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The Xianggu Mushroom Industry in Xixia County, Henan: A Case Study

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西峡香菇产业的个案研究

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Abstract
The xianggu (shiitake) mushroom industry in Xixia county, Henan, emerged and initially experienced rapid growth during the reform and opening up period. It has benefited from both the rapid expansion of the food consumption market in China and the guidance and support of the local government. After thirty years of sustained expansion, the growth of the mushroom market began to slow down and competition within the industry became fierce. Facing rich and powerful mushroom dealers, individual mushroom farmers have had to bear the brunt of market fluctuations. To break the predicament of farmers' suffering from low prices (because of the bumper harvest paradox) and to help farmers protect their interests and gain a fair share of the industry's profits, and thus to achieve sustained and healthy development of the mushroom industry, important institutional innovations are needed.

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Keywords
xianggu mushroom industry, bag cultivation, Xixia county, mushroom farmers, mushroom dealers, the bumper harvest paradox

提要
西峡县香菇产业在改革开放时期经历了从零开始的飞速增长，这既得益于食品消费市场的迅速扩张，也得益于地方政府的引导和扶持。在经历了三十年的持续扩张后，香菇市场增速开始放缓，业内竞争压力凸显。面对财大气粗的菇行，势孤力单的个体菇农首当其冲，受到市场的挤压。要破解菇贱伤农的困局，帮助菇农保护自己的利益和分享产业的利润，并实现香菇产业的健康持续发展，就需要在产业组织和制度上进行创新。

关键词
香菇产业、袋料香菇、西峡县、菇农、菇行、菇贱伤农

Since 1980, rural China has witnessed what Philip C. C. Huang has called a "hidden agricultural revolution." Characterized by a fundamental structural transformation and a significant rise in agricultural incomes, this revolution has been driven by the convergence of three major historical changes: an increase in the production of higher value-added agricultural products, which has been the result of a second historical change, namely a revolution in food consumption patterns (a sharp increase in the consumption of meat, fish, eggs, and vegetables, and a significant decrease in the consumption of cereals), and, finally, an increase of arable land per agricultural laborer, the result of a decline in the fertility rate and the growth of non-farming employment. Huang described this revolution as "hidden" because it has differed from previous agricultural revolutions in world history in the dynamics and speed of its growth, and because it has not yet attracted the attention it deserves. However, the fact that it is hidden does not affect its significance and impact. This revolution has not only greatly changed rural China and its agriculture, but has also significantly improved the lives of Chinese farmers in a very short time. Although the revolution has brought profound changes to rural China, the organization of agricultural production that has supported the revolution has not fundamentally changed: it remains the small family farm. The differences, however, are that the acreage per farm laborer has increased and the mode of production has changed from "labor-intensive" into a "dual intensification of labor and capital." After more than thirty-five years of development, Huang argues, the agricultural revolution in China is now at a critical turning point which will determine the future of small family farming in China: will it move toward an East Asian–style of small-scale cooperative "horticulture" or toward large-scale capitalist agriculture modeled after the U.S. experience? (Huang Zongzhi, 2010, 2016; Huang, 2011).

Inspired by Huang's research, we conducted field research on the mushroom industry in Xixia county in Henan in July 2016. In two weeks we visited several xianggu cultivation bases of various sizes, interviewed more than a dozen local people who were mushroom farmers, dealers, local officials, and mushroom-related

employees. This field work allows us to piece together a general picture of the history of the xianggu mushroom industry in Xixia and the dynamics behind it. The development of Xixia's mushroom industry is a very typical case that can help clarify the basic characteristics of the "hidden agricultural revolution" as well as the problems and choices facing rural China after this revolution. The swift rise of the xianggu mushroom industry has been driven by two forces: a breakthrough in cultivation technology and a rapid and sustained expansion of the market, which is the result of the rapid growth of national income and the subsequent upsurge in food consumption. However, the market has not been the only force behind the prosperity of the xianggu mushroom industry. When we look closely at the development of this industry at the local level, we see that—aside from the important role of the local environment and resource endowments—guidance, support, and regulation from the local government have also been a vital factor. Both the macro-market environment and a suitable micro-economic climate created by the local government have contributed to the boom of the xianggu mushroom industry in Xixia. After thirty years of extraordinary development, the mushroom market has now begun to slow down; competition has increased and it is no longer the case that everyone can easily make money because of a rapid expansion of the market. To cope with the market slowdown, the mushroom industry needs institutional innovations rather than an expansion of capacity. In principle, this situation is exactly the same as Huang has pointed out for the country as a whole: China is facing a grand historical choice after the "hidden agricultural revolution." This choice is testing the wisdom, vision, and ability of everyone in the agricultural sector. And of course, it is also testing the wisdom and leadership of the Chinese government.

The Development of the Xianggu Mushroom Industry in Xixia

Xianggu mushroom (*Lentinus edodes* 香菇 also known as "shiitake" mushroom), a fungus planted on decaying wood, is one of China's largest edible fungi in terms of production and consumption. It is nutritious, palatable, and widely prized by consumers at home and abroad. The history of the artificial cultivation of the xianggu mushroom in China can be traced back more than eight hundred years (Zhang, 2013: 6; Baidu Encyclopedia, 2016), but it was not until the 1980s that artificial cultivation of the xianggu mushroom on a large scale began. Mushroom cultivation extends from Southeast to Central and North China and has become an important industry in many rural areas. Like other edible fungi, the xianggu mushroom is cultivated using animal or plant waste as raw materials, and has an input-output ratio that is much higher than most other crops,[1] making it highly profitable for its cultivators. It has, moreover, contributed significantly to economic development in the areas where it is cultivated.

[1] Some experts have estimated that the output value of edible fungi is 3.8 times that of greenhouse tomatoes for the same acreage, 29 times that of cotton, and 67 times that of the wheat (Lu and Li, 2012).

Before 1978, there was virtually no xianggu mushroom industry in mainland China. In 1985, China's total output of xianggu was 5,000 tons, accounting for only 12 percent of the world total of 40,000 tons.[2] In the same year, production in Japan, South Korea, and Taiwan was 24,000, 3,000, and 4,900 tons respectively. But in 1989, China surpassed Japan and became the largest producer of xianggu mushrooms. In 1990, China's annual output exceeded 30,000 tons, surpassing the total output of Japan, South Korea, and Taiwan combined (Zhang, 2006: 73; Zhonggu, 2014). The xianggu mushroom industry in China thereafter continued to grow, and its scale of production and output reached a new height in the years that followed. According to official statistics, in 2008 China's fresh xianggu mushroom production exceeded 3 million tons; in 2011, 5 million tons; in 2013, 7 million tons; and in 2014, 7.35 million tons (Chinese Industrial Information Network, 2015). Today China is the world's largest xianggu mushroom exporter. In 2014 it exported 89,400 tons of dried xianggu mushrooms,[3] with the total value US$1.259 billion (Ministry of Commerce, 2015), and in 2015 exports reached 97,400 tons, amounting to US$1.449 billion (Edible Fungi Association of China, 2016).

The exponential growth of the xianggu mushroom industry can be attributed to the expansion of the scale of cultivation as well as progress in the technology of cultivation. During this period, the most important technological breakthrough has been using substitute materials 代料 to replace wood 原木. Originally, xianggu mushrooms were grown on logs 段木 (about 10 cm in diameter and 50 cm or longer in length). This method, 原木栽培, consumes a great deal of forest resources and thus causes serious damage to the environment. It is also time-consuming and requires a great deal of labor, but the yield is low. The new technology, known as substitute cultivation 代料栽培, uses hardwood sawdust, straw, and wood fibers plus wheat bran, rice bran, and others, as nutritious ingredients to replace wood as the culture medium (called "culture materials" 菌材 by mushroom growers) for growing mushrooms. The culture materials can be put into a variety of containers or molded into various shapes. In 1982, mushroom farmers in the province of Fujian put culture materials in plastic bags and made them into cylindrical sticks on which mushrooms were grown (culture materials in a cylindrical shape were therefore called "culture sticks" 菌棒 or "culture bags" 菌袋) and achieved excellent results. This new cultivation technology quickly spread to many areas and became the most popular method of mushroom cultivation in China. The size of culture sticks or culture bags varies from area to area. In Xixia county, the plastic bags are commonly 17 cm × 55 cm, which can make a culture stick of about 11 cm in diameter and 50 cm in length. Because substitute cultivation now widely involves using culture bags, it is also called "bag cultivation" 袋料栽培.[4]

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[2] Throughout the article, when we speak of "China" we are referring to the mainland.

[3] The ratio of fresh mushrooms to dried mushrooms is about 8:1.

[4] In Chinese both "substitute cultivation" 代料栽培 and "bag cultivation" 袋料栽培 are pronounced the same. Although people use these two terms freely and interchangeably, historically

After xianggu strains have been inoculated, the culture bags are placed in the shade in a greenhouse, so that mycelia 菌丝 can grow into biofilm 菌膜 in the bags, and, in due course, mushrooms will emerge. Compared with wood cultivation, substitute cultivation can not only greatly save the use of wood, but also significantly raise productivity and efficiency. Furthermore, the culture materials can be blended following different formulas to suit the biological characteristics of various edible fungi, and raising mushrooms in greenhouses, rather than in the open, makes it easier to control the conditions required for different cultivation needs. Thus the yield and quality of mushrooms are relatively stable, the production cycle is comparatively short, and returns on money invested are quicker.[5] Judging by product quality and economic efficiency, bag cultivation is much more productive and effective than wood cultivation. In addition to all these advantages, bag cultivation can be widely adopted in most areas, and it has also paved the way for factory production of xianggu mushrooms (Yang, Qiao, and Guan, 2000: 79–80). The boom in the mushroom industry in China since the 1990s can be attributed in the first instance to the large-scale adoption of bag cultivation technology.

Xixia county is located in the southwest corner of Henan, in the foothills of the Funiu Mountains 伏牛山. The climate here is mild, rainfall is moderate, and 80 percent of the area is covered by forests. Since the 1980s, due to Xixia's very suitable geographical and climatic conditions and good transportation links, the xianggu mushroom industry has expanded rapidly, and mushrooms have become a major cash crop and a pillar of local agriculture.

The xianggu mushroom industry in Xixia has gone through several stages, corresponding with the evolution of cultivation technology. In the 1970s, Xixia county became a site of production of black fungus, *Agaricus bisporus*, and other edible fungi (Xixia County Gazetteer, 1990: 199–205). Beginning in the mid-1980s, some villages and towns in mountainous areas started raising xianggu mushrooms using logs. In 1984, the Research Center for Edible Fungi—state-owned and sponsored by the county government—was established with the aim of providing technical services for the production of edible fungi. The center employed experts from home and abroad as technical advisors, and collaborated with well-known research institutions to breed strains of xianggu mushrooms suitable for local cultivation. In 1988, the county government organized a trip to study wood cultivation of mushrooms in Jingshan county 京山县 in Hubei,[6] and began wood cultivation locally after the trip (Yan, Bai, and Li, 2014). In the early 1990s, Xixia became the largest production base for wood cultivation of xianggu mushrooms in China (Xixia County Gazetteer, 2010: 249–50). However, since wood cultivation

substitute cultivation preceded bag cultivation (Zhang, 2013: 191–92). And by definition, the term "substitute cultivation" is more extensive than "bag cultivation."

[5] Bag cultivation usually starts in the spring and ends in the fall/winter with the harvest, but there are also varieties where cultivation begins in the fall and harvesting takes place in the summer.

[6] In the original source, the county is referred to 金山, a typographical error for 京山 county.

consumed large quantities of timber and forest resources and was inefficient, it severely restricted the scale of production.

In 1995, in order to solve the problem of the huge consumption of forest resources, a delegation, headed by the secretary of the Xixia County Communist Party Committee and composed of officials from different county bureaus and townships, went to Pan'an 磐安 and Qingyuan 庆元 counties in Zhejiang to study bag cultivation of mushrooms. After returning, the county government drew up a development plan for the xianggu industry and set up a special office, the Office for the Production of Edible Mushrooms, to organize and guide the production of xianggu mushrooms countywide. In 1996, about 3.22 million bags were cultivated and total output reached 2 million kilograms. In the spring of 1997, the county's party committee and the government set up an office headed by the party secretary and the county magistrate to promote the production of edible mushrooms. The development of the xianggu mushroom industry was listed as the "number 1 project" in the county's economic plan. Every township was also required to set up an office to guide mushroom production. That year production swelled to 28 million bags, and thereafter output began to grow by leaps and bounds. In 1998, about 40 million bags were cultivated in the county, with a total output of 7 million kilograms of dried mushrooms with a gross value of ¥260 million. The next year, the cultivation figure rose to 50 million bags and total output was 8 million kilograms of dried mushrooms, a tenth of the total national production. This made Xixia the largest producer of high-quality mushrooms in the country (Xixia County Gazetteer, 2010: 22–23, 249). Since 2000, Xixia's xianggu mushrooms have won many awards nationwide (Liu Chaorui, 2003).

The booming xianggu mushroom industry has brought a significant increase in the income of Xixia's farmers. According to Liu Chaorui, former county magistrate and county party secretary, during those years 50,000 out of the county's total of 80,000 households cultivated xianggu mushrooms, and the average annual total income was about ¥400 million, or ¥8,000 per household. In 2002, rural per capita net income in Xixia was ¥2,100. The income from xianggu mushrooms accounted for more than 80 percent of mushroom farmers' total income, as well as 45 percent of the county's per capita net income. Xianggu mushrooms also made an important contribution to the finances of Xixia's townships. Thirteen of the eighteen townships in the county raised mushrooms on a large scale. The tax revenue from mushrooms totaled ¥22 million a year—¥1.692 million per township—accounting for 40 percent of township revenue.[7]

[7] Since 1986 Xixia county levied a specialty tax 农林特产税 of 8 percent on mushrooms and related products. From 1996 to 2000, with the rapid expansion of mushroom, kiwi, and herbal medicine production, the tax revenue grew at a rate of 30 percent annually, and became an important source of local revenue (Xixia County Gazetteer, 2010: 556). In 2002, following the order of the State Council on reforming rural taxes and fees, the Xixia government rescinded the specialty tax on mushrooms (Liu Songxian, 2016c).

During the eight years from 1995 to 2003, income from xianggu mushrooms made it possible for Xixia's farmers to make capital investments of ¥3 billion. A large number of farmers have moved into urban businesses and set up factories, which in turn has caused a boom in small towns and private enterprises. The total number of industrial and commercial households in the county increased by 67 percent within five years: from 4,116 in 1997 to 6,865 at the end of 2002. Two-thirds of such households were engaged one way or another in the mushroom business. The mushroom industry also stimulated processing, transportation, and even tourism in the county, lengthening the industrial chain locally. By 2003, more than 380 companies were engaged in mushroom storage, wholesaling, transportation, and initial processing, and employed tens of thousands of workers. To meet the demand for both fresh and dried mushrooms, local mushroom dealers opened 68 storage facilities, with a capacity of more than 6,000 tons in total (Liu Chaorui, 2003).

During this period, people used the hand-cut method in bag cultivation. That is to say, sawdust and other materials were stuffed into thick plastic culture bags. The bag had to be thick enough to retain moisture after water was injected. When mushrooms began to grow from inside of the bag, small cuts were made on the bag surface to allow the young buds to break out and grow into mushrooms. This manual cutting work was very laborious and time-consuming. The shape and quality of mushrooms largely depended on the worker's cutting skill. Though the mushroom industry achieved large-scale production in Xixia county, the hand-cut procedure became a bottleneck.

In 2010, a cut-free method was introduced in the county. This method uses two plastic bags: a thin bag within a thick bag which contains culture materials. When mushroom buds begin to emerge, the outer bag is removed and young mushrooms then easily break through the thin inner bag without human intervention. This method can not only save a significant amount of labor, but it also improves the quality of the mushrooms. As a result, the bottleneck constraining the scale of production was broken. Many farmers, in fact, doubled their production.[8] County-wide, in 2010 a record high of 150 million bags were cultivated (Annual Work Report, 2011).

Since 2011, mushroom production in Xixia county has always been above 100 million bags. According to a survey, the county's output of fresh mushrooms was 270,000 tons in 2011,[9] ten percent of China's total, valued at ¥1.6 billion, or 55 percent of the county's total agricultural GDP (Yan, Bai, and Li, 2014). In 2012, 130 million bags were cultivated in fifteen of the county's townships, with total output

[8] With the cut-free method, mushroom production expanded, but per bag yield has been reduced.

[9] We often found significant gaps between mushroom cultivation figures and output figures from different sources, making it very difficult to judge the accuracy of these figures. But one thing is certain: since 2010, the cultivation scale in Xixia has been consistently above 100 million bags.

reaching 170,000 tons, valued at more than ¥1.1 billion. The total revenue related to mushroom industry was ¥2.5 billion (Xixia Today, 2012; Annual Work Report, 2013). By 2012 income from mushrooms accounted for half of the per capita net income of farmers.

Xixia's mushrooms are not only sold on the domestic market but are also exported in large quantities. Mushrooms exported from Xixia amounted to 2,920 tons with a value of US$34 million in 2008; 4,100 tons and US$58 million in 2009; 6,300 tons and US$81 million in 2010; 7,800 tons and US$111 million in 2011; and 8,100 tons and US$120 million in 2012 (Yang, 2013). In 2013, the value of mushroom exports swelled to US$410 million, and in 2014 Xixia led the nation in mushroom exports, breaking the US$600 million mark (Annual Work Report, 2015). The value of exports in 2015 was also around US$600 million (Annual Work Report, 2016).[10]

The Xianggu Mushroom Market in Xiping Township

Xiping township 西坪镇, the westernmost township of the county, is adjacent to Shaanxi province and has excellent transportation links: it is served by two expressways, two national highways, and a rail line. In the 257–square-kilometer township are 19 administrative villages and 1 neighborhood 居委会, with a total population of 41,000 in more than 9,000 households. The township is mountainous and 80 percent of its area is covered by forest. Since the late 1990s mushroom cultivation has become a major pillar of the local economy.

In 1992, wood cultivation of xianggu mushrooms was introduced in Xiping. However, because of the low economic efficiency of this technology, the scale of cultivation was very small. But once substitute cultivation was introduced, the scale significantly expanded. About 300,000 bags were cultivated in 1997, 800,000 bags in 1998, and, in a huge leap, 20 million in 1999. The boom in the mushroom industry has raised both local farmers' income and the local government's revenue. About 70 percent of the township's farmers are engaged in xianggu production and the income from mushrooms accounts for 70 percent of farmers' income. Similarly, the mushroom industry provides 70 percent of the township government's revenue. After twenty years of development, Xiping now cultivates 16 million bags a year, producing 15 million kilograms of fresh mushrooms annually, with a value of ¥200 million (Xiping Township Government, 2012a). Eleven villages now specialize in mushroom production (Liu Songxian, 2016a).

To promote sales, the township government provided tax relief for mushroom dealers from Zhejiang, Fujian, and other places who did business in the local market. It also encouraged local mushroom dealers to sell Xixia's mushrooms to other places. The township government tried to exploit Xixia's advantages in

[10] According to the "Xixia Today" news page on the Xixia government's website (2013, 2015, and 2016), the value of mushroom exports was $410 million, $570 million, and $600 million in 2013, 2014, and 2015 respectively. These export values included both mushrooms and mushroom products, such as canned food, chips, and other processed products.

transportation and location to make it a key mushroom market serving the transborder region of western Henan, southern Shaanxi, and northern Hubei. After years of development, the town of Xiping has become a major trading center for xianggu mushrooms, serving nine townships and five nearby counties. Apart from locally produced mushrooms, large quantities of supplies also come from those five counties. Mushrooms from the local area have been sold to Guangzhou, Xi'an, Taiyuan, Wuhan, Ji'nan, Lanzhou, and other large and medium-sized cities (Xiping Township Government, 2012b). In recent years, the annual trading volume of Xiping's fresh and dried mushroom has reached 80,000 tons and 2,000 tons respectively, and total sales amount to more than ¥600 million. Fresh and dried mushrooms are sold not only domestically, but also are exported to the EU, the United States, Southeast Asia, Russia, and elsewhere (Liu Songxian, 2016a; Interview 10).

Market and Government in Xixia's Mushroom Industry

The market has played a very important role in factor allocation and has provided incentives for the development of Xixia's mushroom industry. Most street shops in the county seat and in many local towns are engaged in mushroom-related businesses. Signs advertising mushrooms tend to be overwhelming. A variety of products and services addressing the needs of every link in the production chain can be found in Xixia's market. For example, in the town of Xiping, one can find shops for culture materials (such as sawdust and wheat bran), plastic bags for making culture sticks, construction materials for building greenhouses, packing boxes, and so on. Special devices and equipment for mushroom production, such as bag-filling machines, sterilization furnaces, and dryers also can be purchased from manufacturers and suppliers in town. There are also shops and factories that prepare and supply strains for mushroom production. Numerous mushroom-dealer warehouses in Xiping collect fresh or dried mushrooms from farmers and sell them to domestic and foreign buyers. In addition, there are shipping companies and even shops for mushroom-feet (the lower part of the xianggu mushroom, also called "the mushroom handle"). The market also provides paid services for many production links using special equipment. For example, wood milling (processing sawdust), filling bags, sterilization of culture materials, inoculation, and so on. During the busy season, the local labor market mobilizes local workers and also attracts many people from neighboring counties.

Everyone and every household, according to their ability, resources, and personal preferences, can find a niche in the industry chain to make a living. In Xiping, we interviewed a shopkeeper selling cigarettes and liquor as well as culture materials and plastic bags for growing mushrooms. He told us that his shop sold about 30 tons of plastic bags (about 200 million bags) a year, with a total revenue of ¥280,000. His profit is more than ¥20,000. There are more than a dozen shops selling plastic bags in the town, with some selling more than 40 tons a year (Interview 1). A shopkeeper who runs a shop selling cardboard boxes used for packing

mushrooms told us that her husband was a migrant worker. She managed the shop alone and made enough to support her two children, one in middle school and the other in college (Interview 2). We also interviewed the owner of a mushroom-foot shop in the town. With the help of a ten-year-old boy, the owner and his wife were busy airing, weighing, and loading mushroom-feet on a concrete slab in front of the shop. The owner told us that mushroom-feet can be made into mushroom sauce or seasoning. The shop purchased 100,000 kilograms of mushroom-feet a year. The mushroom-feet sold for ¥3.20 per kilogram, and thus the shop's annual sales were ¥320,000. The owner did not disclose his income (Interview 4), but judging from what we saw and from our conversation with him, we are confident that his shop earned its income through hard work.

Town residents can take advantage of all kinds of business opportunities in the supply and marketing links of the mushroom industry, while village residents can find opportunities in the mushroom production chain. An interviewee in the village of Xigang has raised mushrooms for the past nineteen years. In recent years, he and his wife manage about 10,000 bags a year. Since mushroom cultivation has continued to expand, bag filling and sterilization services are in demand and have become profitable. Our interviewee bought a bag-filling machine and a sterilization furnace to provide filling and sterilization services for local mushroom farmers. The filling machine and furnace cost him ¥7,000–¥8,000 and ¥3,000–¥4,000 respectively. Every year in February and March, his business is very busy. He charges ¥0.20 for filling a bag and ¥0.05 for sterilization a bag. In about two months, he can net ¥10,000, after deducting all costs and wages (he hired four workers) (Interview 12).

Another interviewee in Xigang does not cultivate mushrooms herself but instead organizes several people during the slack spring season to provide inoculation services in neighboring villages. She provides the equipment and the mushroom farmers prepare strains and culture materials. The price for an inoculation is ¥0.20 a bag. In two months she can earn a little more money than if she hired herself out (Interview 14).

If one has some money and is motivated to learn, one can get technical training and a license, and then open a factory to produce mushroom strains. A couple we interviewed, Wang Zhiheng and his wife, set up a small factory in the county seat to produce mushroom strains. They invested a hundred thousand yuan to rent space and factory buildings, purchase raw materials, and hire workers. The annual output of the factory is about 75,000 kilograms of strains. The production cost for each kilogram of strains is about ¥1.50, and profit is between ¥0.50 and ¥1 per kilogram. Mr. Wang told us that there were two to three hundred strain factories in the county; the large ones could produce 500,000 kilograms of mushroom strains or even more (Interview 6).

There are also residents, most of whom are middle-aged stay-at-home women, who do not grow mushrooms, nor do they engage in any business related to supply or retail. Yet they can still earn a relatively stable income from different kinds

of jobs in the mushroom industry. When we were doing our survey in Xiping, we spotted several women sitting beside a conveyor belt sorting mushrooms in front of a mushroom dealer's shop. They told us that they all came from neighboring villages. They were paid ¥7 an hour. If they worked ten hours a day, thirty days a month, they could earn more than ¥2,000. For them, this was extra income since if they did not work, they would stay at home doing nothing. Xiping's villagers told us that during the mushroom harvest season, all the local residents were mobilized without exception to take care of their own mushroom business or work for other people. Every morning, noon (when most people go back to their village homes to have lunch), and evening, the back and forth flows of commuting people and vehicles (motorcycles, electric bikes, and bicycles) crowded the roads connecting the town and surrounding villages like a huge parade. Because the local work force could not meet the needs of the local labor market, workers from neighboring counties were also hired. And since local wages were pushed up by the booming mushroom industry, people from outside were more than willing to work in Xixia (Interviews 7 and 10).

Collecting mushrooms from numerous individual mushroom farmers and selling them in markets are important parts of the industrial chain. Participating in this chain requires a large amount of capital as well as a large number of workers. In addition, appropriate institutional arrangements are also essential. With the continuing expansion of the market, a clear division of labor between fresh and dried mushrooms in terms of purchasing and selling has emerged. Fresh mushroom dealers need large-capacity cold storage facilities, and dried mushroom dealers need drying equipment. Both types of dealers need a large sum of cash (depending on the size of their business) to purchase mushrooms from farmers, because small farmers will not sell on credit. On the other hand, a wholesaler who purchases large stocks of mushrooms from dealers will not pay dealers immediately, and so dealers usually have to wait a week or longer to get paid.

Fresh mushroom dealers have to turn over their stock quickly because fresh mushrooms do not stay fresh for long even if they are kept in cold storage. Furthermore, the market price for fresh mushrooms is volatile, making the mushroom business risky. If purchases and sales are not timely, the dealer will suffer a loss. Some fresh mushroom dealers therefore have purchased drying equipment to prevent losses due to delayed shipping. If the business reaches a certain scale, a dealer must have a reliable market distribution network, or even transportation of his own, or he will run a great risk.

Running a dried mushroom business, on the other hand, is relatively simple. As long as the merchant has a large warehouse and enough money to keep his mushrooms in storage, he faces relatively little risk from market fluctuations. In Xiping, the big dried mushroom merchants have their own warehouses and drying equipment, and some even hire workers all year round to process, sort, and pack mushrooms. There are also many small and medium-sized dried mushrooms dealers, whose operations are very similar to the brokerage model found in Ming

and Qing times.[11] They provide room and board for outside wholesalers and help them to find a supply of goods, and they also serve as middlemen between sellers and buyers to facilitate deals. For their service, they charge a commission from wholesalers for closed deals based on the size of the transaction, usually ¥0.80 a kilo (Interviews 7, 10, and 11).

In Xixia, most dealers are local people, while wholesalers are outsiders mainly from Fujian and Zhejiang. In the early stage of Xixia's mushroom industry, wholesalers were all outsiders, but in recent years quite a few local mushroom dealers have sufficient resources to trade on the national and even the overseas market. The county government also encourages local businessmen to get into the export market, as is evident in the slogan "Buying from the country, selling to the world." The purpose is to further expand the local mushroom market and turn it into a major national trading center for purchasing, wholesaling, and exporting. We have witnessed movement in this direction in Xiping.

The mushroom market in Xixia functions in an orderly and sound fashion, follows a spontaneous logic without any artificial interference and control, and allows everyone to play their proper role. In this regard, the market is fair and efficient at least formally. (In principle, especially in the early stage of industrial development, when the market is expanding rapidly, the economic differentiation between people is not large and everyone has a relatively equal opportunity to participate in the market.) However, the market is not a panacea. It is obvious that the introduction of the xianggu industry from Zhejiang and Fujian to Xixia during the 1980s–1990s was not the result of spontaneous market forces, but rather the efforts of the county government. Without this initial impetus, no matter how powerful market forces might have been, it is doubtful that the market alone could have transplanted an industry a thousand miles away into the local area so fast and effectively. It is the Xixia government that targeted the xianggu mushroom as a leading industry that could mobilize local people to escape from poverty. In the early days of development, the county government led local officials to Zhejiang and Fujian to study mushroom cultivation, and, as mentioned earlier, it also set up a special office at the county level to guide mushroom cultivation throughout the county. The county authorities ordered the township governments to set up pilot mushroom cultivation projects to inspire local farmers. The county government also organized technical personnel to write manuals for farmers, offered training sessions, and gave video road-shows to circulate cultivation know-how among farmers—all these services were free of charge (Xixia County Gazetteer, 2010: 249–50). To encourage farmers to grow mushrooms, the county government even provided them with subsidies. Especially when bag cultivation was first introduced, the government gave farmers ¥0.40 for each culture bag, or offered them culture bags at a low price of ¥2 per bag (Interviews 7 and 8). Because of the government's efforts, the xianggu mushroom industry took root in Xixia. In central

[11] On the Ming-Qing brokerage model, see Hu Tieqiu, 2015.

China there are many counties whose geographical and climatic conditions are very similar to those of Xixia, but only Xixia became a major nationwide production site. This remarkable achievement should be attributed to the hard work and dedication of all the people involved in the industry, but especially the local government for its many years of planning, guidance, encouragement, and support. Only when the mushroom industry had gotten started in Xixia was the market able to play its role as the "invisible hand" allocating resources and pushing the industry forward into a virtuous cycle.

After the local mushroom industry began to take off, the Xixia government did not take a laissez-faire approach to market forces, but kept a close eye on the market and stepped in to coordinate and manage the market when needed. The results proved to be positive. In 1999, after the adoption of bag cultivation, mushroom output soared. Wholesalers from Fujian and Zhejiang took advantage of this situation by offering low prices for mushrooms, which caused anxiety and discontent among mushroom farmers. The county government sent staff to other provinces to gather price information. After a careful assessment, it asked the township governments to buy mushrooms to stabilize the purchase price. The Xiping township government spent more than ¥200,000 to purchase mushrooms. In the fall and winter that year, the courtyard of the township government compound was full of mushrooms spread all over the ground to be dried. Government intervention caused some backlash from wholesalers, and some hired people even picked fights in the markets. However, timely intervention was successful. The market calmed down, prices stabilized, and the interests of mushroom farmers were secured (Interview 8). Theoretically, market prices are decided by supply and demand, and no government intervention is needed. However, if there is asymmetry of information and economic power between the seller and the buyer, prices can be easily distorted in favor of the party who controls more information and is economically more powerful. In the above case, the buyers had more market information and also greater economic power. Scattered individual farmers simply were at a disadvantage. Facing powerful wholesalers, they had no way to resist. Under these circumstances, the government intervened with economic tools to balance the equation.

At first, farmers used wood from their own contracted forest land, but with the rapid expansion of mushroom cultivation, local forest resources were depleted in just a few years. Erosion caused frequent floods and an environmental crisis was looming (Zhao, 2011). Xixia county is located in the water catchment area of the Danjiangkou Reservoir 丹江口水库, which is the starting point of the middle route of the South-to-North Water Transfer Project 南水北调中线工程. Once construction on the project started in late 2003, the central government gave a strict order to local governments regarding environment conservation in the catchment area. Thus, early in 2006, the county government issued a ban on cutting down trees. All mushroom materials (mainly wood) thus had to be brought in from outside. The county government organized a large number of staff to buy

raw materials from neighboring provinces and sold them to local mushroom farmers. The government wanted to secure the supply of culture materials, but also to ensure the quality of those materials. This was a very heavy extra workload for the local government and very stressful. Liu Songxian, the director of the Xiping's petition office, recalled that in 2006 and 2007, officials in the Xiping township government were extremely busy, working more than ten hours a day and almost all year round. Nonetheless, mushroom farmers complained that the government purchase monopoly pushed up the price of culture materials. Thus at the end of 2007, the county government ended its control of culture material imports—although at the same time it announced it would "strengthen" its "supervision" of the market for culture materials and that people who were doing culture material business would have to have a license (Xizhengwen, 2007). In any case, the price of culture materials dropped from ¥0.72 a kilo to ¥0.60 (Interview 8).

We cannot simply blame the market for the deforestation caused by farmers. By cutting down trees on their own contracted forest land to produce mushrooms, farmers could greatly lower their production costs. And this was an economically rational choice. However, the consequences were devastating. Though farmers' income increased, the environmental damage became increasingly serious. This is a typical case of economic externalities. It is clear that these externalities could not be quickly resolved by relying on the market itself. In this sense, what was involved was a market failure. Under this situation, even if we believe the market can solve externalities through the free trade of property rights, we can imagine that this process will take a long time and incur high transaction costs.[12] Whether the local environment and community can endure more damage caused by such delays is a big question. Therefore, the market intervention by the Xixia government under pressure from both the environment and higher levels of government was timely and beneficial to the sustainable development of the mushroom industry and of the local economy.[13]

Environmental pressure has also convinced the Xixia government that it is important to improve the efficiency and quality of production, rather than pursuing quantity expansion blindly. In 2010, the county government proposed to "introduce new varieties of mushrooms of high quality and efficiency, to search for and

[12] According to neo-institutional economists, as long as the property rights of interested parties are clear and can be freely traded, externalities can be solved through transactions of property rights (Coase, 1990 [1988]).

[13] However, importing culture materials is an action of exporting externalities to the areas that exported the materials, and this may cause pressure or damage to the environment of those areas. In our interviews, we heard concerns from the local officials and people on the sustainability of importing culture materials. Since 2011, the Xixia county government has no longer disclosed in its annual work reports the quantity of imported culture materials. It is very likely that the government wanted to avoid public criticism for the transfer of externalities. Of course, purchasing culture materials can also be seen as a way of trading environment rights with material exporting areas. Whether trading property rights can solve the externalities discussed here is a very complex issue beyond the scope of this article.

promote technologies that can raise production and the quality of mushrooms, as well as the output efficiency of culture materials" (Annual Work Report, 2010). In 2009, Xixia imported 170,000 tons of materials, nearly doubling the imports of the preceding two years. The following year, because of the adoption of cut-free technology, mushroom cultivation reached a record high of 150 million bags, an increase of 76 percent over 2009. To cool down this explosive expansion, in 2011 the county government for the first time required that "the scale of production be adjusted" 调菌 downward, setting the goal of 80 million bags for that year. This was only around half the number of bags cultivated in 2010. At the same time the government spoke of the need for "standardized production and intensive development" 标准生产、集约发展, asking each of the key townships to set up one or two standardized production bases for mushroom cultivation to serve as models for mushroom farmers (Annual Work Report, 2011). In its annual reports since 2011, the county government has repeatedly called for controlling the scale of mushroom production, even if it no longer sets quantitative targets but instead stresses the need for structural adjustment and improving the quality of mushrooms (Annual Work Report, 2015, 2016). However, the government's efforts in this regard have not been very successful, this because the scale of cultivation has not been effectively controlled. In 2012, 130 million bags of mushrooms were cultivated, with the value of the output in 2014 and 2015 reaching ¥2 billion in both years. These figures indicate that the scale of production has not been contained, but instead continues to expand.[14] Is this because the government has lacked the means to enforce its policy? Or because the government has had no real intention of reducing the scale? Or because the government has been unable to wrestle with market forces? The answer may be a mixture of the three. Despite its deficiencies, the Xixia government has played an indispensable role in the development of the xianggu mushroom industry. This is a government that understands markets and can take the initiative in promoting local interests. Without this government, there would have been no significant development in the mushroom industry of Xixia.

Mushroom Farmers and Dealers: A Cost-Profit Analysis of Production and Marketing

The mushroom industry has been of great economic benefit to the people involved in the business. Although, as we have pointed out, opportunities abound and everyone can find a niche in the market, different people have different resource endowments, they do different jobs, and they earn varying incomes (these differences

[14] We cannot find the government work reports of 2012 and 2014 in the Xixia county government website. The government reports of 2015 and 2016 no longer disclosed actual cultivation figures; instead, they reported that output in the year 2014 was 200,000 tons, with a total output value of ¥2 billion, and the output value in 2015 was also ¥2 billion. This means the output figures and values of the two years were equivalent. If so, the cultivation figure of each year would be more than 200 million bags, far exceeding the target set by the county government.

often lead to unfair competition and have been enlarged by the market over time). Xianggu mushroom cultivators and dealers are the two major groups in the mushroom industry chain. A cost-profit analysis of the two will help clarify the pattern of income and the relations between production and marketing.

In Xixia, mushroom cultivation is mainly a family business and the scale of cultivation of each household is small since their resources are limited. Farmers told us that in the hand-cut stage, a couple could cultivate 3,000–4,000 bags. But once cut-free technology was adopted, they could cultivate more than 10,000 bags, even 20,000 or 30,000 bags. The investment is not large, and families can raise the funds needed themselves. The major input in production is their own labor. Their income is basically imputed wages and some returns to factors (from capital investments and land).

For example, the Mas, a middle-aged couple from Xigang village, have been growing mushrooms for more than ten years. In the hand-cut stage, they cultivated 3,000–4,000 bags a year. Now, using cut-free technology, their scale has expanded to more than 10,000 bags a year. During the years 2013–2015, they grew 13,000 bags a year, and in 2016, 17,000 bags. Bag cultivation includes several steps: bag preparing (including bag filling 装袋 and sterilization 灭菌), inoculation 接种, mycelial growth and management of the color of the biofilm 转色管理, and, as the final step, harvesting the mature mushrooms. In Xixia, most mushroom farmers now rely on professional services to fulfill the first two steps, and because these services are efficient and reasonably priced, farmers can save a great deal of time and labor (farmers purchase all the needed materials themselves). For example, bag preparing is only ¥0.25 a bag and inoculation is ¥0.20 a bag. Total costs (materials plus labor) of a culture bag after inoculation are below ¥3. The Ma couple told us that the 17,000 bags they cultivated in 2016 cost them less than ¥50,000. After inoculation, culture bags are placed in a sun-screening shed, allowed to sit awaiting mycelial growth and a change in the color of the biofilm, and, finally, are ready for harvesting. Building a shed to accommodate 17,000 bags costs up to ¥5,000–6,000. The shed frame is made of wood and cement columns which can last ten to twenty years. The life of sun-screen nets is three or four years. If one takes ten years as the average depreciation period for both items, then the annual depreciation costs will be ¥500–600. In addition, a shed of this size covers an area of 1.5 mu. Rent in the area is ¥1,000 per mu, and so the cost to rent a plot is ¥1,500. Adding up all these expenses, the cost of each culture bag will be a little above ¥3.

Culture bags are placed on racks in the mushroom sheds for about four or five months. In Xixia, cultivation of xianggu mushrooms starts in spring, and mushrooms begin to sprout in fall. Culture bags will lay in the sheds all summer long. During the summer, a slack season, the farmers regulate the temperature, humidity, and sunlight inside the shed, inject water into the culture bags several times, roll over the bags, and inspect changes in the color of the biofilm inside the bags. Farmers usually take care of these jobs by themselves, but if they cultivate a great many bags, they will have to hire people to do the water injection. In the

summer of 2016, the Ma couple hired two people to do the injecting, 10 hours a day for four days. The local hourly wage is ¥7, and thus they spent ¥560 on labor.

Harvesting mushrooms—the major job that farmers do themselves—starts in October. However, if a household grows more than it can harvest on its own, it will need extra hands. The harvest season lasts from fall to early spring, about six months, and four crops of mushrooms can be harvested from culture bags.[15] This is the busiest season for farmers; besides picking the ripe mushrooms, they have to do interval management between crops. Moreover, they also have to start next spring's cultivation just before Spring Festival, the Chinese New Year. The Ma couple worked all day long, seven days a week, during this season and they also hired two full-time workers. The Mas believe the most appropriate scale of cultivation for a couple is 20,000 bags, but they themselves have never grown that much.

The income and profits from mushroom cultivation ultimately depend on the market price, which fluctuates year by year. Many mushroom farmers told us that mushroom prices had been relatively steady before the cut-free system was adopted. However, competition became intense and prices became volatile after cut-free technology was widely adopted. The Ma couple said that prices in 2013 and 2014 were good. In 2014, one kilo of fresh mushrooms was ¥6.20. That year, their 13,000 bags earned them more than ¥110,000, or ¥8.50 a bag. Based on the information we collected, we have done a cost-profit analysis for the Ma couple for the year 2014.

With a cost of ¥3 for each culture bag, the total cost of 13,000 bags would be ¥39,000. Assuming the sheds for the bags covered an area of 1.15 mu (1.5 mu ÷ 17,000 bags × 13,000 bags), the land rent would be ¥1,150. In addition, the depreciation on the shed would be around ¥500. The workdays of the Mas and the two full-time workers during the harvest season would amount to 720 days (30 days a month for 6 months per person). With a workday of 8 hours and a wage rate of ¥7 per hour (as mentioned above, this is the local rate), the total cost of labor for these 720 workdays would be ¥40,320. It should be noted here that the hourly wage rate is only for hired labor. The Ma couple's work also includes business operations (a family business, though small, still involves managerial matters) and management. Their income should include these activities and thus should be higher than the wage rate for hired hands. However, since these activities are difficult to quantify and calculate, they are ignored in our analysis. Finally, the money (capital) they invested in mushroom cultivation has a cost. We were told that the local rate for private lending is 10 percent a season (here a season refers to the whole mushroom cultivation season, about six months). Most people prefer to borrow small amounts from relatives and friends rather than get a bank loan. Although bank lending rates are generally between 6 and 7 percent a year, much lower than the rate of private lending, the lending procedures are cumbersome and there is no

[15] From each culture bag, mushrooms can be picked four times during the harvest season. After that, the nutrients in the culture materials are exhausted. Farmers call each of these harvests a "crop" 茬 or a "tide" 潮.

guarantee that loans will be approved. As a result, few people seek bank loans. Thus, if we take an annual interest rate of 8 percent in calculating farmers' capital costs, the costs should not be considered outrageous. Accordingly, the Ma couple's capital costs would have been ¥39,000 × .08 = ¥3,120.

Following are the total costs of the 13,000 bags cultivated by the Mas in 2014:

> Culture bags + land rent + mushroom shed depreciation + wages + capital costs: ¥39,000 + ¥1,150 + ¥500 + ¥40,320 + ¥3,120 = ¥84,090.

The Ma couple's gross income from mushrooms was ¥110,000 in 2014. Deducting the total costs of ¥84,870, their net profit was about ¥26,000. This was the return to their capital investment and business operations and management (above their imputed wages). In 2014 mushroom prices were very good, but they fell sharply in 2015. The Mas cultivated the same amount of mushrooms in 2015, but their gross income was only ¥80,000–90,000 (Interview 11). In other words, in 2015 profits were almost nil.

In Xixia, a production scale such as the Mas' is typical. Most young and middle-aged couples manage to cultivate around 15,000 bags. They are the backbone of mushroom production in the county. Old couples, on the other hand, can only manage a scale of fewer than 5,000 bags due to their physical limitations. For example, an elderly couple in Xigang village has cultivated 3,000–4,000 bags a year in recent years. They told us that their annual net income was between ¥8,000 and ¥15,000 a year. If we use the cost information gathered from the Mas, the net income of this old couple is just their imputed wages after deducting the cost of materials and depreciation (Interview 5). In Xixia, young mushroom farmers outnumber older ones, and hence the average scale of mushroom cultivation per household is about 8,000 to 10,000 bags. For example, in Xiping township, there are 1,681 mushroom households which cultivated a total of 14.86 million bags in 2016, for an average of 8,840 bags per household (Liu Songxian, 2016b).

Mushroom dealers are the main players in the marketing side of the industry. Compared to raising mushrooms, running a shop requires a larger investment and involves higher risks. This is especially true for fresh mushroom dealers. Of course, the returns to capital investments and risk taking are also much greater.

Little Xu's Fresh Mushroom Storage, a mushroom shop run by the Xu couple in the town of Xiping, has two cold storage warehouses, with a total capacity of more than 10,000 kilos of fresh mushrooms. The couple lives upstairs above the shop. The main operating costs are for labor and electricity. In the harvest season, the couple employs six or seven workers and pays them more than ¥10,000 each for the season. The monthly electricity bill is between ¥1,000 and ¥2,000. They pay cash for fresh mushrooms. Wholesalers come to the shop to buy their goods in large quantities and ship them to outside markets. They settle their accounts in a week in most cases. Thus besides storage facilities, to run a dealer shop one has to have a large amount of cash. Mrs. Xu told us that in the busy season they buy

more than 5,000 kilos of fresh mushrooms a day. Every year they put aside more than ¥200,000 to purchase mushrooms. If they run out of cash, they usually seek private loans to meet their immediate needs (Interview 3). According to the information we got, the Little Xu's operating costs include labor (¥7 per hour, 8 hours a day, 180 days), ¥11,000 × 6 = ¥66,000; and electricity, ¥1,500 × 6 = ¥9,000; making a subtotal of ¥75,000.

According to our investigation, in Xixia for every kilo of fresh mushrooms purchased a dealer can gross ¥1.00 in profit. The Xus told us that they bought close to 100,000 kilos each season. That means their gross revenue is ¥100,000, leaving only ¥25,000 after paying wages and the electric bill. Since the Xus have two warehouses of their own, they do not have to pay rent for storage. The rent for warehouses of this capacity is about ¥4,000–5,000 a month. This rent should also be considered a part of the operation cost of running a shop. For a whole season of six months, the rent will cost ¥27,000 (¥4,500 × 6). In addition, there is also the cost for the working capital the Xus have prepared to buy mushrooms. One can take an interest rate between the bank rate and the private lending rate to figure out Xus' capital cost. Of course, the Xus should also receive some income for their work. Therefore, the Xus would have to buy more than 140,000 kilograms of fresh mushrooms to break even.[16]

According to Du Mingxing, a former official in the Bureau of Industry and Commerce of Xiping township, there are about 84 fresh mushroom dealers in Xiping (Interview 10). The Xus shop is relatively small, but we also interviewed one of the largest dealers in Xiping, the Sun Edible Fungi Company. The founder and the general manager, Sun Dunshan, got into the mushroom business very early when bag cultivation had just gotten started locally. He recalled that at first he took the bus to sell mushrooms in the county seat. After more than twenty years of hard work, his company, which buys 2,000 to 3,000 tons annually, is now the largest fresh mushroom dealer in Xiping. Sun estimated that his company alone accounts for a fifth of the total fresh mushroom purchases in Xiping. It is therefore in a position to have a direct impact on mushroom prices in the Xiping market. In addition to operating in the local market, the company is also engaged in the mushroom business in other provinces. The company employs more than thirty people all year round and hires more temporary workers in the busy season. In Xiping the company has a storage capacity for fresh mushrooms surpassing 200 tons. As we discussed earlier, a large fresh mushroom company cannot depend on outside wholesalers to buy its stock of goods and so must have its own means of transportation and a large distribution network. Sun's company has established a regular

[16] The gross profits for 140,000 kilos of purchased mushrooms is ¥140,000, and after deducting ¥102,000 for wages, the electric bill, and rent, the remaining ¥38,000 would cover exactly the capital costs of ¥16,000 (¥200,000 × interest rate of 8 percent) and the Xus' basic wages (¥11,000 × 2 = ¥22,000). Obviously, only when the Xus' shop can purchase more than this amount can it make a profit. The local mushroom farmers told us a dealer's shop like the Xus' will have a gross profit of ¥200,000. If this is true, the gross income of the Xus shop would be ¥200,000 and the net profit ¥60,000.

partnership with a number of large supermarkets nationwide. The company also has collaborations with many big mushroom wholesalers in different regions and can get supplies of mushrooms across the country when needed. The company owns a fleet of trucks and works with the Shuanghui Group 双汇集团, a well-known domestic meat production giant: during the slow season for mushrooms, Shuanghui has access to Sun's trucks, during the busy season for mushrooms, Sun has access to Shuanghui's trucks. Sun's company also runs its own information network on mushroom prices, which can gather timely and accurate nationwide price information. Sun proudly told us that one year the market was nervous and most dealers hurried to purchase mushrooms, but his information told him there was no reason for alarm. In the end, those who rushed to buy suffered serious losses but he made a handsome profit.

In 2015, encouraged and supported by the township government, Sun's company invested ¥7 million in building a model base for standardized cultivation of mushrooms, and a production line for making culture bags, with a capacity of one million bags. This was a response to the county government's call in 2013 for the unified production of culture bags to achieve standardization, specialization, and intensification of cultivation (Annual Work Report, 2013, 2015, and 2016). The designed capacity of the base is 500,000 bags. In 2016, 230,000 bags were actually cultivated. The success of Sun's company has not come easily. Sun told us that for more than twenty years he has worked all year round and traveled all over the country. His son, who joined the family business after graduating from high school, is now over thirty and has taken charge of the company's nonlocal businesses. Sun can finally breathe a sigh of relief (Interview 9). Sun did not tell us about the company's finances; thus we cannot undertake a cost-profit analysis of his company. But judging by the volume of its purchases, we can estimate that the company's annual profit easily exceeds one million yuan.

The rapid development of Xixia's mushroom industry is closely related to the ongoing expansion of the market. This in turn is the result of the sustained effort of mushroom dealers (including both local dealers and outside wholesalers). The market of course has generously rewarded them. The returns from mushroom marketing are certainly higher than from mushroom cultivation. The larger the scale, the bigger the profits. Moreover, although dealers and farmers collaborate via the market, they also compete. Dealers, especially big dealers, are obviously in a more favorable position than mushroom farmers and have more power over pricing and marketing. When the industry is booming and the market is expanding, everyone can make money and conflicts between production and marketing are not significant. But once the market gets saturated, competition between farmers and dealers will intensify. The results will be easy to predict.[17] Not only will mushroom farmers be hurt, but ultimately the mushroom industry itself will also suffer.

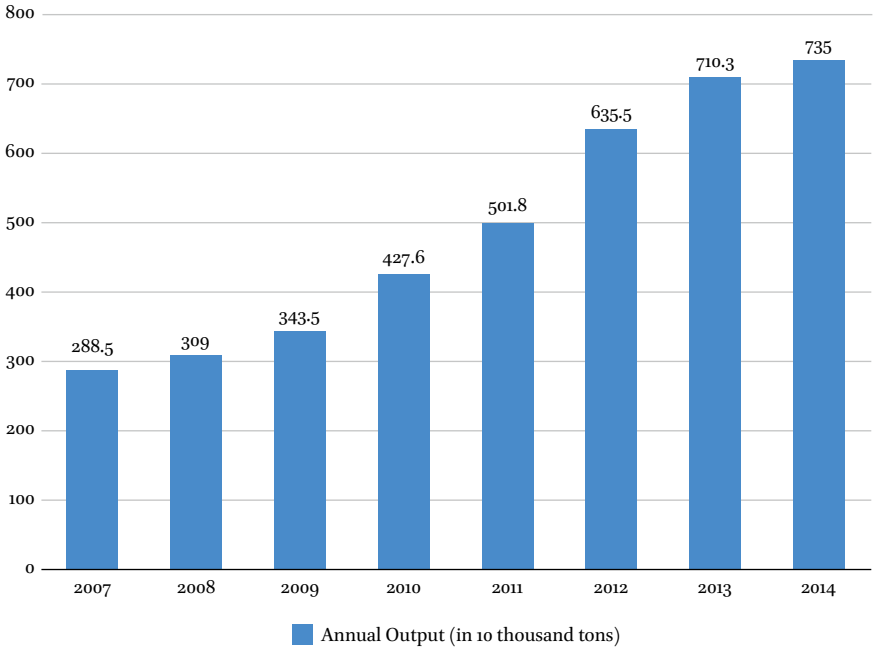
[17] In China's agricultural market, especially in the market for the high-value-added products of the so-called "new agriculture," unfair competition between small farmers and large commercial capital because of their unequal power is not an exception but the norm (see Huang Zongzhi, 2012).

The Prospects for Xixia's Mushroom Industry

Xixia's mushroom industry has been a success story. As long as the market continues to expand, the story can also continue. In the past thirty years, China's mushroom industry started almost from scratch and quickly achieved remarkable growth. Judging from the potential demand, one might expect the industry to continue to grow for a long time. But in fact, the xianggu mushroom industry reached a peak in 2014. Since then both the growth rate and market price have fallen (see Figure 1 and Table 1). Obviously, the industry will go through some changes in next few years and will not repeat the seemingly unstoppable and triumphant growth seen in the past few decades. In our interviews, farmers, dealers, and government officials all expressed various concerns about the future of the industry.

As long as the market continues to expand, everyone can survive. But once the market begins to slow down, competition will intensify and prices will drop. Aside from a macroeconomic contraction, over-expansion of the mushroom industry in previous years has also been responsible for market slowdowns and sluggish prices. In recent years, neighboring counties have begun to promote mushroom cultivation, which has greatly intensified the competition over raw materials, market share, and human resources. Mushroom farmers have also continued to expand their scale of cultivation, further exacerbating the situation. As scattered

Figure 1. China's mushroom production, 2007–2014.



Source: Chinese Industrial Information Network, 2015.

Table 1. Wholesale Prices of Mushrooms in Regional Markets, 2012–2016.
(Unit: yuan per kilogram.)

	2012/6/30	2013/6/8	2014/10/17	2015/6/29	2016/7/5
Beijing and Hebei	¥9.00	¥8.00	¥11.01	¥9.80	¥7.38
Jiangsu, Zhejiang, and Shanghai	¥12.57	¥18.00	¥13.15	¥11.15	¥12.50
Guangdong and Fujian		¥10.80	¥12.84	¥11.90	¥9.40
Henan	¥11.50	¥11.25	¥12.00	¥11.33	¥7.80
Northeast	¥5.50	¥6.50	¥7.67	¥5.50	¥7.17
Average		¥10.67	¥11.87	¥11.17	¥9.27

Source: Xinsinong network, "Xianggu Mushroom Price Quotes," xinsinong.com/quote/list-1581-1.html.
Note: This table is based on mushroom price quotes from the Xinsinong website. If there are several prices for one region at one time, we take their arithmetic average. The national average of 2013 is the average of the prices of the five regions in this column. The national average prices for the remaining three years in this table are directly quoted from the website.

individuals, mushroom farmers lack economic strength and market information, and therefore they have little bargaining power with dealers and few ways to hedge market risks. They are always the first group to bear the brunt of market fluctuations. When mushroom prices fell in 2015, farmers did not make a profit. On the blog of the Zhonggu Mushroom Company of Xixia we found many complaints from local mushroom farmers, who used the term "mushroom crying" (菇菇叫), mimicking popular internet locutions such as "ruthless garlic, checkmate by ginger, and teasing you with beans" (蒜你狠，姜你军，豆你玩) to express their discontent (Zhonggu, 2016c). A mushroom farmer even published a doggerel, "Mushroom Cultivation Is Real Suffering, A Whole Busy Year Turned Out to Be in Vain." The doggerel recounts the farmers' plight:

> Mushrooms harvested, but nobody wants them, scared by the low prices!
> Today up, tomorrow down, prices are like a roller coaster ride!
> Dealers gain, bosses earn, farmers' sweat and blood are in vain!
> Others win, farmers lose, eyes full of tears!
> Mushrooms sold, but farmers didn't get paid for many days!
> More hateful, the boss's gone, can't be found in this world!
> Hard-earned money lost without a trace, like taking a shower in cold water!
> (Zhonggu, 2016d)

The host of the website did a survey, asking people if they actually made money from the mushroom business. The results were published on the web together with a blog, "Who Earned Money in the Mushroom Business?" The blog grumbled:

> Can farmers make money from mushrooms? Can they get rich? In today's market, if you do a survey, 90 percent of the people will shake their heads. To break even is good fortune, don't even think of making money! Recently, a lot of sad jokes have appeared on the Internet, giving voice to endless grievances. There are jokes every year, but this year they are particularly numerous. Where is the money? Who's got the money? The following are the results of our survey!

According to the survey, the top four moneymakers were all people involved in marketing: dealers, wholesalers, supermarkets, and retailers (vegetable shops). They were followed by raw material suppliers, equipment suppliers, mushroom processing companies, and banks, which were ranked from the fifth to the eighth respectively.

The blog lamented: "It seems that mushrooms can make money, but the money does not go to farmers! The mushroom farmers did the hardest jobs, but they made the least money! How bitter their lives are!" (Zhonggu, 2016d).

Obviously, in the face of market volatility, isolated mushroom farmers are the most vulnerable group, and will suffer the first and the most in a market downturn. If we allow market fluctuations to take their toll without intervention, it is not only mushroom farmers who will be hurt, but the mushroom industry itself will suffer serious damage. Because once profits disappear, all that farmers can get from cultivating mushrooms are wages. This is no different from hiring out and working for others. If this situation remains unchanged, it will inevitably force more and more farmers to give up growing mushrooms, and a collapse of the mushroom industry will surely follow. The key to sustainable development of the mushroom industry is finding a way to avoid the pitfalls of the bumper harvest paradox, to escape the fate of the proletarianization of mushroom farmers, and to enhance farmers' ability to hedge market risks.

Not only is the market undergoing an adjustment, but the mushroom industry itself is also facing technical changes and a structural transformation. So far mushroom cultivation has been done on a small scale, by households. No one denies that this family production has made a significant contribution to the mushroom industry, but researchers tend to agree that this mode of family production depending on cheap labor has many disadvantages, such as a high labor intensity, low technology, seasonal production difficulties in regulating the production process, and difficulties in controlling quality and raising productivity (Zhang and Li, 2012; Tan, 2015). Therefore, almost all researchers regard family production as backward and in need of improvement, or even as something that should be eliminated. It is true that in order to raise production efficiency and quality, technological innovations are needed. But organizational and institutional innovations are also needed. Many experts have stressed the need to rely on leading enterprises to achieve a transformation of the industry and further development. In their view, leading enterprises can organize scattered households together to enhance intensification and specialization of production. Thus the key is to nurture and support a number

of leading enterprises, and have them guide and lead mushroom farmers in expanding the scale of production and improving efficiency and quality (Lin, 2015; Zhao, 2011). This view has influenced or even dominated industrial policy making in some local governments.

The Xixia government began to promote the "standardization, specialization, and industrialization" 标准化、专业化、产业化 of mushroom production in 2009. In 2010 and 2011, it proposed building several large standardized mushroom cultivation bases to replace scattered family cultivation around farmers' houses by encouraging farmers to move their cultivation into the bases. Beginning in 2013, the government called for "unified factory making and selling culture bags" 推广企业统一制售菌棒 and promoted the "factory production" of mushrooms (Annual Work Report, 2009, 2010, and 2011). Urged by the county and township governments, mushroom production did take some practical steps under the government's guidance. For example, in 2012, Zhaigen township 寨根乡 collaborated with a well-known local mushroom processing enterprise, Zhongjing Big Kitchen Co., Ltd. 仲景大厨房股份有限公司, to build a mushroom cultivation base with a capacity of 5 million bags. The parties agreed that the government would provide the land and the company the funds. By summer 2016, the company had already invested more than ¥3 million, and the base that was built could accommodate 2.5 million bags (Zhaigen Township Government, 2015). The base is huge, stretching several kilometers along a valley. The mushroom sheds are all of the same size and design. Mushroom farmers can rent the shade, use the water, ventilation, roads, and other facilities in the base, all at a low price because of subsidies from the township government (Interview 13). Many townships in Xixia have also built mushroom cultivation bases of various sizes. For example, as we mentioned earlier, Sun's company responded to the government's call by building a large base in Xiping in 2015. It is true that the standardized cultivation bases and the factory-made culture bags can improve the working environment and conditions of mushroom cultivation, and can also raise the efficiency and quality of mushroom production, thus achieving a certain degree of economies of scale. But these technical improvements cannot change the fundamental pattern of family production, and also cannot change the isolated and helpless situation of individual farmers in the market. Even if they have moved their culture bags into the base and are working in the base, mushroom farmers still cultivate mushrooms individually using the resources of their own individual household, and mushrooms harvested from the base are still sold on the market by individual farmers.

Although the government is eager to promote specialization and the industrialization of mushroom production, most mushroom farmers have doubts and concerns about the domination of leading enterprises in the development and transformation of the mushroom industry. They hope to keep the initiative for production in their own hands. An article published on the Zhonggu website voiced their thoughts: "The direction of the development of the mushroom industry should be factory production of culture bags, and family cultivation and

management of mushroom cultivation. This is the development model for everyone, including mushroom farmers. Farmers do not want to see mushroom factories come in and grab their jobs and take away their livelihood. . . . For the mushroom industry to achieve rational and sustainable development, we have to maintain environmentally friendly cultivation and peasant family management. Thus we can attain economic effectiveness as well as sustained growth" (Zhonggu, 2016a).

Judging from present technology and market conditions, factory production of xianggu mushrooms is not yet a mature option. Currently, China has made certain progress in the factory production of some edible fungi, such as *Flammulina velutipes*, *Agaricus bisporus*, *Pleurotus eryngii*, and *Agrocybe cylindracea*, and others.[18] Factory production is also believed to be the future direction of xianggu mushroom production. But to date, there has been no case of successful factory production of xianggu mushrooms in China, except for the factory production of culture bags (Baidu Library, 2015; Huang Yi, 2014; Bai, 2015; Sheng, 2016).[19] The consensus in the xianggu mushroom industry is that at the present stage, the best policy is to vigorously promote "intensive and specialized" cultivation 集约化、专业化栽培 of mushrooms, rather than to blindly pursue factory production (Tan, 2015).

Since family production of xianggu mushrooms cannot be changed for the time being, the most important task for the development of the mushroom industry now is to fully exploit the advantages of family production and to overcome its weaknesses. At the same time, farmers' interests should be protected and their ability to withstand market fluctuations should be enhanced. In recent years, the Xixia government has worked to promote specialization and the industrialization of mushroom production, which can help farmer households improve cultivation at the technical level. However, the government's efforts to help farmers resist market risks are minimal and basically lackluster.

In order to enhance farmers' ability to deal with market risks, it is necessary for them to organize themselves so that they can employ the power of collective bargaining, even in the face of a market downturn. In this regard, mushroom farmers themselves should take the initiative. The government, nonetheless, has a compelling obligation to actively encourage, guide, and support cooperation among mushroom farmers.

However, to date, the Xixia government's efforts in this regard amount to no more than sloganeering. In its work reports of 2008 and 2010, the Xixia government proposed developing farmers specialty cooperatives and a business model of collaboration between "companies plus specialty co-ops" 公司+专业合作社模式 (Annual Work Report, 2008, 2010). But such calls are not mentioned in the

[18] However, as some studies have pointed out, factory-produced edible fungi are often costly, and thus cannot compete with those produced by farmer families (Bai, 2015).

[19] Experts believe that the current factory production technology is immature because it does not permit the production of mushrooms that are cheap enough to compete in the market (Huang Wei, 2015; Sheng, 2016).

subsequent government work reports. There also have been no practical measures to follow up the 2008 and 2010 proposals. To be sure, there are a few mushroom cooperatives in Xixia,[20] such as Sun's Specialty Cooperative for Edible Fungi in Xixia County 西峡县孙氏菌业专业合作社 established by Sun Dunshan. According to information released by Sun's company, the cooperative was established in late 2011 and had 53 members in 2016 ("A Brief Introduction," n.d.). However, we have learned from our interviews that Sun's cooperative exists merely in name and in fact is a ruse to take advantage of the many policy favors to so-called cooperatives in terms of land use, bank loans, and government support.[21] Obviously such "cooperatives" do not protect and promote the interests of farmers. This situation is common. The Shuanglong township 双龙镇 government of Xixia declared that "farmers who join cooperatives should be real members, they should take cooperatives as a unified entity to deal with outside parties, from procuring mushroom materials, purchasing strains, to marketing mushrooms. This way they can not only reduce production costs, but also increase their bargaining power in the market. At the very least, they can change their weak position due to their isolation. However, few cooperatives have ever played such a role, and thus the real purpose of establishing cooperatives has not been realized" (Shuanglong Township Government, 2015).

How to change the current situation and lead mushroom farmers to embark on real and effective cooperation is therefore the key to the healthy and sustainable development of the xianggu mushroom industry in Xixia. This is a test Xixia's mushroom farmers, dealers, and the government all have to face today. But the government's role in promotion, guidance, and support is especially important. This is what the government should do, can do, and must do at this moment. Of course, this job is far more difficult than many other tasks facing the government. Hence, it can be an excellent test of the government's wisdom and ability to govern and lead. The three decades of the development of the mushroom industry in Xixia have demonstrated not only the creative spirit and practical ability of the people of Xixia, but also the forward thinking and strong leadership of the Xixia government. History gives us reason to be optimistic about the prospects of the xianggu mushroom industry in Xixia.

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[21] In our interviews, both government officials from Xiping township and Sun Dunshan himself do not deny this fact.

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