Effect of Pig Price Volatility on Sichuan Pig Farmers' Behavioral Response in China

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Abstract

This study aims to analyze cobweb phenomenon of pig price volatility and its effects on pig producers in Sichuan, China. Historical data showed that pig price from 2000 to 2003 pertained to Occlude Cobweb Phenomenon; while pig price from 2004 to 2012 pertained to Divergent Cobweb Phenomenon. Based on Cobweb Phenomenon this article provided a comparative analysis of pig price volatility's effects on scattered farmers, scale farmers and pig factories via examining their basic information, response to price volatility, reasons leading to such response, and price expectation. The results indicated that scale farmers were the most sensitive to price volatility; hence their production behaviors probably boosted pig price volatility to some degree. Factory farming was the most competitive farming pattern and was bound to be the main trend in pig industry in the future.

Keywords: cobweb phenomenon, pig price volatility, pig farmer

1. Introduction

1.1 Pig Price Volatility in China

Since the reform and opening up (in the year of 1978), the development of China's pig production accelerated rapidly. Pig herds, pig slaughter and pork production increased exponentially, so did the improvement of pig production level. However, in 2003 the large-scale outbreak of SARS seriously dampened the pig industry. Since then pig price fluctuated increasing intense (Figure 1). Asymmetric price volatility is observed when different volatility is recorded between an increase and a decrease of price of the same amount (Rezitis and Stavropoulos, 2009). The pig price fluctuation law had two features, namely waving in a single year and waving between years. Pig price usually rises in December and January, and declines in May and June. From 1984 to 2005, there witnessed four major cyclical fluctuations of pig price in China, namely from 1984 to 1987, from 1987 to 1993, from 1993 to 2000, and from 2000 to 2005 (Lv & Zuan, 2007). After the reform and opening up, pig price experiences six significant fluctuations, which main symbol is the annual growth exceeds by 10%. According to historical data, the average period of fluctuation cycle is around six years, and the average rising period and falling period is 3.5 years and 2.5 years respectively (Agricultural Department, 2007) (Note 1).

Figure 1. Monthly pig price of Sichuan Province from January, 2000 to December, 2012

Source: The data is from China Livestock Information Network, http://www.caaa.cn/

1.2 Price Volatility Review

Pig production is a crucial part of pig industry; so the measurement of pig production is a research subject of great concern. Heshmati et al. (1995) used a generalized Cobb-Douglas model to investigate the issues of technical efficiency, technical changes and bias in technical change in the Swedish pork industry. Plain and Lawrence (2003) thoroughly studied the pig production of the United States. They explored many features of American pig industry, such as typical growth cycle, the size of pig industry, production cost, production efficiency, and pig prices. Many technological and efficiency changes have significantly altered the productivity of pig sector. Since the mid-1980s, the U.S. pig industry has shifted to larger operations, with increased contracting and vertical coordination, to optimize year-round slaughter capacity (Mathews et al., 2013).

Price volatility is a common phenomenon in agricultural products, like coffee, cocoa (Malan, 2013). Due to seasonality, inelastic demand and production uncertainty, pig price is easy to volatile (Holt & Johnson, 1988). Since 2003, pig price of China became increasing fluctuant and aroused great concerns among scholars. In summary, pig price volatility attributes to five reasons, pig's natural growth cycle which makes supply lags behind demand (Yang & Tang, 2010); the outbreak of wide-spread epidemic diseases occasionally (Huang, 2009); pork is perishable and cannot to store for a long time period (Liu, 2007); affected by rising prices of food and crude oil (Zhang, 2008); and producers' irrational behavior of expanding or declining pig herds (Wang & Wang, 2007; Xu, 2008; Li & Fu, 2009).

Pig producers' views, beliefs, responses and strategies which can determine pig production to some degree are vital factors in pig production studies. Patrick et al. (2007) examined pig producers in Indiana and Nebraska about the sources of risk, effectiveness of alternative risk management strategies, participation in past risk management education activities, and ratings of alternative learning methods. Price fluctuations translate into a significant price risk. Thus, an increase in price volatility implies higher uncertainty about future prices, a fact that can affect producers' welfare especially in the absence of a hedging mechanism (Rezitis and Stavropoulos, 2009). It is of great importance to understand pig farmers' response and strategies by the influence of pig price fluctuation, for it can draw a persuasive and reliable conclusion about price fluctuation. But fewer scholars studied how exactly producers respond to pig price change and their strategies against it. Producers' response and strategies can affect pig supply, and eventually affect pig price via the role of the law of value. Vice versa, price change can affect producers' response and strategies. Constrained by growth cycle, regulation of production always lags behind price change, which leads pig supply and demand trapped into divergent cobweb effect in China (Yang, 2008).

1.3 Research Problems

Some scholars (Wang & Lin, 1999; Wang & Wang, 2007; Xu, 2008; Li & Fu, 2009) thought it was pig farmers' irrational behavior that they surged into pig industry when price was profitable and evacuated when lost money. Those farmers' response broke the balance of market supply and demand, and then resulted in price fluctuation. In fact there were three kinds of pig producers in China, scattered farmers, scale farmers and pig factories (Li & Deng, 2006). Scattered farmers and scale farmers were the two predominant types of pig producers in China recently, and pig farmers usually referred to both scattered farmers and scale farmers (Wang et al., 2010). Apparently, these scholars failed to point out who exactly broke the market equilibrium and cause price fluctuation.

Though a number of studies focused on pig price volatility features, fluctuation cycles, causes, and consequences, fewer studies investigated how pig price volatility affects producers. The purpose of this article is to analyze cobweb phenomenon exists in pig price volatility and provide a comparative analysis of effects of pig price volatility on scattered farmers, scale farmers and pig factories. To find out who is to blame for breaking market equilibrium, and how pig producers make decision and response to pig price volatility, we conducted a field survey about response to price fluctuation among scattered farmers, scale farmers and pig factories in Sichuan, January, 2013. We aim to analyze the different producers' responses and strategies to pig price volatility, and explore who exactly break pig market balance.

2. Cobweb phenomenon

Cobweb theorem links supply reacting to the lagged price to demand reacting to current price (Barten &Vanloot, 1996). Cobweb models access to the investigation of the price dynamics of a non-storable good, such as livestock and vegetables that takes one time unit to produce (Dieci & Westerhoff, 2010). Due to the production lag, producers form naive expectations about future prices and select their output so as to maximize expected profits under fairly general demand and cost functions (Dieci & Westerhoff, 2011).

Occlude Cobweb Model is used to demonstrate a phenomenon that when the market is interfered and deviates from the original state of equilibrium, actual price and actual production fluctuate around the equilibrium point with equal range, neither further away from nor gradually tend to the equilibrium point. The pig price of Sichuan Province was around 5 Yuan/kg from January, 2000 to December, 2003 (Figure 2). During this period, the lowest price was 4.40 Yuan/kg in June, 2000, and the highest price was 6.15 Yuan/kg in December, 2003. This phenomenon was highly coincide with occlude cobweb model.
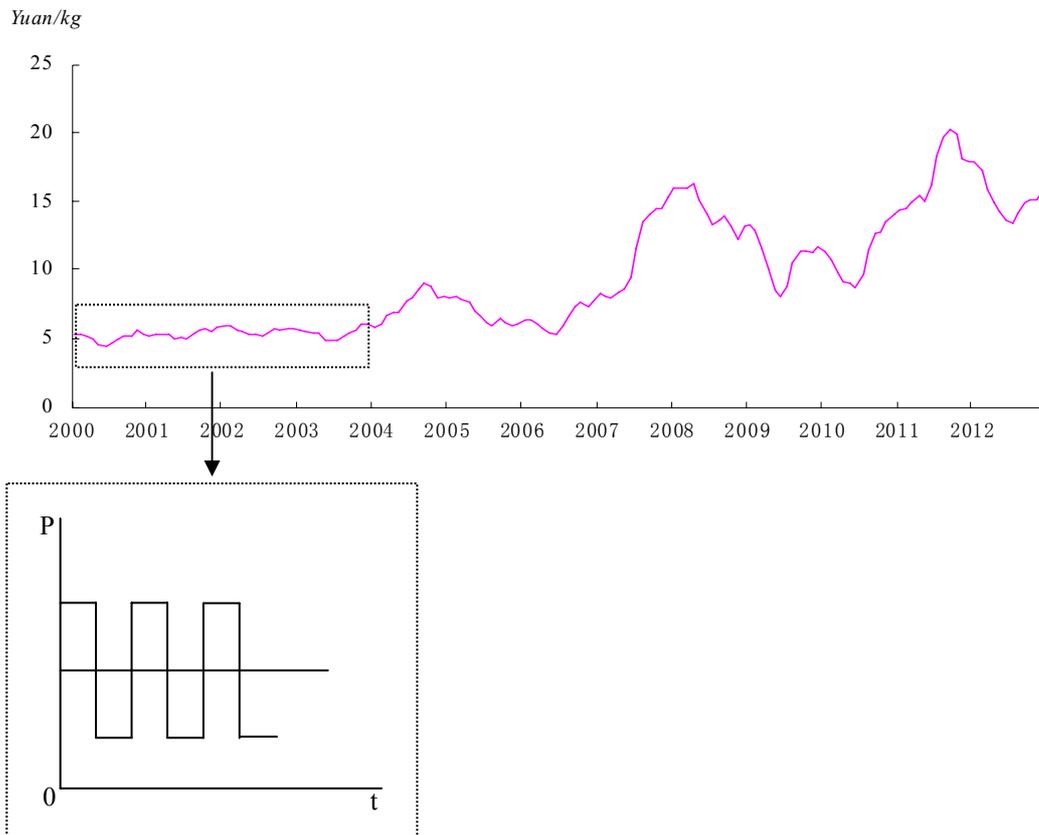

Figure 2. 2000-2003 pig price of Sichuan resembles like occlude cobweb model

Divergent Cobweb Model is used to demonstrate a phenomenon that when the market is interfered and deviates from the original state of equilibrium, actual price and actual production fluctuate intensely around the equilibrium point with an increasing range, and deviate from the equilibrium point further. Figure 3 shows that, at the beginning of 2004, pig price was 5.90 Yuan/kg, and then it climbed to 8.70 Yuan/kg at the end of 2004. Pig price reached to the second peak at 16.21 Yuan/kg in April, 2008, and then fell to valley at 8.18 Yuan/kg in June, 2009. Since June, 2010, pig price increased gradually and reach the third peak at 20.21 Yuan/kg in September, 2011. The fluctuation range was as much as 15. The trend shows that volatility of pig price is increasing intense.
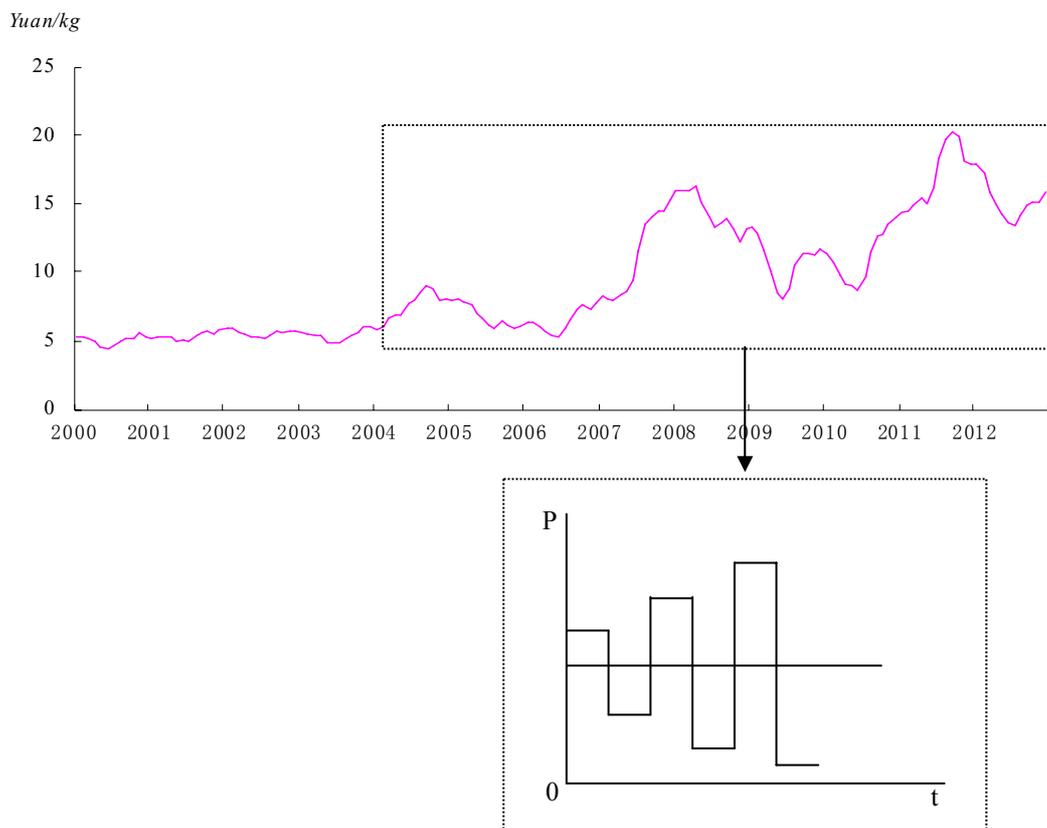
Figure 3. 2000-2003 pig price of Sichuan resembles like divergent cobweb model

Pig production has a certain cycle. Once the farming scale is determined, it is hard to change the supply before one production cycle is finished. Thus, pig supply always lags behind pig price (Huang, 2009). The typical cyclical volatility of pig price is as follow: once the pork price rises in some certain period, then the piglet price rises, then the amount of sows increase, then the supply of piglets increase, then the amount of fattening pigs increase, then the supply amount of pork increase, which result in supply excess demand. Therefore, the pork price declines in the end. The decline of pork price results in piglet price declines, then the amount of sows decrease, then the amount of piglets decrease, then the amount of fattening pigs decrease, then the supply amount of pork decrease, therefore, pork price rises and goes back to the original price level again. According to foreign experience, it usually takes approximately four years to finish a cyclical volatility like this (Huang, 2009).

3. Data Description

3.1 Survey Site and Sample Size

Pig farming is a traditional farming practice operating by peasant households as a sideline farming production in china, and has long been extensive and small scale farming. After the reform and opening up, with the rapid growth of pig production, intensive farming and level of organization were rising. In 1996, intensive farming only accounted for 13.6% for the overall pig farming in China. In 2002, the proportion was relatively low and only accounted for 27.2%. While at the beginning of 2004, this figure began to skyrocket, and in 2008, the proportion of intensive pig production notched to 62% (Note 2). Those figures fully demonstrated that intensive farming is in a stage of rapid development in the past ten years, and this trend will continue in the future.

We chose Sichuan Province to conduct the survey for two reasons. Firstly, Sichuan has advantages of geography and nature resource, such as subtropical climate, suitable temperature and humidity, ample rainfall, and large amount of fertile farmland, which is an ideal area for pig farming. As a consequence, Sichuan is one of the main pig production areas in China (Note 3). Moreover, Sichuan has a large population (Note 4) and pork is the favorite meat for Sichuan people. Consequently, Sichuan is one of the main pork consumption areas in China at the same time (Feng, 2006). Based on above concerns, it is of great value to study features and situations of pig producers in Sichuan Province.

Pig farming areas are mainly concentrated in the eastern areas in Sichuan Province (Feng, 2006). The eastern areas can divide into three parts, south district, central district and north district (Figure 4). In the survey, we selected Yibin and Leshan in the south district, Chengdu and Meishan in the central district and Guangyuan in the north district (Table 1). The topographical features of Sichuan province are mainly hilly, mountain and plain (Feng, 2006). The five survey sites cover all the topographical features of Sichuan (Table 1). The survey combined communications and questionnaires with pig producers. At last, we got 274 valid questionnaires, including 66 pig producers in Yibin district, 68 in Chengdu district, 40 in Guangyuan district, 52 in Meishan district and 48 in Leshan district, respectively (Table 1).

Figure 4. The distribution of pig farming districts in Sichuan Province

Table 1. Sample distribution

District	Yibin	Chengdu	Guangyuan	Meishan	Leshan
Location	South	Central	North	Central	South
Terrain	Hilly	Plain	Mountain	Hilly & plain	Hilly & mountain
Sample size	66	68	40	52	48

Source: The data is from the statistic results of field research on "pig producers' response to pig price volatility" in January, 2013.

3.2 Basic Information

There are three types of pig producers in Sichuan, namely scattered farmers, scale farmers and pig factories. According to The Compilation of National Agricultural Costs and Returns （2010）, We define individual householder whose annual slaughter pigs are under 50 as scattered farmers; define individual householder whose annual slaughter pigs are between 50 and 500 as scale farmers; and defined organizations whose annul slaughter pigs are above 500 as pig factories. Scatted farmers are part-time producers and they adopt traditional farming methods with small number of pig herds; while scale farmers are full-time producers and they put into a lot of money and manpower. By contrast, scale farmers have higher management and decision-making level than scattered farmers (Wang et al., 2010). Pig factories are more specialized and only focus on pig farming. Usually, pig factories are required to register at the Industrial and Commercial Bureau, and inspected and examined strictly by the environmental protection departments.

In the study of relationship between intention and behavior, Herath (2013) demonstrated that age and education of farmers show a significant relationship with behavior. In the survey, scattered farmers have the largest average age and the least male farmers participating in pig farming, while owners of pig factories have the best education background (Table 2). Pig farming is a part of housework and it is usually done by female. The majority scattered

farmers are women, their average age is 56 years old and their average education level is less than 5 years. This phenomenon attributes to large amount of migrant workers swarming into urban areas. In many rural areas in China, most young farmers work out for a long time, and the elderly are left in villages farming. Most scale farmers are self-employed and almost all family members are involved in pig farming. The majority scale farmers are male, accounting for 71.1%. Their average age and average education year are about 49 years old and 8 years respectively. All the pig factory owners we investigated are male. They are much younger and more literate than both scattered farmers and scale farmers. Pig factory owners are entrepreneurs, and making profits in pig production is the sole aim of their investment.

Table 2. Basic information of pig producers

		Scattered farmers	Scale farmers	Factories
Personal information	Average age	56	45	37
	Education year	5	8	11
	Gender(male)	31.0%	71.1%	100.0%
Farmland (ha.)	Under 0.33	68	73	-
	0.33 to 0.67	59	29	-
	Over 0.67	21	1	-
Diet composition	Maize & forage	126	2	0
	Home-made feed	22	100	5
	Compound feed	0	1	18
Feeding method	Sow only	19	0	0
	Pig only	99	5	0
	Sow and pig	30	98	23
Farming years	Under 10	9	65	15
	10 to 20	34	31	7
	20 to 30	79	6	1
	Over 30	26	1	0
pig share of gross income	Under 30%	112	4	0
	30% to 50%	31	8	0
	50% to 80%	4	38	0
	Over 80%	1	53	23
Average area of piggery (m^2)		25	340	3,500

Note: Farmland was made up two parts, farmers' own land and rental land. The average arable land per person in China was relatively low, only about 0.1001 hectare per person.

Source: The data is from the statistic results of field research on "pig producers' response to pig price volatility" in January, 2013.

The three kinds of producers (Note 5) have six conspicuous differences. The first difference among these producers is that pig factories had no farmland, and spent no energy on growing crops. Farmland is of great importance to pig farmers, more than 54.0% scattered farmers possess more than 0.33 hectare farmland, while 70.9% scale farmers own less than 0.33 hectare (Table 2). The second disparity among these producers is diet composition. Scattered farmers produce pig diets themselves, while the other two parts buy diet in the market. Most scattered farmers take advantage of farmland to produce grain and forage to feed pigs, while most scale farmers usually purchase raw materials, such as maize, bran, feed addictive, then make pig feed themselves. More than 78.3% pig factories choose compound feed as main diet composition. The third discrepancy among these

producers is feed method. Nearly all the scale farmers and pig factories apply farrow-to-finish production; while about 76.7% scattered farmers buy piglets in the market and only farm pigs. Farrow-to-finish production can extent profits but increase risk as well at the same time. The fourth difference is farming years. Pig farming is a traditional agricultural practice in Sichuan history, and farmers are get used to farm pigs generation after generation. More than 70.9% scattered farmers have been farmed pig for more than 20 years, by contrast, more than half of scale farmers and pig factories have less than 10-year farming experience. The fifth difference is proportion of pig farming income in the total gross household income. Most scattered farmers are part-time pig producers, so pig income only takes a small share in family gross income; while as a full-time job, most of scale farmers' income come from pig farming. Generally, most owners of pig factories invest a large amount of their family fortunes into pig production to expect high returns, their family income are totally from pig farming. The last difference is the area of piggery. Scattered farmers usually keep pigs in their backyards (Wang et al., 2010), and the average area of piggery was about 25m2. Scale farmers usually build piggeries around their houses and the average area of piggery is about 340m2. With ample subsidies (Note 6) from central government, pig factories are able to build large piggeries. In the survey, the average area of piggery of factories is around 3,500m^2.

4. Empirical Results and Analysis

Pig price volatility can affect pig producers in many aspects. Here we choose the most important three aspects, producers' response to pig price volatility directly, reasons or factors causing these responses, and pig price expectation.

4.1 Response to Price Volatility

In 2003, there was a sudden outbreak of SARS national wide, which seriously dampened the pig industry. There indeed existed a slight fluctuation in pork price before 2003, but after 2003 the volatility became increasing violent and frequent (Fan, 2012) (Figure 1). In 2006, there erupted epidemic diseases of high swine fever and streptococcosis suis (Note 7), which led to increasing pig price between 2007 and 2008. Around in 2010, foot-and-mouth disease and PRRS (Note 8) continued to wreak havoc which resulted in decreasing pig price in the year of 2009 and 2010. How did pig producers respond to frequent volatility of pig price from 2007 to 2010 respectively? According to statistic results, it is obvious that scale farmers are much more sensitive than scattered farmers and pig factories; they are prone to regulate farming scale when pig price change (Table 3). When price goes high, 84.5% scale farmers enlarge the scale; in contrast when price goes low, 52.4% scale farmers shrink the scale. On the contrary, more than 95% scattered farmers keep the same farming scale no matter how price change.

Table 3. Pig farmers' response to pig price change

Period	From 2007 to 2008			From 2009 to 2010		
Response	Increase	Decrease	Unchanged	Increase	Decrease	Unchanged
Scattered Farmers	7	2	139	3	14	131
Scale Farmers	87	0	16	40	54	9
Factories	15	0	8	8	9	6
Total	109	2	163	51	77	146

Note: The response activities of increase, decrease and unchanged was defined by the amount of pigs of that year compared with the previous year.

Source: The data is from the statistic results of field research on "pig producers' response to pig price volatility" in January, 2013.

It seems a little bit of odd that in 2009 and 2010 when pig market slumps, around 38.8% scale farmers and 34.8% pig factories aggrandize the supply of pigs. In fact, since 2007 considerable quantity capitals both domestic and overseas continued to influx into pig production sector. For example, NetEase's founder and CEO William Ding begun to invest in pig industry in 2009 and the Wuhan Iron and Steel Corporation (WISCO) planed to invest $6.2 billion to build pig farms and "urban modern service centers" in 2012 (Li, 2012). It reported in August 2008, Deutsche Bank invested $60 million to Shanghai Hongbo Group to get 30% stake of the pig business. In September of the same year, Goldman Sachs Group invested approximately $300 million to get acquisition of more than a dozen large-scale pig farms in Hunan, Fujian and other districts (Shen, 2012). Thus it is not surprising

that a considerable part of scale farmers and pig factories expanded scale of pig farming despite that pig market is suffering from slump.

Pig price affects producers' supplement enthusiasm directly (Ning & Qiao, 2010). When pig price increases, producers are able to make more profits and tend to increase supply of pigs gradually. Conversely, when pig price decrease, pig farming profitability reduce or even loss, hence producers are inclined to reduce the supply of pigs gradually. Pig producers have viewed a lot of changes in pig industry which has changed the risk environment for pig producers (Patrick et al., 2007). Time-varying volatility in pig prices usually accompanies risk in threats of pig industry (Chang et al., 2011). In China, compared with scattered farmers and pig factories, scale farmers suffer high pressure from market, facing with price risk, epidemic risk and policy risk (Note 9) at the same time. Scattered farmers dabble in pig market with a small amount of pig supply, thus pig price volatility has little effect on them. Supported by solid economic capability, extended pig production chain and subsidies from government, pig factories have more powerful abilities to resistant risks in pig industry than scale farmers.

4.2 Reasons for Response

In order to make it clear which factors affect pig producers' response activities mostly? We asked pig producers to choose top three factors from fourteen influencing factors that they may concern to when make decisions on whether raise or reduce the number of fattening pigs. The fourteen influencing factors are pig price, piglet price, feed price, maize price, labor cost, sows farrowing rate, epidemic disease, subsidy from the state, farming habit, manpower of the household, grain (mainly maize or rice) yield, personal anticipation to pig price, area of piggery, and practice of other producers. Statistic results indicate that scattered farmers valued grain yield high when they regulate the numbers of fattening pigs, while scale farmers and pig factories most concerned pig price and feed price respectively.

Li (2007) examined some inner factors, such as purpose of pig farming, labor resource, farmland and household wealth to study pig farming decision-making behavior of individual household in lagged areas of China. Li concluded that education level and farming cost are two most significant factors when pig farmers make decision. According to our survey, scattered farmers make decisions mostly depend on production factors at their disposal and their long time farming habit (Figure 5). Most scattered farmers say if they had more grain available they would raise one or two more pigs. Most farmers are convinced that pigs feed on whole grain have a better flavor and nutrient than those feed on industrial feed. As a result pig farming has been an essential part of farming production for a long time period. Stimulated by economic interest, when pig price is profitable, farmers incline to add several pigs. However, for utility of meat consumption and manure accumulation, they never give up farming although price is very low. Besides, manpower of the household, piglet price and piggery could affect scattered farmers' decision to some degree.
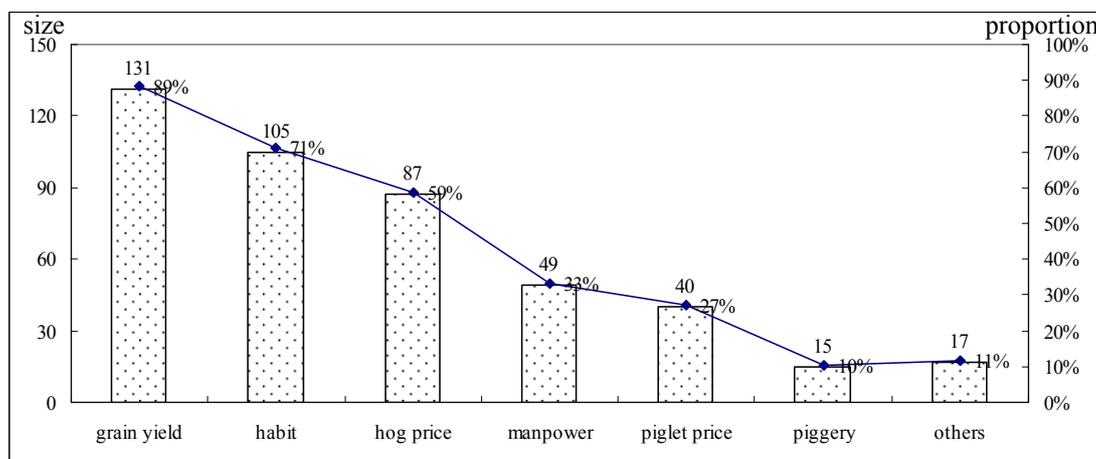

Figure 5. Factors that affect scattered farmers to regulate pig herds

Source: The data is from the statistic results of field research on "pig producers' response to pig price volatility" in January, 2013.

Compared with scattered farmers, scale farmers concern much more factors when they make decision (Figure 6). Pig price determines economical returns directly, thus 71% scale farmers put it in the first place when they make decisions. Piglet cost is about 25% to the total cost of pig production, and feed cost is around 50% to 60% to the total cost of pig production (Xue et al., 2006). Feed price determines production cost and affects the income to some degree, so about 40% scale farmers refer to it when make decision. About 95.1% scale farmers apply farrow-to-finish production, so they care much more about farrowing rate than piglet price. Epidemic disease is a fatal factor for pig farming industry. Scale farmers are doomed to lose money or even go bankrupt if there emerges wide-spread epidemic diseases. Besides, maize price, self-anticipate to future market, piglet price and piggery can affect scale farmers' decision-making in different degrees.
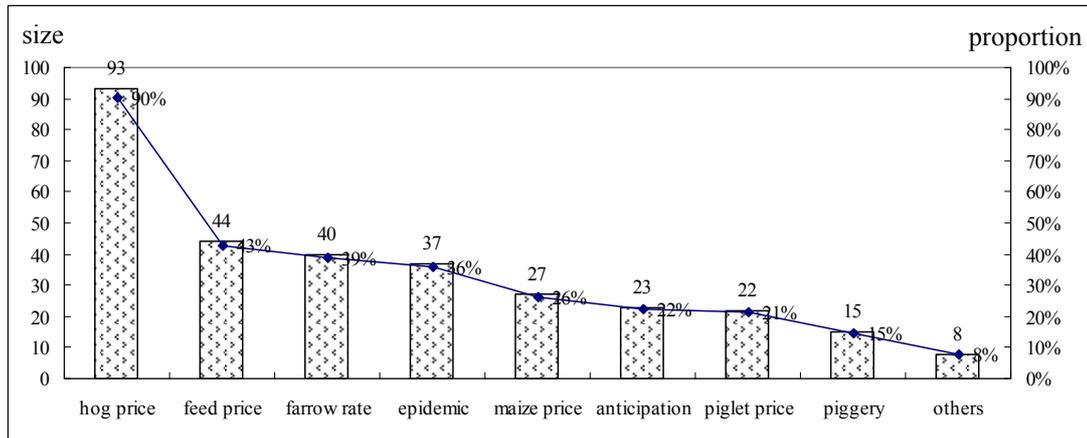

Figure 6. Factors that affect scale farmers to regulate pig herds

Source: The data is from the statistic results of field research on "pig producers' response to pig price volatility" in January, 2013.

Large number of purchasing can increase buyers' bargaining ability, which enables buyers to reduce purchasing cost per unit. Large-scale farming can promote sales and cut down sales cost per capita of pigs (Li, 2007). For pig factories, reducing production cost has a significant impact on total income, so pig factories mostly concern feed price when they make decisions on regulating farming scale (Figure 7). Pig price becomes to the second most important factor following feed price. Most of pig factories owners are well-educated. They apply what they have learnt into judging pig market trend spontaneously. Therefore self-anticipation is the third factor that affects adjusting pig herds. In addition, epidemic disease, subsidy from the state, sows farrowing rate, labor cost and piggery could also affects pig factories' response activities.
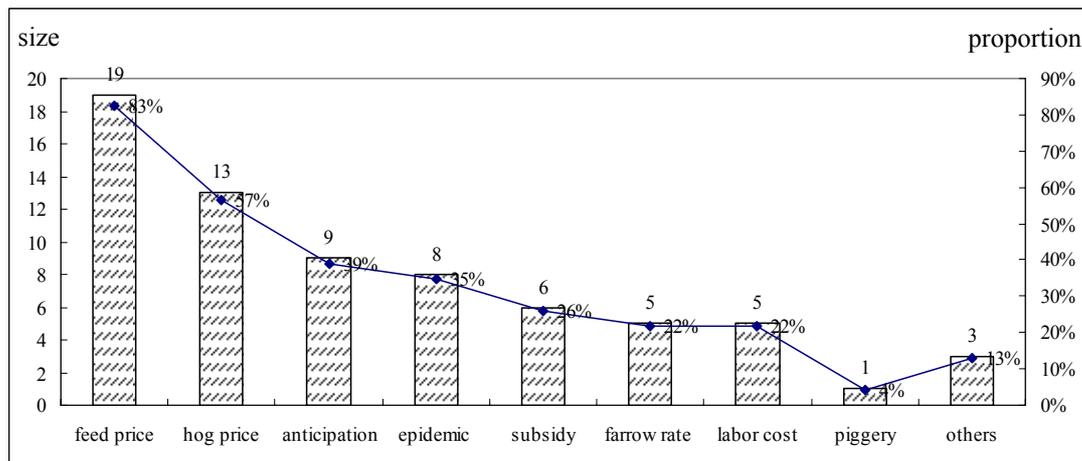

Figure 7. Factors that affect scale pig factories to regulate pig herds

Source: The data is from the statistic results of field research on "pig producers' response to pig price volatility" in January, 2013.

In conclusion, it is motivation of farming and capability to resistant farming risk that make pig producers concern different influencing factors when make decision on regulating pig herds. Scattered farmers farm pigs mainly to satisfy household consumption, and participate in pig market with small amount of pigs. Therefore, price volatility has only a little effect on them, and they suffer the least risk among the three kinds of producers. The sole purpose of scale farmers and pig factories is to reap profits in pig industry, thus they were both sensitive to pig price volatility. Nonetheless, scale farmers suffering from price risk, disease risk and policy risk at the same time with tight capital are much more sensitive to pig price than pig factories. Large-scale farming can reduce production cost and risks, which is conducive for pig factories to enhance farming income. Besides, pig factories are able to get ample subsidy from government. Pig factories are the most advantageous among the three pig producers, and would become the main producer in the future of pig production sector.

4.3 Price Expectation

People have some expectations about the future, which will affect their behavior, thus affect macroeconomic quantity (Lucas, 1972). Market expectation could guide pig production. If there is a good expectation to future market, producers may expand farming scale, otherwise, they may shrink farming scale. Around 70% scattered farmers have no idea about the future pig price expectation. Others guess price trend according to their intuitions. On the contrary, almost the whole scale farmers and pig factory owners have clear expectations to future market price. Scale farmers and pig factory owners often pay close attention to epidemic diseases locally and nationally, estimate pig supply and pork demand with seasonal change. Through continuous learning and experience, most scale farmers and pig factory owners are familiar with the U-shape pig price trend (Note 10) in a year. In sum, scattered farmers have scant market expectation, while scale farmers and pig factories have sufficient market expectation. Consequently, scale farmers and pig factories are well prepared for pork price volatility.

5. Conclusions

This article aims to explore cobweb phenomenon exists in pig price volatility from 2000 to 2012, and investigate the relationship between pig price volatility and producers' responses via using first-hand data from Sichuan, China. The historical data shows that from 2000 to 2003, pig price volatility coincides with Occlude Cobweb Model, while during the period from 2004 to 2012 pig price volatility coincides with Divergent Cobweb Model. Moreover, there exist trends that pig price will increasing intense in the future.

During pig production process, scattered farmers pursue utility maximization of meat consumption and manure accumulation in the first place; while scale farmers and pig factories mainly seek for economic profit maximization. More than half of scale farmers enlarge or shrink their farming scale when pig price increase or decrease. While most scattered farmers and pig factories remain unchanged. Scattered farmers make the decision of farming scale according to the grain at disposable. Scattered farmers are the least sensitive to pig price change for they merely dabble in the pig market. Pig factories are not very sensitive to pig price volatility either, for they have solid financial capacity. Scale farmers are the most sensitive to pig price change for their objectives of maximum economic returns and high pressure from pig industry. Scale farmers encounter price risk, epidemic risk and policy risk at the same time. Due to the impact of natural growth cycle, regulation always lags behind price change. Scale farmers always regulate farming scale according to market price, which can result in intense price fluctuation. Therefore it is scale farmers who always break market equilibrium and suffer most from price volatility at the same time.

At current, scattered farmers and small scale farmers who have difficulties in creating brand products are the two main kinds of pig producers participating in market competition in China, which lead to slow development of China's pig industry (Lu, 2013). Around 75% scattered farmers in the survey are over 50 years old, and young farmers are reluctant to farm pigs, as a result, the number of scattered farmers will be smaller and smaller or even disappear as time goes. Scale farmers trend to enlarge the size of the farm operation and will transform into pig factories in the end. Pig factory farming is bound to be the dominant producer of future pig industry. Pig factories should upgrade the quality of their product and improve their performance in the level of providing standardized packing products (Rezitis and Stavropoulos, 2009). Government should further assist pig producers to participate in intensive investment programs and interpose pig price as little as possible. It is the most effective way to let the "invisible hand" to regulate price in the pig market.

Acknowledgement

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Notes:

Note 1 Agriculture Department. (2007).The rising pig price is the abnormal fluctuation this year. From: http://www.xinnong.com/news/20071212/25727.html.

Note 2 Fan, E.G. (2011): Pathways to intensive farming of pig industry. Minsheng Weekly, 32. From: http://paper.people.com.cn/mszk/html/2011-08/08/content_894612.htm?div=-1

Note 3 In 2011, the top ten provinces of pig herds in China were Sichuan (accounting for 11.5%), Henan (9.6%), Hunan (8.5%), Shandong (5.9%), Yunnan (5.8%), Hube (5.3%), Guangdong (5.1%), Guangxi (5%), Hebei (4.4%) and Jiangsu (3.7%). There were 20 provinces whose annual pig slaughter was more than 10 million in China. Sichuan Province was the largest province of pig production in China, whose annual pig slaughter exceeded 60 million, accounting up to 10.5% of the national pig slaughter.

Note 4 The population of Sichuan Province is 80,418,200 according to the sixth national population census main data bulletin Ⅱ in 2010.

Note 5 Recent years, the proportion of total pig production from scattered farmers dropped significantly, but the amount of scattered farmers was still high, approximately 64 million and took up 96% of the whole pig producers. There were about 2.54 million scale farmers, accounting for about 4% of the whole pig producers. Pig factories whose annul pig slaughter up 3000 capita took up 0.03 percent of the whole pig producers (Wang, J. M., Pan, Y. G., 2012): Development problems of pig industry in China. Guoyan Network. From: http://www.qstheory.cn/jj/jsshzyxnc/201210/t20121009_185170.htm.). Therefore, we got 148 scattered farmers, 103 scale farmers and only 23 pig factories in our survey.

Note 6 In 2007, pork price rocketed greatly and drove the growth of CPI. Government intended to control pork price by increasing the supply of live pigs. To promote intensive pig farming production and accelerate transformation in pig production, the state provided subsidies to pig farms whose annual slaughter of pig is more than 300 to build pig farms. In 2008, the subsidy standard increased annual slaughter of pig to 500. Between

2009 and 2010, pork price declined, and this policy was abeyant. In 2011, this police continued to implementation again.

Note 7 In 2006 streptococcosis suis was epidemic in Sichuan Province originally.

Note 8 PRRS is the abbreviation of Porcine Reproductive and Respiratory Syndrome.

Note 9 Policy risk means the change of subsidy from state and local government, the standards of pig farm construction. In the past years government gave abundant subsidy to farmers when pig price was very high, and withdrew it when pig price was very low. The standards of pig farm construction are become growing demanding in recent years.

Note 10 Starting from every February, pork price begins to decline. Pork price stops declining in May and June, but the low price trend sustains to November. In December, pork price begins to rise again. This change trend has a great relationship with pork consumption habits of Chinese residents. In the main pork consumption areas, residents get used to store abundant pork for Spring Festival, thus in every December and next January, there will be a significantly increasing demand of pork, so pork price will rise. While in May and June, due to hot temperature there is an overall decline in pork consumption, so pork price will fall (Zhao, 2010).

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