Feasibility Analysis and Schematic Design of Chinese Hog Price Insurance

(Extended Abstract)

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Since the year of 2007 when the policy of agricultural insurance piloted, Chinese agricultural insurance has achieved rapid development. For the past 7 years, agricultural insurance premium income in China has risen to 30.66 billion yuan from 2.05 billion yuan; China has become the world's second largest agricultural insurance market.

Currently, agricultural insurance in China is mainly to cope with production fluctuation caused by natural disasters; however, there are few insurance products to cover market risks due to price fluctuations of agricultural products. The "No.1 Central Document" clearly pointed out to explore the way of constructing "target price insurance pilot" in agricultural products like grain and livestock in 2014. Among all kinds of agricultural products, hog has the largest impact on urban and rural residents besides grains. Hog raisers are faced various risks such as diseases, disasters and accidents and meanwhile suffered from the dramatic volatility of feed and hog price which also affect their income. How do the farmers deal with the live hog market price risk? Can hog price insurance be included in agricultural insurance system? The objective of this paper is mainly to discuss the feasibility of hog prices insurance in China and to analyze the main points of scheme of hog price insurance design.

## 1. Hog price fluctuation and risk characteristics in China

The data of this paper is based on national hog market price monitoring data on monthly basis from January 2000 and December 2013 provided by agriculture department. We conduct quantitative decomposition smoothing technique to analyze the time series price data. We decompose the detrended price data into periodic fluctuations, seasonal fluctuations and random fluctuations, and then analyze each part of risk characteristics.

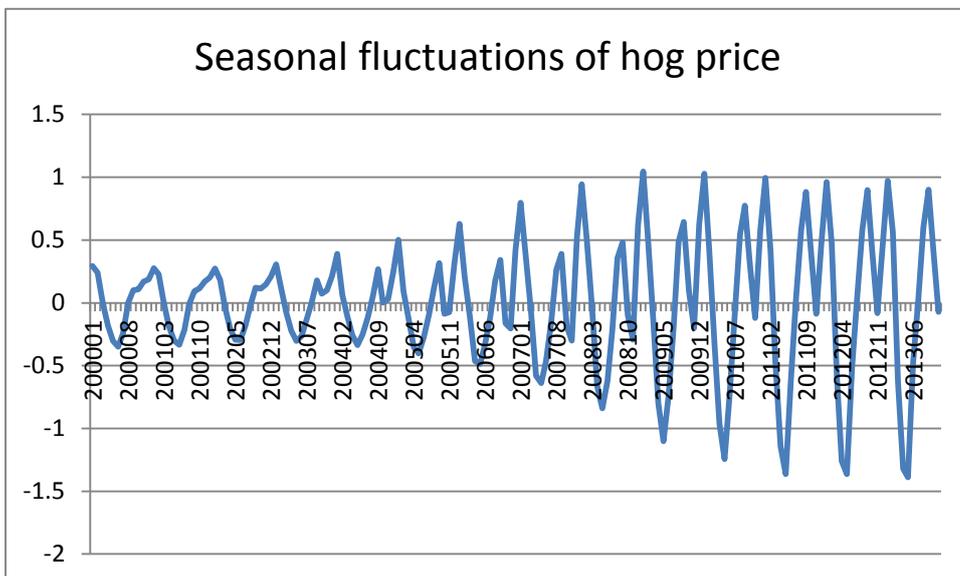### 1.1 Hog price fluctuations

1.1.1 Periodic fluctuations

Hog price fluctuations from January 2000 to December 2013 can be divided into 3.5 complete cycles. The periodic fluctuations have obvious regularity. First, each cycle's length is about 40 months. Second, the downward and upward of each cycle are about 20 months respectively. Third, the cycle fluctuations tend to become much more drastic.

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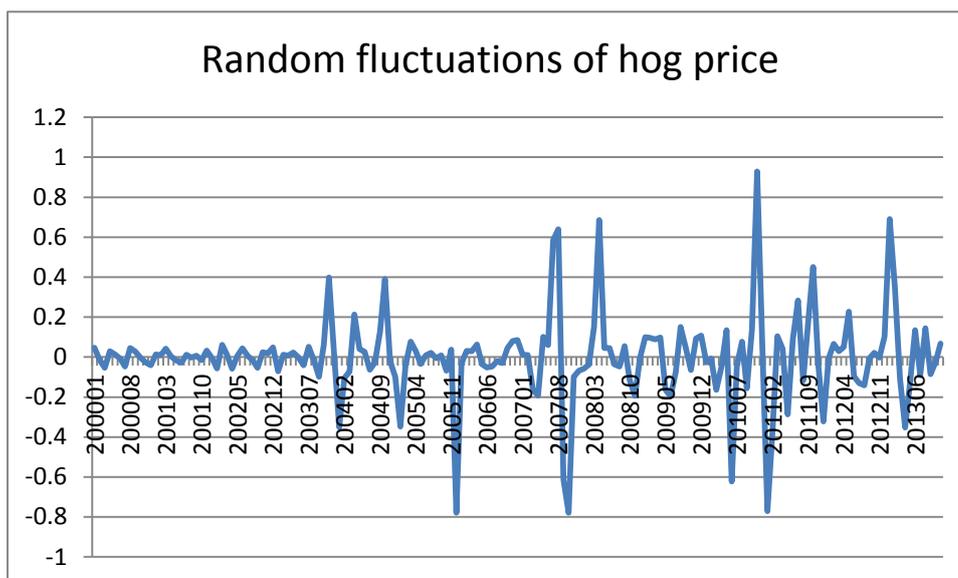
Period fluctuations of hog price
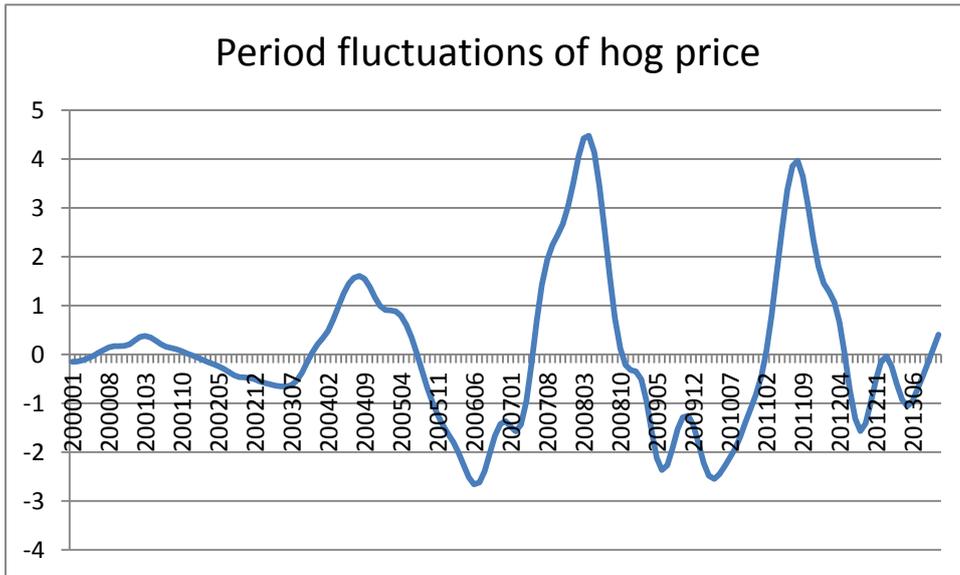
1.1.2 Seasonal fluctuations

Hog price fluctuations follow a regular U-shaped seasonal pattern for one year. Specifically, in each year, the highest price comes in January; after then, the price goes downward at the start of February and maintains decrease to May when the price bottoms; then the price begins to rise in June till October; after a slight downgrade, the price continues to climb till next year and peaks in January.

Seasonal fluctuations of hog price

1.1.3 Random fluctuations

The amplitude of random fluctuations has a tendency of increase.

Random fluctuations of hog price

1.2 Hog price risk characteristics

1.2.1 Systematicness

The systematicness of hog price risk performs in the following three aspects. Frist, the trends and characteristics of hog price fluctuation in different regions keep almost in line; second, the trends and characteristics of farm price, wholesale hog price and retail hog price basically maintain consistent; third, all producers with different scales are faced with the same trends and characteristics of hog price.

Imperfect randomness

Hog prices are influenced by a variety of uncontrollable factors, hog prices fluctuate in a mean of random to a large degree. However, seasonal fluctuations and periodic fluctuations are predictable.

1.2.3 Multiple risks

Hog price risks consist of random fluctuation risk, seasonal fluctuation risk and periodic fluctuation risk. Among them, random fluctuation risk has the smallest amplitude but the largest probability of occurrence. The periodic fluctuation risk has maximum amplitude and minimum probability of occurrence. The seasonal fluctuation risk is between the two. The proportions of three kinds of price fluctuation risks occupying the total risk are displayed as follows:

The proportions of three kinds of price fluctuation risks

risk	Periodic risk	Seasonal risk	Random risk
proportion	60.46%	26.19%	13.35%

2. Feasibility analysis of hog price insurance in China

2.1 The challenges and solutions to implement hog price insurance

2.1.1 Requirements of insurability

Traditional theories hold that insurable risks need to satisfy the following requirements: a) Randomness, that is, the occurrence of the risk is casual, accidental and unpredictable. The loss of the risk is not caused by the insured's intentional act. If the policy-holders and insurers study through the related historical data and are able to discover a certain regularity of occurrence of the risk, the risk is not random and therefore, it cannot be insured. b) Independence, which means that the risk is independent rather than systematic. Highly relevant risks can hardly be diversified by pooling and are likely to lead to huge losses. c) Measurability, which means there are data or methods to estimate the probability of risk events and their economic loss in order to calculate the probability distribution of the risk and appropriate premium rate. d) Symmetry. The information of the cause and the loss of risk are equally readily available between the insurer and the insured, so as to minimize the possibility of moral hazard and adverse selection. E) Mutuality. The occurrence likelihood and severity should match relatively. If the severity of loss is too high, the premium rate is too high for the insured to afford; if the severity of loss is extremely low, it is not necessary to take a certain cost to transfer or diversify the risk.

2.1.2 Challenges to implement hog price insurance

The systemicness and imperfect randomness of hog price risks violate part of the requirements of insurable risk. Specifically, the violation may lead to the following four potential problems: a) Frequent occurrence of catastrophe. The systematicness of price risk means that catastrophic risk may occur frequently which makes it difficult to spatially diversify the risks and the insurer is likely to be faced with huge loss and indemnity at a time. b) High premium. Because of occurrence of catastrophe, insurance company needs a high premium rate to cope with the huge indemnity of catastrophe, and the premium is probably beyond the price range of farmers. c) Adverse selection. Since hog price fluctuations show periodical and seasonal regularity, the insured will take advantage of it if the period of insurance is set inappropriately. d) Lack of standard and transparent price information. Price insurance has strong requirements of data which must be verifiable, easily to observe, determined by market, and timely to release. The futures price are generally considered to be the best information to determine the premium and indemnity of price insurance, but there are no hog futures in China.

2.1.3 Solutions

Whether hog price risks are insurable or not is determined by the solutions of four following problems which depend on institutional and technological innovation. a) Premium subsidies from the government. The problem of high premiums can be resolved through the government's premium subsidies and this is also the basic requirement of policy-oriented agricultural insurance. Because agriculture is quasi-public goods, Chinese government has an obligation and willingness to subsidize the agriculture. b) To establish catastrophic risk diversification system. A multi-level catastrophic risk diversification system is needed to cover potential catastrophic risk and the possibility of huge indemnity. Now China is speeding up to build catastrophic diversification system of agricultural insurance. c) To optimize the insurance product. In the terms of the potential adverse selection caused by in seasonal and periodic fluctuations of hog prices, insurance technology and product innovation is the main solution. At present, the study about policy-related agricultural insurance is increasingly intensive by experts in insurance industry and academia, and great progress has been made in the technology and innovation in insurance

product. b) Price collection and publish system. In terms of requirement of third-party price information, Chinese government has established and improved agricultural product price collection and release system. Therefore, hog price can be timely published to meet the demand of information in hog price insurance.

2.2 The advantage of hog price insurance

Hog price risks management methods consist of a variety of tools and policy measures including contracts, futures, options, minimum protective price and temporary reserve by government. Compared with these methods, hog price insurance has the following advantages:

a) Effectively play market mechanism. Compared with the direct governmental intervention measures, such as minimum protective price and the temporary reserve, hog price insurance does not interfere with the market price formation mechanism, nor distort market participants' behavior, so it give full play to the market mechanism.

b) Accord with the rules of WTO. The direct production subsidy or price subsidy policy belongs to the "yellow box" policy of WTO rules. However, the hog price insurance is one of the "green box" policies, and thus it is not restricted by the international rules.

c) Low barriers to implement. Compared with the traditional price risk management tools such as futures and options, hog price insurance is more easily to understand and the covered scale requirement for individual is also far lower than that of the futures contract. Therefore, it is more acceptable for farmers.

d) Protecting the farmers' income. By using futures and options, farmers can realize to hedge the risk through reverse operation and lock the future strike price, but that makes farmers' income determined. However, hog price insurance covers the risks in a different way. Farmers pay a lower premium in advance, and price insurance can not only protect the risk that prices are lower than the expected, but also make farmers obtain the earnings when price is beyond the expectation. Therefore, insurance lets farmers get benefits of price raise.

e) Low transaction cost. The promotion of hog price insurance in China could make use of all kinds of resource and service system of existing hog death insurance, thereby saving a lot of transaction costs.

3. Schematic Design of Hog Price Insurance

3.1 Indicator

The selection of the coverage price is directly related to the insurance liability. According to the international practice, there are two types of coverage indicators-hog price and hog-corn ratio. We believe the hog-corn ratio has more advantages than hog price. Given that Chinese price collection and publish system, coverage based on hog-corn ratio is preferable as following reasons: a) Hog-corn ratio reflects the status of the income of the hog raisers more accurately than hog price indicator does. The prices of corn and soybean meal are the main factors affecting the cost of hog breeding, and thus, hog-corn ratio based method is more attractive to the farmers because it covers hog prices as well as feed prices. b) hog-corn ratio based method can decrease the loss ratio and premium. In general, hog price changes in line with feed prices. Therefore, the volatility of hog-corn ratio will be less than that of hog prices. Smaller volatility means, under the

same coverage level, lower probability of indemnity and less premium. c) Premium rate is more easily to determine through hog-corn ratio. Insurance is mainly to cover the risk that prices fluctuate, so long-term trend must be eliminated. Hog-corn ratio has no obvious long-term trend, and thus, the determination of premium is easer through hog-corn ratio based method

3.2 Coverage price

Coverage price refers to the insured price in the insurance policy during the period of insurance and it reflects the judgment and preference of the insurers and the insured. Coverage price can be a dynamic expected indicator (like LGM-SWINE in America), or a fixed expected indicator (like Chinese hog price insurance). Using dynamic forecast price as coverage price is more conducive to prevent policy-holder's adverse selection, but it needs to rely on the prices in futures market. However, there is no hog futures market in China, so we need to forecast the expected price. At present, Chinese government is applying itself to promote fixed target hog insurance, in which the coverage hog-corn ratio is 6:1. However, it needs delicate design of insurance product (e.g., appropriate insurance period) to effectively prevent the policy-holder adverse selection.

3.3 Insurance period

3.3.1 Insured period

Now we assumed coverage price is determined as fixed target: break-even point of hog-corn price. Thus, the insured period has to be set according to hog price fluctuation cycle. Hog-corn price cycle is in line with hog price cycle which is about 40 months. As mentioned above, there are 20 months upward and 20 months downward. In order to prevent the policy holders' adverse selection, the insured period should be more than a year.

3.3.2 Policy length

Policy length has to match with the approximated hog's production period that is from hogs are raised to be marketed. In general, hog breeding cycle is about five months, and hog farm apply "all-in, all-out" method, namely after a batch of hogs slaughter, the houses are cleaned and sterilized, and then are empty for 5-10 days before next batch of hogs brought in. Therefore, hog raising and marketing in the year is a continuous process. The policy length should insure the market price of each batch of hogs, and the indemnity should be determined when the batch of hogs are slaughtered instead of the end of insured period. So, in our design, there are 2-3 times of settlement during the insured period, and each policy length shall be four to six months.

3.4 Coverage and indemnity

In the fixed hog-corn based method, the coverage can be calculated by the following formula:

*Coverage = expected hog-corn ratio * contracted corn price (yuan/kg) * insured average weight (kg/head) per hog * insured head number*

At the end of insurance period, if the actual hog-corn price is lower than the expected hog-corn ratio, i.e. a payout is triggered, the indemnity is calculated as follows:

*Each indemnity amount = (expected hog-corn –average hog-corn) * contracted corn price*contracted average hog weight*finished head number*