the order of each batch of production.

The left side of Table 7 shows the proportions of the four major settlement methods that the various surveyed market entities adopt. The integrated enterprises and most of the production-processing enterprises choose the first method more often, settling the payment according to a fixed time period (usually monthly or quarterly). The yarn dealers and sweater shops prefer a more flexible payment schedule contingent upon their sale status, primarily because they bear the most market risk and their sales and profits are more variable than those of the production-processing workshops. For transportation services, payment most often follows the orders.

Table 7. Major ways of payment settlement in 2004

	Mode of Payment				Conflict Resolution		
Types of division	By time (%)	By accrued amount (%)	By mutual financial status (%)	By production batch (%)	Lawsuit (%)	Out of court (%)	Mediation (%)
Yarn dealers	36.40	9.00	45.60	9.00	0.00	90.90	9.10
Family weaving workshops	65.63	3.12	28.13	3.12	0.00	96.87	3.13
Dyeing factories	80.00	0.00	0.00	20.00	40.00	60.00	0.00
Finishing factories	83.33	0.00	0.00	16.67	83.33	0.00	16.67
Printing workshops	60.00	20.00	20.00	0.00	0.00	80.00	20.00
Ironing workshops	0.00	33.33	33.34	33.33	0.00	100.00	0.00
Sweater shops (VPCs)	30.80	5.10	61.50	2.60	10.30	89.70	0.00
Three-wheeler drivers	0.00	0.00	0.00	100.00	0.00	100.00	0.00
Logistics company	0.00	0.00	0.00	100.00	50.00	50.00	0.00
Integrated enterprises	78.57	0.00	0.00	21.43			

Source: Survey by authors.Mutual financing and flexible settlements fit the rural industrial cluster very well. The system ensures the normal operation of enterprises in the production chain, and avoids collapses due to credit crunches.

5.3. Contract Enforcement and Conflict Resolution

Because there are numerous transactions involving different parties in a cluster, the use of formal contracts for each transaction could lead to prohibitive transaction costs. Thus, while many large enterprises sign formal business contracts, most SMEs prefer oral agreements. For example, when a VPC sends a batch of yarn to a family weaving workshop for processing, there might be an oral agreement about the desired weaving, the time of delivery, and the time and manner of payment to the workshop. There is no formal contract, which leads to the question: who ensures execution of the agreement?

Although the agreements are not legally bound, SMEs tend not to break the oral agreements for the following reasons. First, there are so many family weaving workshops and VPCs in the Puyuan cluster and the barriers to entry are so low, the market approximates perfect competition. If a family weaving workshop cannot ensure its promised delivery schedule and product quality, it will lose both current and potential clients because word spreads quickly. Conversely, why don't VPCs violate their oral agreements of payment, given the abundance of substitutes? In practice, this rarely happens because an unfamiliar subcontractor offers no guarantee regarding quality and delivery, and it takes time and money to build trust. Consequently, VPCs may not want to act opportunistically to break oral agreements. In these ways, the market serves as a powerful disciplinary mechanism in a cluster, helping to enforce informal contracts.

The right side of Table 7 depicts how different types of enterprises in the cluster resolve disputes. It is apparent from the table that the large enterprises typically opt for formal, legal methods of dispute resolution, whereas the SMEs prefer out-of-court settlements. The latter is largely due to two reasons: first, because it is hard to obtain reliable evidence for legal prosecution, given that most SMEs do not have formal contracts; and second, because the relative court costs are higher for small enterprises compared to larger ones.

6. CONCLUSIONS

The rapid development of rural SMEs has played an important role in China's rapid economic growth over the past several decades. The literature stresses the importance of formal finance in this process of industrialization. However, the state-owned commercial banks rarely offer loans to the SMEs in China. Based on primary surveys in a cashmere sweater cluster in Puyuan, we show that clustering play a key role in helping SMEs overcome financial constraints in several ways.

First, the industrial cluster lowers the capital barriers to entry through the division of labor, enabling individuals to choose the appropriate type of specialization according to their capital portfolio. The deeper the division of labor, the easier it is for people with different talents and endowments to find their own positions. Clustering can be a useful way to facilitate the entry of numerous new businesses at the earliest stage of industrial development, when the financial sector is still in its infancy.

Second, during the course of daily operations, most entities inside the cluster have figured out ways to ease the constraints of working capital. Clustered SMEs often depend upon informal finance from friends and relatives. In addition, through trade credits, SMEs in the cluster indirectly gain access to credits as their working capital.

Third, the availability of flexible payment methods help buffer credit constraints in daily operations. Finally, oral agreements typically substitute for formal contracts in the cluster, lowering the transaction costs by increasing the division of labor.

The development of labor-intensive industries is crucial for generating employment and reducing poverty in many developing countries. Therefore, studying the formation and evolution of clustering, a labor-intensive mode of production, has important policy implications. However, as Williamson (1975) pointed out, subcontracting, which is a common feature in clusters, may also involve excessive transaction costs. It is difficult for an individual enterprise to act alone to reduce many of these transaction costs. As shown in this case study, the local government in Puyuan has taken active collective actions to diminish the transaction costs and support the growth of the cluster. In many parts of the developing world, the local governments may not be as much entrepreneurial as that in China. In the future, it will be useful to examine whether clustering is a viable strategy for rural industrialization in the absence of an active local government, and to identify what kinds of institutions and policies can support cluster-based industrial development.

The development literature has generally emphasized the importance of financial development in promoting industrialization, while largely neglecting the organizational response to financial constraints. During the course of development, in addition to looking for options to relax the most limiting constraints, it is equally important to identify innovations that may help circumvent the existing constraints. The transformation of binding constraints into driving forces for innovation deserves more research.

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