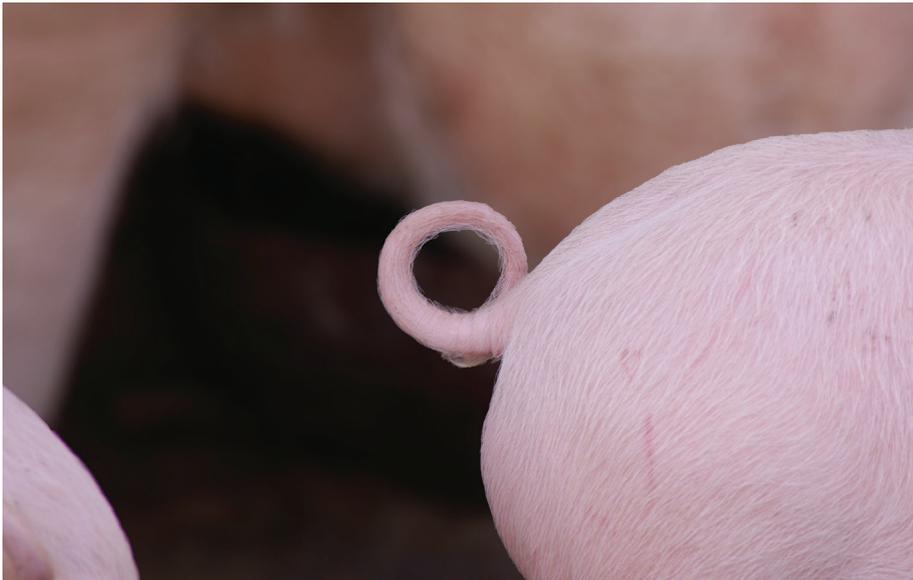




A Cautionary Tale

An exploration of the features and issues associated with Pig Price Index Insurance, a non-traditional agriculture product in the Chinese market that indemnifies pig farmers when the average pig:corn price ratio falls below a pre-specified threshold.



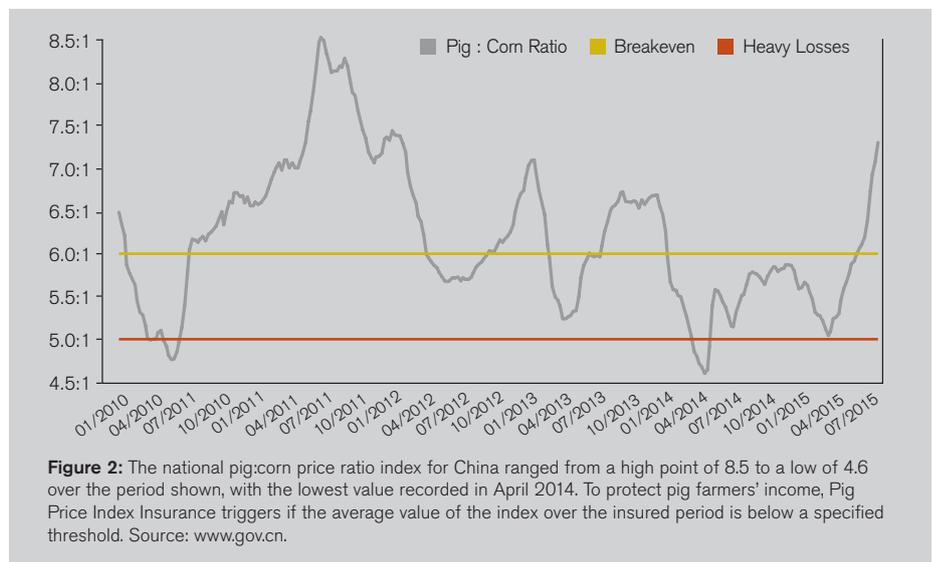
Pig Farmers' Profitability	Pig:Corn Price Ratio
Break even	6:1
Small losses	between 5.5:1 and 6:1
Moderate losses	between 5:1 and 5.5:1
Heavy losses	below 5:1

Figure 1: The pig:corn price ratio for China, published centrally on a weekly basis, is taken as an indicator of approximate profitability for pig farmers. The ratio is used as a trigger for Pig Price Index Insurance; indemnification is triggered if the average ratio over the period of insurance falls below a specific threshold. Source: www.gov.cn.

The need for cover

Economic growth has seen the demand for meat, in particular for pork, rise dramatically in China. In fact, pork prices have a strong influence on China's Consumer Price Index (CPI). A number of scares, including an epidemic in 2007 which led to the annual rate of increase in the CPI hitting a ten-year high¹, prompted the government to seek ways to protect farmers against losses, ensure continued supply and avoid price volatility. With corn as the primary feed for pigs, Pig Price Index Insurance was launched as an income protection solution that would protect farmers based on the relative prices of pig and corn.

On a weekly basis, the government publishes the national average pig price per kilogram, corn price per kilogram and the pig:corn price ratio². Although corn is not the only feed for pigs and there are regional differences in terms of pig and corn prices, as well as other factors impacting income and expenditure, such as labor costs, the



pig:corn price ratio is often cited as the primary indicator of pig farmers' profitability. The pig farmers' breakeven point is considered to be a pig:corn price ratio of 6:1. The accepted relationship between the pig:corn ratio and losses to farmers is shown in **figure 1**.

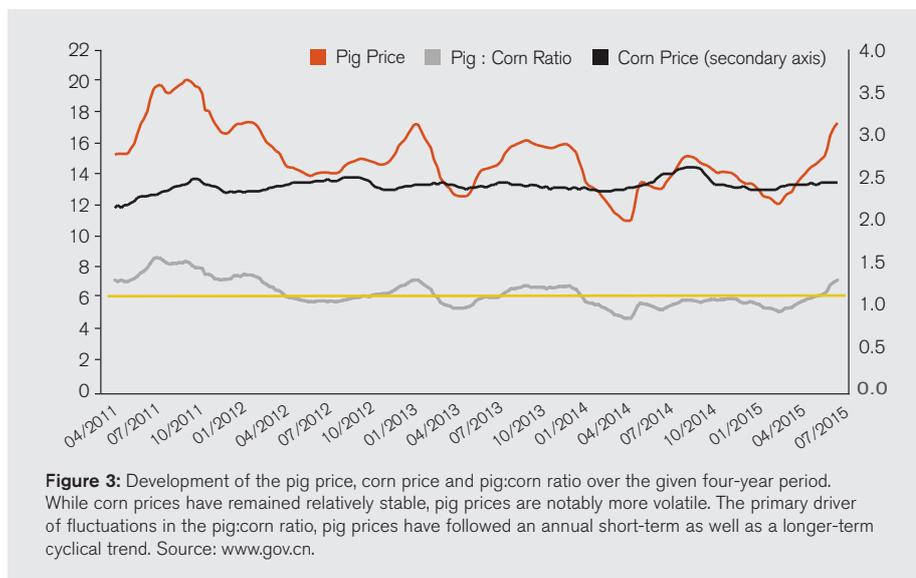
Despite recent reports of a spike in the price of pork in China, the pig:corn price ratio was below the breakeven point from mid-January 2014 to May 2015 (see **figure 2**); farmers are estimated to have lost between 200–500 RMB³ per pig over this period⁴. As a result, and supplementing traditional agriculture insurance

¹ e.g. The Economist, 'Empire of the Pig', 2014.

² www.gov.cn

³ Chinese Yuan Renminbi (RMB or CNY)

⁴ www.xinnong.net/zh



Wording Type	Payout per pig when PC(a) < PC(t)
A	$[PC(t) - PC(a)] \times C \times KG$
B	$\frac{[PC(t) - PC(a)]}{PC(t)} \times C \times KG$
C	$[PC(t) - PC(a)] \times \% \text{ of SI, \% increases with } [PC(t) - PC(a)]$

Figure 4: Calculation of the claim payout per pig for Pig Price Index Insurance according to three different wording types. Source: PartnerRe.

Wording Type	A	B	C
SI (RMB)	2,160	2,160	2,100
Actual PC(a)	Payout per pig (RMB)		
6.0	-	-	-
5.8	72	12	14
5.6	144	24	28
5.4	216	36	42
5.2	288	48	56
5.0	360	60	70
4.5	540	90	140
4.0	720	120	280
3.5	900	150	560

Figure 5: Numerical example showing how the payout per pig varies between wording types for specific PC(a) values. Source: PartnerRe.

example whereby PC (t) = 6:1, C = 2.4, KG = 150, and for cover C the SI is 2,100 RMB. In this example, the payout per pig for different values of the PC(a) ratio are as given in **figure 5**.

In this example, wording A compensates an assumed 'full loss' suffered by the farmer when the pig:corn ratio falls below 6:1, whereas wordings B and C only compensate for part of the loss. The insurer of wording A would require a high enough premium rate to cover such claims.

Now approximating the performance of the product against pig:corn price statistics: Market experience indicates that premium rates for wording A have been recorded at between 2% and 4%, and the PC(a) ratio

products that cover disease and accident, the government encouraged insurers to provide income protection products to farmers that raise pigs and which trigger when the average ratio over the insured period is below 6:1.

Behind the ratio

Taking a closer look at the last four years (see **figure 3**), it is apparent that the corn price has remained relatively flat in comparison to the more volatile pig prices. Traditionally, pig prices follow an annual cyclical trend with higher prices in winter due to increased demand (also seen on the May 1 and October 1 public holidays). In addition to this annual short cycle, there was over this period also an underlying longer cycle that was also driven by factors of supply and demand:

- Pig prices reached an historical high in 2011, peaking at over 20 RMB per kg. Pig farmers substantially increased their stock of sowing pigs in that period to produce more fattening pigs.
- As a result, the supply of fattening pigs increased over the next few years, causing the price of pig to gradually fall.
- The consumption of pork then reduced due to a crackdown on corruption and a move away from pig to fish, dairy and egg for protein intake.
- Due to the subsequent lack of profitability in 2014, pig farmers significantly reduced both the number of sowing pigs and fattening pigs. At present, the level of stock has fallen to a five-year low and the price of pig is again rising.

Workings of the insurance

There is no standardized wording for Pig Price Index Insurance and covers vary by insurer and province, although there are in general three types of cover known as A, B and C, A being the most common. With the high national importance of pork, most premiums are subsidized by the government by up to 80%, the government also sets some of the parameters regarding how the cover works, including approval of the trigger ratio, as well as influencing the rates.

General cover factors for Pig Price Index Insurance

- PC(a): the average actual pig:corn price ratio, as published on the government website, over the insured period (commonly three months, six months or one year).
- PC(t): the trigger point of the cover, which is also a pig:corn price ratio, usually 6:1.
- C: agreed corn price per kg, usually the market price at policy inception.
- KG: agreed weight per pig, on average approximately 150kg.
- If C or KG are specified, the Sum Insured (SI) = PC(t) x C x KG. If not, there is an Agreed Sum Insured (SI) per pig.

The calculation of claim payout per pig varies by wording type (see **figure 4**).

To show how wording type impacts claim payment, let us consider a theoretical

was 5.34 for H1⁵ 2014, 5.68 for H2 2014 and 5.72 for H2 2015. Covers based on wording A with a trigger point of 6:1 and an example premium rate of 3% would have easily attracted loss ratios exceeding 500% in this period. For policies issued in 2015 there was a subsequent reduction in the trigger ratio to values in the range of 5.4 and 5.6. With the reduction in supply of pig following low profitability in 2014, the PC(a) ratio is now back above 7:1 and the indication is that insurers have increased the trigger point back to the breakeven ratio.

The risks for re/insurers

From the above it is clear that the major driver of claims experience is the pig price. Protecting price fluctuation raises many questions and difficulties for re/insurers.

Is the risk insurable?

Traditional livestock insurances that protect against diseases, fire and natural perils, indemnify accidental losses. Pig Price Index Insurance losses do not however occur at random, but are linked to falling pig prices and follow a cycle of demand and supply.

Are the frequency and severity of expected losses assessable?

Traditional insurance models are not appropriate for price fluctuation covers, which are similar to a put option in finance. Such covers could therefore be better assessed via option pricing strategies.

Is the risk manageable?

In the medium term, it is possible for farmers to diversify into different types of livestock and feed and hence to minimize losses due to pig or corn price fluctuations. Collectively, pig farmers can also impact the medium-term pig price by either

increasing or reducing supply, though there is a delay in effect (for example, it took more than 12 months for the pig:corn ratio to climb back above the breakeven level of 6:1 in 2015).

The government also takes a number of measures that can help to stabilize the ratio, such as putting pork into cold storage to reduce supply and maintain price levels. The impact of this on the ratio is however also delayed and unquantifiable. Furthermore, although the corn price has appeared relatively stable in past years, it is uncertain as to whether this is representative of the future.

Can the risk be diversified?

Some covers refer to the national ratio, while others refer to a province level ratio. If the cover refers to a province ratio, there may be a limited diversification benefit for insurers writing across provinces. However, provincial ratios have historically followed a similar trend to the national ratio.

Improving the long-term viability of the product

Given the issues discussed, more could be done to improve the long-term viability of this product. Insurers can seek to limit their exposure by arranging Quota Share or Stop Loss reinsurance treaties, but for a more sustainable solution for all concerned and to continue to achieve the goal of protecting farmers, the following points should be considered:

- Working together with the government on adjusting the product's features and premium rates.
 - The 6:1 breakeven point, for example, is too high as a policy trigger given the frequency at which the ratio falls below it.

- In addition, wordings such as B and C are preferable to wording A, which compensates the assumed full loss to the farmer without farmers taking any share of the risk.
- Introducing a loss cap if the product is to be sold widely, as this is a systemic risk that requires careful risk management and adequate capitalization.
- Hedging the risk in the financial markets as insurers are effectively selling a put option to farmers. This would rely on a mature commodity trading market. There has been recent news regarding pilot commodity trading products that have been designed and submitted for approval by PICC Dalian in China, whereby the insurer sells commodity price protection products to farmers and at the same time hedges the risk via futures⁶.

Agriculture Risk Solutions from PartnerRe

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