Demand for Price Insurance among Farmers in India: A Choice Experiment-based Approach

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ABSTRACT

Using choice experiments, we estimate the willingness to pay for price insurance among cotton and paddy farmers in the Indian state of Gujarat. We also identify the interactions between the demand for price insurance and the existing informal and formal insurance mechanisms. Our results indicate that cotton farmers value price insurance more than paddy farmers. Also, most of the existing informal risk management strategies of farmers seem to have a positive effect on the demand for price insurance, suggesting potential complementarities. Important policy implications on the design and bundling of innovative financial products follow from our findings.

Keywords: Willingness to pay, price insurance, choice experiments, India

JEL classification: D81, D01, G13

1 INTRODUCTION

Agriculture is an intrinsically risky economic activity. Farmers face a multitude of risks, such as production risks, on account of weather variations, and price risks, associated with falling output prices (Newbery and Stiglitz 1981; Walker and Ryan 1990; Kurosaki 1998; Harwood *et al*. 1999; Hardaker *et al*. 2004). While farmers all over the world are vulnerable, farmers in the developing world are more susceptible to such risks because the markets for credit and insurance are either absent or incomplete (Rosenzweig and Binswanger 1993). To mitigate these risks, farmers rely on a number of informal risk management strategies, such as spatial and variety diversification; staggered plantation; and support from informal risk sharing networks (Alderman and Paxson 1992; Rosenzweig and Wolpin 1993; Townsend 1994; Dercon 1996; Skees 2002). However, while these informal mechanisms may be effective against idiosyncratic and low-magnitude shocks, they may fail in the eventuality of systemic or covariate shocks that affect a large number of farmers in a specific region simultaneously (Townsend 1995). Given the inadequacy of informal risk management mechanisms in the developing world to mitigate systematic and covariate risks, there have been attempts at developing efficient formal or market-based risk transfer instruments. But most available instruments focus on insuring production risks of farmers through either multi-peril crop insurance (Hazell *et al*. 1986; Mishra 1995) or through index-based weather insurance (Manuamorn 2007; Barrett *et al*. 2007; Barnett *et al*. 2008; Cole *et al*. 2012), and lay little emphasis on insuring farmers' price risks that could impact farm revenues considerably (Ramaswami *et al*. 2004). Although pilot revenue insurance programmes have previously tried to address the issue of price risk, individual farm-level price risk is left unmitigated in these programmes, primarily because of the aggregated estimates of yield and price used in such programmes (Mahul and Wright 2003).[1]

2 PRICE RISKS, EFFECTS OF UNMITIGATED PRICES RISKS, AND PRICE INSURANCE

2.1 Price Risks: Larger Concern

Though yield risk is important for farmers, the uncertainty in harvest prices and the downside risks in output prices is sometimes a larger concern, particularly for cash crop farmers who stand to lose substantially if they receive lower-than-expected prices (Harwood *et al*. 1999; Sarris *et al*. 2006). Moreover, during times of very low prices, farmers in developing countries are prone to distress sale of their produce as credit and storage facilities in these countries are imperfect (Sahu *et al*. 2004; Poulton *et al*. 2006). Harvest price risks are managed primarily by

[1] Revenue insurance products make a payout based on the revenue index, which is generally a product of yield in a homogeneous area (county, state, or other smaller division) and the futures price. This index might not actually reflect the individual farmer's income risk in all cases.

the state's institutional arrangements. Failures in these arrangements expose farmers to considerable price volatility. For example, the system of minimum support prices (MSP) in India guarantees floor prices for different commodities, and promises procurement by the government if market prices crash, but the system has not effectively insured prices realised by farmers.[2] Moreover, while market-based risk management options (such as hedging in the futures or options markets) provide farmers in the developed world ample strategies to hedge price risk (Berg and Schmitz 2008), developing world farmers have few such options.

2.2 Effects of Unmitigated Price Risk

The effects of unmitigated price risk can be seen in both ex post and ex ante decision-making of agents in an economy (Dehn 2000). In a seminal work, Sandmo (1971) explores the effect of price risk on ex ante decision making and shows that a risk-averse firm would produce less if the output price were uncertain than if it were deterministic. In the context of a farm household, Finkelshtain and Chalfant (1991) show that the same may not be true for farm households when they produce commodities that they consume a part of. But Sandmo's (1971) hypothesis can be held true for farm households that produce cash crops, and we have reasons to believe that generally risk-averse farmers would produce less under price uncertainty than if prices were certain. It has also been argued that unmitigated price risk can significantly impact farmers' revenue and their short-term labour allocation, crop choices, and long-term investment decisions (Dercon 1996; Hill 2009, 2010).

For food crop growers and subsistence farmers, volatile harvest prices are a major concern. The impact of food price volatility on farm household welfare depends on whether such households are net buyers of the food crop or net sellers (Bellemare *et al*. 2011). Moreover, the price risk associated with these crops is found to have a differential impact on rich and poor farmers (Barrett 1996), and could have important welfare consequences in the developing world.

2.3 Price Insurance

The aforementioned studies suggest that while the price risk associated with crops could adversely affect farmers' decision-making and welfare, farmers' options to insure these risks are limited. Given this conjecture, there is strong motivation to believe that farmers might be willing to pay for market-based insurance to insure against price risk, namely 'price insurance'.

Accordingly, three things become relevant in understanding the demand for price insurance.

1. The willingness to pay (WTP) for price insurance might be different for cash crop cultivators than for food crop cultivators.

[2] At present, the MSP is announced for 25 major agricultural commodities (all-important cereals; and pulses, oilseeds, cotton, jute, sugarcane, and tobacco).

2. The demand for such price insurance might depend on the farmer's risk attitudes and the existence of informal risk mitigation strategies.
3. The demand for price insurance could also depend on the availability of alternative 'price discovery' and formal risk management instruments to hedge income risk.

These demand side issues are critical and need to be understood, especially in the context of developing countries, but no systematic studies address the issue of price risk for farmers in India. The implementation of government MSP programmes for various crops has not been very effective (Government of India 2006; Basu 2010), and farmer participation in the nascent commodity futures markets is very low.[3] Trading in commodity options has been banned; even if the ban is lifted, farmer participation might be low because of complexities like minimum lot size and margin money involved while trading in exchanges (Simmons 2002; Pannell *et al*. 2008). Given this scenario, it is critical to understand the value of price insurance for farmers. This issue has not been explored in the Indian context and this paper attempts to address this gap.

Using the methodology of choice experiments involving 480 farmers in two talukas of the state of Gujarat, our study addresses the following questions:

- Do farmers have the willingness to pay (WTP) for price insurance?
- What attributes of price insurance products do farmers value?
- What are the factors that influence the sum farmers are willing to pay for price insurance?
- How does the existence or usage of informal risk management mechanisms and rainfall insurance products (a formal mechanism of risk mitigation) affect the WTP?
- Are there heterogeneous effects in the WTP and factors affecting WTP for cash crop farmers (cotton) and food crop farmers (paddy)?

The remaining paper is organised as follows. Section 3 reviews the literature on the demand for price insurance in different country settings. Section 4 explains the choice experiment approach in detail. Section 5 presents the description of the experimental design, survey, and the data used in our analysis. Section 6 presents our main findings, and Section 7 concludes our study.

3 DEMAND FOR PRICE INSURANCE

The literature on demand for price insurance is nascent. A few authors have used different methodologies to study the demand for price insurance and identify factors of demand for

[3] A 2007 survey by the Ministry of Consumer Affairs, Food and Distribution of 2714 farmers found that only 1.3 per cent of the farmers knew of futures markets (Government of India 2008).

hypothetical price insurance products. For example, Hill (2006) estimates Ugandan coffee farmers' WTP for price insurance and finds substantial demand, and that a major factor of that demand is the perception of price variations. Sarris *et al*. (2006) estimate Tanzanian coffee and cashew nut farmers' WTP and find that the usage of informal risk coping mechanisms negatively impacts demand. More recently, Kouame and Komenan (2012) estimate the WTP for minimum price insurance among cocoa farmers in Cote D'Ivoire and establish that apart from various household and demographic characteristics, risk aversion has a significant negative impact on the demand for price insurance. These studies seem to demonstrate a latent demand for formal price insurance among farmers in least developed countries (LDCs). These studies also demonstrate that risk attitudes and existing informal mechanisms (apart from other factors) could significantly impact the WTP for such insurance.

In the absence of actual insurance products, the WTP for insurance has been estimated by using 'stated preference' methods such as contingent valuation and 'revealed preference' methods.[4] The contingent valuation methods use one of two methods: (1) the farmer's direct responses on WTP for insurance (Sarris *et al*. 2006; Kouame and Komenan 2012) or the (2) indirect method, which uses farm household data and risk preference data, and measures WTP as the difference between utility of the household with and without insurance (Sarris 2002; Hill 2006). The revealed preferences method uses farmer's household behaviour data and estimates the WTP by assuming an expected utility maximising behaviour (Gautam *et al*. 1994).

Each of these methods has their own advantages and disadvantages, and has been used in various circumstances accordingly. Strikingly, none of these methods considers the features or attributes of price insurance products while calculating the WTP for farmers, even though these features or attributes could have a significant impact on farmers' WTP.

Attributes like level of coverage (amount of insurance provided) could be considered an important feature that could affect farmers' WTP. Other features like coverage period and claim settlement time are also of practical importance. A priori, we expect that farmers would want to pay more for a price insurance product with a shorter claim settlement time, early coverage start time or a later coverage end time. A choice experiment design to estimating the WTP helps us to understand the effects of these features on the demand for price insurance. To the best of our search, we have not come across any study that has used such an approach to estimate the WTP for a price insurance product.

4 CHOICE EXPERIMENT DESIGN: AN APPROACH FOR UNDERSTANDING THE DEMAND FOR NON-MARKETED PRODUCTS

Choice experiments have been widely used in the consumer demand literature to understand the demand for intangible products or products not yet offered in the market (Alpizar *et al*.

[4] For a discussion on stated preference and revealed preference techniques to elicit WTP, see Carson *et al*. (1994) and McFadden *et al*. (2005).

2003; Hu *et al*. 2004; Birol and Das 2010; Rigby *et al*. 2010; Chiang *et al*. 2012). Most of the usage of choice experiments has taken place in the developed world, and mainly in the field of marketing, transportation, environmental valuation (Louviere *et al*. 2000), and health economics (De Bekker-Grob *et al*. 2012)

The use of choice experiments to assess the valuation and demand of products in the developing world has also increased in recent times. Valuation or demand has been assessed for

- pig breeds and cattle breeds in Kenya (Scarpa *et al*. 2003a, 2003b);
- biodiversity conservation and scenic beauty in Cote D' Ivoire (Bienabe and Hearne 2006);
- water policy scenarios in South Africa (Hope 2006);
- colour and nutritional quality of maize in Kenya (De Groote and Kimenju 2008);
- eco-tourism in Rwanda (Bush *et al*. 2009);
- intercropping systems and GM crops in Mexico (Birol *et al*. 2009);
- improved wastewater treatment in India (Birol and Das 2010); and
- bio-fortified orange maize in Kenya (Meenakshi *et al*. 2012).

These studies show a shift from the simple contingent valuation method to the choice experiment method for valuing non-market and intangible goods. Since price insurance is not marketed currently, our analysis uses the choice experiment design.

Choice theory draws its fundamentals from the work of Lancaster (1966 and 1971), who postulated that the consumer derives utility from the attributes (features) of the product, and not the product itself. Thus, when a consumer chooses a product over another, the trade-off is not just between two products but between different attributes of the two products. Therefore, it is necessary not only to understand how much a consumer values the product but also how much s/he values its different attributes.

The econometric foundation for the choice experiments are derived from the 'random utility theory' following Luce (1959) and McFadden (1974), who proposed a 'conditional logit model', which is useful in determining the impact of a particular feature on the demand for a particular product. According to random utility theory, a customer derives utility (U_{ij}) from a particular alternative. This alternative can be broken down into a systematic component (V_i), which will be determined by the product's features (what Lancaster calls 'consumption technology') and a random component (ε_{ij}), which will depend on the individual's tastes and which is unobserved, as we cannot 'peep into the head' of an individual (Louviere *et al*. 2000, 5). Based on this theory, the linear choice model is represented by the equation:

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad (1)$$

$$V_{ij} = \beta_1 X_1 + \beta_2 X_2 + ... + \beta_n X_n \quad (2)$$

where b s are the utility parameters assumed initially to be constant across all the individuals.

Under a typical assumption of extreme value distribution of error terms, the probability of choosing a particular alternative in a choice set is given by:

$$P_{ij} = \frac{\exp(V_{ij})}{\sum_{h} \exp(V_{ih})} \qquad (3)$$

Based on the choices made by the farmers in our study, the utility parameters are estimated using maximum likelihood estimation (MLE). The above model is also referred to as the conditional logit model, and it assumes that all households or farmers have homogeneous preferences.

To understand the heterogeneity of preferences among the farmers, one alternative is to use the random parameter logit model (RPLM) (Train 1998; Birol and Das 2010), which provides a range of parameter values. But the RPLM fails to explain the sources of heterogeneity (Boxall and Adamowicz 2002). To detect its sources, while accounting for unobserved heterogeneity, we include interactions of household factors with the choice-specific attributes in the utility function. The equation for the utility in this model (with interactions) can be expressed as:

$$V_{ij} = \beta_1 Z_1 + \beta_2 Z_2 + \ldots + \beta_n Z_n + \delta_1 S_1 + \delta_2 S_2 + \ldots + \delta_m S_m \qquad (4)$$

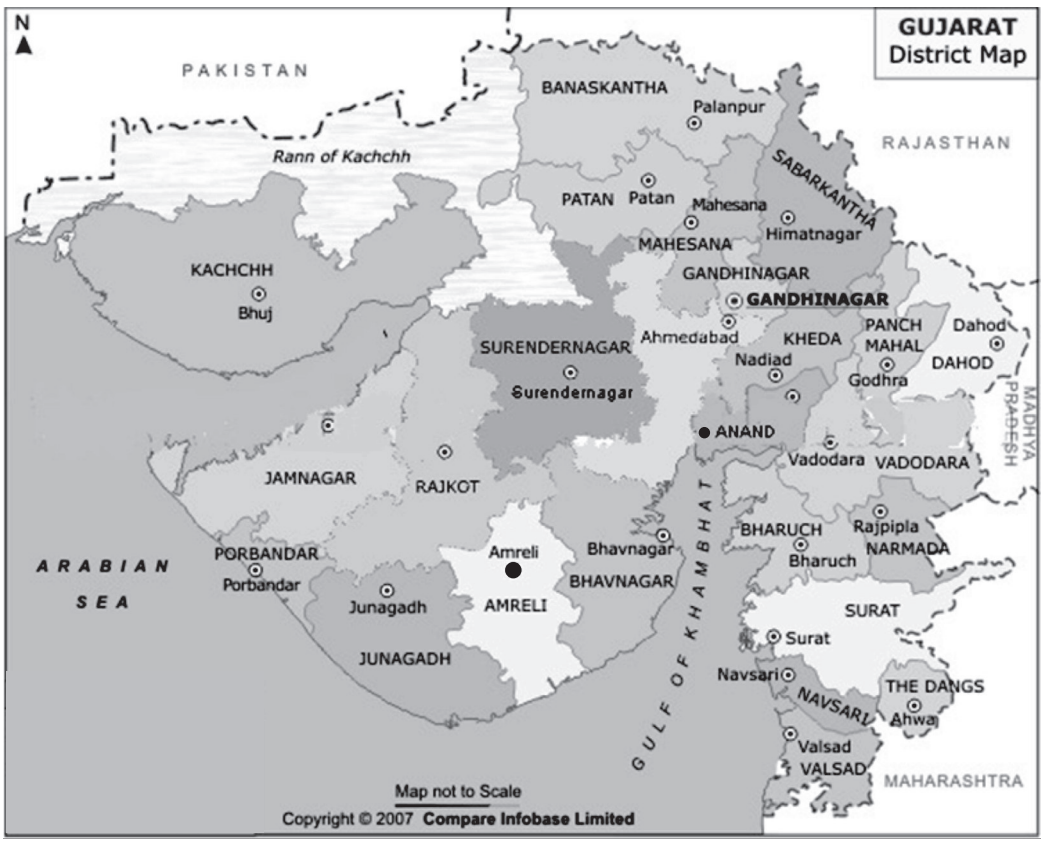
where, as before, n attributes of the price insurance product are defined and the βs are the vector of parameters that define the utility associated with each attribute. In this specification, m household factors are also considered to see if they explain the choice of a particular price insurance product. The δs are the vector of coefficient terms attached to the vector of interaction terms (*S*) which influence utility. Since the household characteristics are constant across choice occasions, they are only entered as interaction terms with the price insurance product attribute.

5 EXPERIMENTAL DESIGN, SURVEY DETAILS, DATA AND SAMPLE CHARACTERISTICS

For the choice experiments in this study, we selected 480 farmers in two agro-ecological zones of the Indian state of Gujarat. The experiments were conducted in January-February 2012 (see Figure 1 for a map of our study regions). Our sample comprises cotton and paddy farmers in Khambha and Khambhat taluka, respectively. From every taluka, we first selected eight villages and then 30 farmers were randomly sampled from a sampling frame comprising all land-holding farmers in every study village (totally 240 farmers per taluka).

The choice of study region (and the villages) was influenced by our objective to study the WTP for price insurance under different agro-climatic conditions, variable social systems, and cropping patterns. In June 2011, our field partners had marketed rainfall insurance to paddy farmers in Khambhat taluka in Anand district and to cotton farmers in Khambha taluka in Amreli district; this was another motivation for our focus on these regions. The harvest and sale of the produce grown in the major cropping season of 2011 was completed by the time our choice experiments (survey) were conducted. The survey gathered detailed information on demographics, financial savings, credit, household consumption, income sources, farm characteristics, risk attitudes, crop production, informal risk management strategies, and rainfall insurance adoption.

Figure 1 Map of the Indian state of Gujarat indicating our study districts



Source: India Meteorology Department (www.imd.gov.in)

Note: The solid dots indicate the approximate location of our study talukas: Khambhat in Anand district and Khambha in Amreli district.

5.1 Choice Experiment Data

As mentioned earlier, we collected data for WTP for price insurance using choice experiments. The design of products offered to the farmers using appropriate attributes and levels is very critical to get appropriate WTP estimates, as these could be biased by cognitive biases and heuristics if all appropriate attributes are not considered (see Hensher et al. (2012) and Hensher and Rose (2012) for issues with inappropriate attribute selection). In our study, the definitions of attributes and levels were based on unstructured interviews with farmers in the region and members of the field organization, who were instrumental in marketing rainfall insurance in our study regions in the previous years. Though the idea of a price insurance product is novel, the issues raised by partners regarding index-based rainfall insurance were considered while developing the attributes needed to define the price insurance product. Finally, we came up with five attributes having three levels each to design the choice sets.

Also, as the survey sample consisted of both paddy and cotton farmers, we had to develop attributes that involved prices specific to the crops. We also considered bundling weather insurance as one of the attributes, but an actual weather insurance product was already being marketed, and so we thought that this attribute might confuse farmers—is a real product being offered, or a hypothetical product is being considered. Therefore, we avoided bundling weather insurance as one of the attributes. The attributes and levels considered for the choice experiments design are presented in Table 1.

Table 1 Attribute and levels for choice experiments

Sr. No	Attribute	Crop	Levels
1	Sum Insured	Paddy	Rs.1100 Rs.1300 Rs.1500
	Cotton	Rs.4000	 Rs. 4500 Rs.5000
2	Premium		6% of sum insured 12% of sum insured 15% of sum insured
3	Coverage Start Date		June 15, 2012 July 15, 2012 August 15, 2012
4	Coverage End Date		January 15, 2013 February 15, 2013 March 15, 2013
5	Claim Settlement Time		7 days 15 days 30 days

With a total of five attributes with three levels, there were 243 possible combinations of price insurance products—impractical to consider for our study. The number of orthogonal combinations needed to estimate the main effects of the attributes was found to be 18 (as suggested by the orthogonal design of experiment application in the SPSS software). So, we developed 18 hypothetical products maintaining level and balance. These 18 alternatives were used to make three choice sets of six alternatives each. But even choosing three alternatives would have been too much of a burden on the farmers, given five attributes and different levels. So, each farmer was asked to choose only one alternative from the only choice set shown to him/her. The choice sets were assigned to farmer randomly. So, 80 farmers made their choices from a particular choice set. Before a farmer was actually shown the options, the surveyors explained to him/her what a price insurance product means. The surveyors were trained to be patient with the farmers (and not hurry) while explaining the concept of price insurance products to the farmers. Typically, the surveyors took 20-25 minutes per respondent for the above-mentioned process. Only after a farmer (or respondent) was briefed about price insurance products was s/he shown the options to choose from.

A chart in which all the features of a particular alternative were shown was used to represent a particular alternative. To avoid order bias, the surveyors were asked to show each farmer the charts in a random order. Each farmer (respondent) had to go through the charts and choose the chart s/he felt had the product features that suited her/him the most (see Appendix A for an example of the choice set and the associated chart). There was no opt-out option; though this might burden farmers' cognitive ability (Hess *et al*. 2012), farmers might have chosen to opt out to avoid the cognitive task, and we would not have known their true preferences (Rigby et al. 2010). The process of choosing an alternative was followed by a few descriptive questions on why the respondent chose a particular alternative.

5.2 Sample Characteristics

The rich set of information on socio-economic and demographic attributes at the household and individual (respondent) level enables us to investigate the role of various factors influencing WTP for price insurance. Though our choice experiments cover 480 farmers, we use information on 461 farmers only for the analysis. This is because there is problem of some missing information in the case of the 19 farmers excluded from the analysis. The 461 farmers included in the analysis comprise 233 cotton and 228 paddy farmers, respectively. The sample characteristics of these farmers are provided in Table 2.

One can observe from Table 2 that the average household size of the paddy farmers is marginally higher than that of cotton farmers. The educational attainment in cotton-growing households is on an average better than that of paddy-growing households. The distribution of educational qualification also indicates that there are more paddy farmers who have no formal schooling experience. Moreover, this is reflected in farmers' ability to read and write Guajarati. However, the average age of farmers sampled is pretty much the same in the case of cotton as well as paddy farmers.

Table 2 Sample characteristics

	Cotton Farmers Mean/ Proportion (%)	(N=233) Standard Deviation	Paddy Farmers Mean/ Proportion (%)	(N=228) Standard Deviation
Household Characteristics				
Household Size	5.86	1.84	6.31	3.15
Household Head's Year of Schooling	7.71	2.87	6.59	3.53
Household Head's Father's Years of Schooling	6.17	4.32	5.61	4.33
Household head's Mother's Years of Schooling	3.13	3.3	2.63	2.76
Respondent's Characteristics				
Age	44.78	8.63	45.99	9.61
No Formal Schooling	2		13	
Schooling: < =5 Years	22		24	
Schooling: >5 and < = 10 Years	68		57	
Schooling: > 10 Years	8		6	
Able to Read Gujarati	98		87	
Able to Write Gujarati	94		84	
Household level Factors				
Annual Household Income (INR)	228441	112124	180393	116869
Per Capita Consumption Expenditure (INR)	2825	1239	2116	1122
Total Land Holding (Acres)	4.67	3.14	8.5	8.1
Percentage of Irrigated Land	95.65	19.25	93.06	24.69

Source: Authors' computations based upon a primary survey.

A basic look at income, land holdings, and consumption shows some salient differences between cotton-growing households and paddy-growing households; cotton-growing households earn more annually on average than paddy-growing households despite having not only less land but also less land under irrigation. Unsurprisingly, therefore, the average monthly per capita consumption expenditure is also less for paddy farmers.

5.3 Farmers' Financial Portfolio

We gathered detailed information on the current financial portfolio of farm households in terms of their formal and informal credit and savings values (Table 3).

The savings, credit, and insurance portfolios are also different among paddy and cotton farmers in the two regions. One very interesting finding is that more paddy farmers than cotton farmers have some savings, but the value of cotton farmers' savings is substantially higher. Also, more paddy farmers than cotton farmers have savings in every form other than bank savings. But the value of cotton farmers' savings is higher in all forms of savings except with self help groups (SHG)

Paddy farmers also have higher outstanding loans (in terms of both proportion as well as value) than cotton farmers and seem to depend on informal sources like friends, relatives, and moneylenders more than cotton farmers. However, paddy farmers have less crop loans outstanding from the banks.

Only paddy farmers adopted rainfall insurance as it was not marketed in the taluka where cotton farmers are located.

Table 3 Summary of household financial portfolios

	Cotton Farmers Mean/ Proportion	**(N=233) Standard Deviation**	**Paddy Farmers Mean/ Proportion**	**(N=228) Standard Deviation**
Savings (yes, %)				
Have Savings	96		99	
Deposits in Bank	96		95	
Cash at Home	75		98	
Jewellery (Silver/Gold)	52		87	
SHG	3		71	
Savings Amount (in INR)				
Total	69468	88770	18336	11097
Deposits in Bank	8694	14108	2016	4791
Cash at Home	5286	19211	674	348
Jewellery (Silver/Gold)	55430	75570	14695	7077
SHG	57	4552	951	1762
Outstanding Loan (yes, %)				
Have outstanding loans	59		63	
Bank	47		32	
Friends and Relatives	29		58	
MFIs	0		3	
Money Lender	0.4		23	
Outstanding Loan Amount (in INR)				
Total	6207	6922	27326	26510
Bank	4614	4229	7974	15209
Friends and Relatives	1495	7030	14246	15709
MFIs	0	0	764	12985
Money Lender	0	0	4145	12142
Crop Loan from Bank (Yes, %)	45		21	
Purchased Rainfall Insurance (Yes, %)	0		56	

Note: INR stands for Indian Rupees.
Source: Authors' computations based upon a primary survey.

5.4 Existing Risk Management Strategies

As discussed previously, farmers use various informal and formal mechanisms to mitigate and cope with their income risks. The desire and ability to use a particular mechanism as well as the availability of mechanisms is expected to differ by farm households.

The risk management portfolio of cotton and paddy farmers is presented in Table 4, and provides a contrasting picture. On the one hand, plot diversification and income

diversification is not very different between cotton and paddy farmers, with cotton farmers having 1.33 plots on average and 61 per cent of their total income from farming, and paddy farmers having 1.67 plots on average and 65 per cent of their incomes from farming. On the other hand, the general strategies that cotton and paddy farmers prefer to mitigate financial distress or shocks are quite different.

Many cotton farmers (93 per cent) prefer saving money for bad times, which is not the case with the paddy farmers (25 per cent). About 34 per cent of cotton farmers prefer planting a variety of crops, while only 20 per cent of the paddy farmers prefer this measure for risk management. More paddy farmers (83 per cent) are ready to seek off-farm employment compared to cotton farmers (31 per cent). The least preferred strategy among both cotton farmers (4 per cent) as well as paddy farmers (1 per cent) is to sell off the household assets. Also, both cotton (12 per cent) and paddy farmers (27 per cent) are reluctant to reduce investment in seeds and fertilisers for managing the risk. This would indicate that farmers understand that there are positive returns to investment, and that reducing it for mitigating risk might just plunge them into further distress. Interestingly, 55 per cent of cotton farmers and 73 per cent of paddy farmers are ready to reduce their household consumption in case of shocks. Farmers (69 per cent of cotton farmers and 83 per cent of paddy farmers) prefer borrowing from friends and relatives rather than taking non-loan financial assistance from them (13 per cent of cotton farmers and 11 per cent of paddy farmers), probably because of the stigma attached to it and social status. This reflects the tensions in informal risk management strategies where apart from financial considerations, the social status and social pressures also become relevant (Morduch 1999). For loans, more cotton farmers prefer moneylenders (29 per cent) and banks (55 per cent) than paddy farmers (18 per cent and 15 per cent, respectively).

The information on risk coping strategies used by farmers also provides us some interesting insights into their social networks and informal risk management mechanisms. Most cotton farmers (94 per cent) use more of the saving to cope with risk while most paddy farmers work more in the village (90 per cent). This is consistent with the preferences of risk mitigation strategies they had mentioned in their responses. The proportion of paddy farmers having household members working outside their villages (79 per cent) is substantially higher than cotton farmers (44 per cent). The proportion of paddy farmers receiving help, gifts, and money from informal sources is also more than cotton farmers. However, the proportion of cotton farmers (26 per cent) receiving credit from formal sources is substantially larger than the paddy farmers (7 per cent). In addition, the prevalence of selling assets is also significantly larger in the case of cotton farmers (28 per cent) than for paddy farmers (4 per cent).

Unfortunately, many paddy farmers (78 per cent) and cotton farmers (73 per cent) reduce their consumption expenditure to cope with risk. Last but not the least, paddy farmers are more actively involved in both giving and receiving transfers in kind and cash than cotton farmers.

Table 4 Farmers' informal risk management strategies

	Cotton Farmers (N=233) (Mean/ percentage)	Paddy Farmers (N=228) (Mean percentage)
Crop/plot Diversification (measured as number of plots)	1.33	1.67
Income diversification (% of income from own agricultural cultivation)	61	65
Strategies Normally used by Household to mitigate financial distress or financial shock	34	20
Plant a variety of crops		
Have Dairy Animals or Livestock	97	79
Seek employment off farm	31	83
Save Money for Bad Times	93	25
Reduce Investment	12	27
Reduce Household Consumption	73	55
Buy Insurance	28	98
Borrow Loan from Friends and Relatives	69	83
Seek Non Loan Financial Assistance from Friends and Relatives	13	11
Take More loans from Moneylender	29	18
Take More loans from Bank	55	15
Sell Household Assets	4	1
Did you use any of the risk coping strategy in the last year?		
Received more help from relatives/neighbors	27	61
Received more gifts from relatives/neighbors	5	15
Borrowed more from relatives/neighbors or moneylender	9	21
Family member worked more outside village	44	79
Worked more in the village	52	90
Received more formal credit	26	7
Used more savings	94	27
Sold more assets	28	4
Reduced consumption more	73	78
Transfers		
Given money (Excluding loans)	1	53
Received money transfers (Excluding Loans)	23	63
Given things in kind	3	37
Received transfers in kind	0	16

Source: Authors' computations based upon a primary survey.

Having discussed the risk management strategies of the farmers, we expect savings, credit, transfers, and sale of assets to generally have a negative impact on the demand for price insurance if the farmers find these mechanisms efficient. But, these mechanisms could also have a positive impact on the demand for price insurance in cases where either the farmers feel that the price insurance product would complement the existing products in their wholesome risk management portfolio or where the farmers would want to replace a particular mechanism in their risk management portfolio with the offered price insurance product.

6. RESULTS

Since we find that the socio-economic and agricultural characteristics of the cotton and paddy farmers as well as the features of the hypothetical price insurance products for cotton and paddy differ substantially, we analyse the choice experiments for the cotton and the paddy farmers separately.

6.1 Conditional Logit Model Results for Cotton Farmers

The results of the conditional logit model (of utility derived from the price insurance product) for cotton farmers are provided in Table 5. The overall goodness of fit of the model excluding the interactions is high (Louviere et al. 2000), and the model is significant at 5 per cent level of significance. The model results indicate that cotton farmers are concerned with only three product attributes: sum insured; premium; and coverage start date. Their choice of product is significantly affected by neither the coverage end date nor the claim settlement period. The attribute sum insured has a positive impact on the choice of the product, which means farmers prefer 'more sum insured' than 'less sum insured'. They also prefer a product with lesser premium and an earlier coverage start period. The early coverage period is highly significant (at 1 per cent level of significance), and it indicates the farmer's willingness to get rid of price uncertainty as early as possible. This finding is in line with the literature on the usage of price risk management products by farmers where various authors have presumed that if farmers use price risk management instruments, like futures or options, they would want to buy them just before sowing time (McKinnon 1967; Rolfo 1980; Lapan and Moschini 1994).

Table 5 Estimates of the conditional logit model (without interactions) of the utility derived from the price insurance product: cotton farmers

Variable	Parameter Estimates Model (1), Without Interactions
Sum Insured	0.19**
	(0.08)
Premium	-0.15*
	(0.08)
Coverage Start Date	-0.25***
	(0.08)
Coverage End Date	0.07
	(0.08)
Claim Settlement Time	0.03
	(0.08)
Sample Size	233X6=1398
Likelihood Ratio	18.67
McFadden's LRI	0.0224

Notes: Figures in parenthesis are standard errors; ***p < 0.01, **p < 0.05, *p < 0.10
Source: Authors' computations from a primary survey.

Moving on to the estimate of willingness to pay for product attributes, the willingness to pay for a particular attribute can be calculated as the ratio of the parameters multiplied by the levels of each attribute (Birol and Das 2010). So the willingness to pay for sum insured (in percentage of sum insured) is given by $-3*\beta_{sumInsured} / \beta_{Premium}$ which comes out to be 3.8 per cent. So, a cotton farmer is willing to pay 3.8 per cent of the sum insured for price insurance on an average. Also, by the same logic, for an earlier coverage beginning time, s/he is willing to pay which comes out to be 5.1 per cent of the sum insured amount. The results also show that a cotton farmer is ready to pay around one and half times more for early insurance coverage period than for a more amount of sum insured.

To understand the heterogeneity in preferences among the cotton farmers, we estimate a conditional logit model with interactions. Since the interacting characteristics remain constant across alternatives, they are multiplied with the monetary value, (in our case premium) before estimating the model.

The results of the conditional logit model with interactions are provided in Table 6. For this model, we have reported only variables that are statistically significant at least at 10 per cent level of significance. It can be seen that the goodness of fit for this model is marginally better than the model presented in Table 5. We observe that the choice of a price insurance product is influenced by many of the informal strategies followed by farmers. The utility derived from a particular price insurance product is positively related to whether the farmer's seeks non-financial loan assistance (gifts in kind) from friends and relatives. A positive sign could mean either the farmers would want to replace the existing risk management strategy with price insurance or they find price insurance a useful complement to the existing risk strategy. Also, whether a farmer used more savings in the last year and whether s/he has high savings in jewels seems to have a positive relationship with the utility derived out of price insurance. Given that 94 per cent of the farmers had used more savings (dissaved) last year, the exact cause of the positive effect is ambiguous and, as suggested before, it could be due either to a desire for substitution or a desirable complementary effect.

Interestingly, we find that if a cotton farmer has a more diversified farming portfolio (defined by number of plots in excess of one), it also has a positive impact on the utility of the product. The only informal risk coping strategy that has a significant effect (negative) on the utility of price insurance is the strategy of selling household assets to overcome financial stress. The negative association means that a farmer who sells assets in times of financial distress is willing to pay less for a price insurance product. This could be because of the flexibility provided by the option of selling household assets in the case of financial distress, which does not need her/him to pay any premium at the start of the season.

The positive signs across the informal strategies mean that a farmer using these risk management strategies is willing to pay more than a farmer not using these, so that s/he does

not have to use informal risk mitigation strategies or because using a price insurance product along with these strategies mitigates risk better.

Table 6 Estimates of the conditional logit model (with interactions) of the utility derived from the price insurance product: cotton farmers

Variable	Parameter Estimate
Sum Insured	0.22***
	(0.08)
Premium	-1.16***
	(0.39)
Coverage Start Date	-0.27***
	(0.08)
Plots >1	0.57***
	(0.21)
Seeks Non-Loan Financial Assistance from Friends and Relatives	0.45*
	(0.25)
Sell Household Assets	-1.38**
	(0.58)
Used more savings last year	0.84**
	(0.40)
Has high savings in Jewels (Greater than median of Rs.90000)	0.35*
	(0.19)
Sample Size	233X6=1398
Likelihood Ratio	43.79
McFadden's LRI	0.0524

Notes: Figures in parenthesis are standard errors; ***p < 0.01, **p < 0.05, *p < 0.10
Source: Authors' computations based on a primary survey.

6.2 Conditional Logit Model for Paddy Farmers

We estimate similar models for the sub-sample of paddy farmers and the results of these models are reported in Tables 7 (without interactions) and 8 (with interactions), respectively.

The results presented in Table 7 show that the sum insured of the product does not affect the utility (derived from the product) of the farmer significantly. However, the farmer is more concerned with the period of time in which s/he would receive the claim.

If we calculate an approximate WTP for price insurance from this result, we find it to be 1 per cent less than the corresponding figure for the price insurance for cotton. However, paddy farmers are willing to pay 4.92 per cent more for 15 days lesser claim settlement time.

Table 7 Estimates of the conditional logit model (without interactions) of the utility derived from the price insurance product: paddy farmers

Variable	Parameter Estimate
Sum Insured	0.12
	(0.09)
Premium	-0.36***
	(0.09)
Coverage Start Date	0.01
	(0.08)
Coverage End Date	0.00
	(0.09)
Claim Settlement Time	-0.59***
	(0.09)
Sample Size	228X6=1368
Likelihood Ratio	68.49
McFadden's LRI	0.0838

Notes: Figures in parenthesis are standard errors; ***p < 0.01, **p < 0.05, *p < 0.10

Source: Authors' computations based on a primary survey.

The estimates of model with interactions (Table 8) reveal that apart from the savings in jewellery (which is the only common factor and has a significant positive effect on the WTP of all farmers), factors of the WTP for price insurance for paddy farmers are quite different from that of cotton farmers. If one of the farmer's used risk strategy is to take more loans from banks, the farmer is willing to pay more for the insurance product. Also, if s/he has coped with a risk by borrowing from informal sources in the previous year, s/he is willing to pay more for the product. Having a bank loan has a negative effect on the paddy farmer's WTP for price insurance. However, risk aversion has a positive effect on the WTP for price insurance. This finding is in line with the existing literature (Hill, 2009).

Table 8 Estimates of the conditional logit model (with interaction) of the utility derived from the price insurance product: paddy farmers

Variable	Parameter Estimate
Premium	-1.49***
	(0.38)
	-0.61***
Claim Settlement	(0.09)
Time	0.64***
Has high savings in Jewels (greater than median of Rs.90000)	(0.19)
	0.43**
Risk is an important criteria while making farming decisions	(0.18)
	-0.62***
Has a bank loan	(0.23)
	0.69**
One of the risk strategy is to take more loans from bank	(0.29)
Borrowed more from informal sources (friends/neighbours/relatives	0.61***
/ moneylender) in the last year to cope with financial distress	(0.22)
Net seller of food grain	0.74*
	(0.38)
Has a weather insurance	-0.14
	(0.19)
Sample Size	228X6=1368
Likelihood Ratio	101.54
McFadden's LRI	0.1243

Notes: Figures in parenthesis are standard errors; ***p < 0.01, **p < 0.05, *p < 0.10

Source: Authors' computations based on a primary survey.

7 DISCUSSION AND CONCLUSIONS

Our paper uses a choice experiment design to examine cotton and paddy farmers' WTP for various features of a price insurance product, in two talukas of the Indian state of Gujarat, and determine various factors of farmers' WTP for price insurance other than the product's design aspects. We acknowledge, in line with Albarran and Attanasio (2005), that any new financial product or scheme is dependent on the proposed product's interaction with existing private and informal arrangements. The farmers in our study use informal arrangements to mitigate risk; we analyse these to understand the effect of usage and preference of these strategies on the WTP for price insurance. Last but not the least, we test whether the demand for a formal weather insurance product offered to paddy farmers in one of our study talukas has any effect on the WTP of price insurance.

Our results indicate that cotton farmers' choice depend on the sum insured, premium, and coverage start date of the price insurance product, while paddy farmers are concerned with the premium and claim settlement time. Cotton farmers are willing to pay up to 3 per cent of the sum insured for price insurance, while paddy farmers are indifferent to the sum insured. This difference could be due to the way farmers cope with price risk and the effectiveness of competing informal risk management mechanisms. These interactions were analysed, and the usage/preference of various strategies was found to have a significant association with paddy and cotton farmers' demand for price insurance. For example, cotton farmers' WTP depended largely on informal risk management strategies related to savings, while paddy farmers' WTP depended largely on informal risk management strategies related to credit/borrowings; most of these strategies seemed to have a positive impact on the WTP for price insurance. This means that the features of these informal strategies could be bundled at different levels to meet farmers' risk management needs.

Three important implications follow from our research.

First, though the amount and cost of insurance is an important aspect for farmers, other design aspects, like coverage start date and claim settlement time, also play an important role in determining farmers' acceptance of a new product.

Second, informal risk management strategies are important to every farmer; tradeoffs exist between formal and informal risk management mechanisms, and understanding these tradeoffs is vital.

Third, a formal risk management product should not aim to 'crowd out' existing formal or informal risk management strategies but instead understand and incorporate linkages so that farmers may manage risk better.

In the post-World Trade Organization era, when international price fluctuations expose developing world-farmers to considerable price risks, this study is especially relevant. Since futures markets either do not exist in the developing world or are underdeveloped, and formal markets to manage risk are nascent, farmers' ability to hedge price risks is limited. By recognising the positive demand for price insurance and the attributes that farmers prefer, our findings open up avenues for research on price insurance to protect the incomes of farmers in developing countries.

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APPENDIX A

An example choice set shown to the farmer

Interviewer Readout:

We want to understand your demand for a price insurance product. We would offer you six different price insurance products, which will have different features. You have to choose the one you would buy if given a choice.

Before we provide you with the choices, I would like to describe to you the basics of a price insurance product. It offers you insurance for your agricultural produce against a low price. You would insure with us the sale of your produce for a particular predefined price at a particular predefined time. On buying the insurance, you have an option to sell the crop produce to us for the insured price at the predefined time. If you feel that the market price is higher, you could sell in the market on or before the time or, if you feel the market prices will rise high at a later stage, you may not sell the crop produce to us at that predefined time. We will define a few terms for clarity.

Sum insured: This is the price in rupees per quintal that you are insured for. For example, if you buy an insurance product, and the sum insured is Rs 5,000, it means you have an option to sell your produce at Rs 5,000 per quintal.

Premium: This is the premium for one unit of insurance you buy. For example, if the premium of a product is Rs 300, it means you have to pay us Rs 300 to buy insurance for a quintal of the crop.

Coverage start date: Your coverage will start on, and your insurance will be effective from, this date.

Coverage end date: If you would want to sell the produce to us at the sum insured, you will have to sell on this mentioned date.

Claim settlement period: this is the number of days we will take to pay you the money for your produce.

We will now show you six products with different features. Please indicate which one of these products you would buy and also indicate how many units you would want to buy of that particular product. Please take your time in evaluating the products before you make the decision. Interviewer checkpoint: please make sure the respondent chooses only one of the options. He should also indicate the number of units only for that option.

1. BUY / NOT BUY	☐	☐	☐	☐	☐	☐
2. IF BUYING INDICATE NUMBER OF UNITS	☐	☐	☐	☐	☐	☐

Contents of the chart describing one of the hypothetical products

Set I - Product 1	
Claim	*5000*
Premium	*600*
Coverage Start Date	*15 July, 2012*
Coverage End Date	*15 February, 2013*
Claim Settlement Time	*7 Days*

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