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Why are farmers not insuring crops against risks in India? A review

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ABSTRACT

Despite decades of sustained efforts by both the national and state governments to enhance the adoption of crop insurance in India, a low adoption rate is continuously reported. Hence, this has become a research issue over the years, and various studies have identified determinants and barriers related to social, economic, educational, and structural factors. There is a dearth of research in the context of behavioural aspects in India, while several empirical pieces of evidence have emerged in this domain from developing and developed countries. This study, therefore, aims to review these two strands of studies by posing two relevant questions: (a) how do different social, economic, educational, and structural factors affect crop insurance adoption in India? and (b) how do different behavioural anomalies affect farmers' decision to adopt crop insurance? In doing so, this study has brought out various research avenues for future studies to be undertaken in India and elsewhere.

1. Introduction

Farmers in India continue to face production risks due to climate abnormalities, resulting in low productivity and fluctuating agricultural incomes [38]. With respect to climate change, several studies have estimated its adverse impact on crop productivity and, subsequently, on farmers' livelihoods [39,45,69,71]. Agricultural output in the country is anticipated to fall by 25% by 2050 [71] and between 10% and 40% by 2100 [39]. Extreme weather events like floods and cyclonic storms have historically damaged agricultural crops. For instance, the loss of agricultural crops from floods was around 3.79 million ha per year from during 1953–2011, and, in pecuniary terms, around INR (Indian Rupee) 11.15 billion [6]. In addition, the farmers, particularly in the developing nations, have been encountering different types of idiosyncratic risks, and both covariate and idiosyncratic shocks are likely to make them more vulnerable and have a high likelihood of dragging them below the poverty line [93].

In order to withstand such risks and to smoothen consumption, farmers utilise a range of farm financial management options such as borrowing from formal and informal sources, selling assets and cattle, disinvestment, purchasing formal insurance, etc. [7,60,77]. Some of the measures are found ineffective during covariate shocks as they impact all the farmers in a particular locality by lowering asset prices and increasing interest rates for informal loans [89]. Both development economics and climate change economics discourses have considered crop insurance as one of the most effective risk coping mechanisms to mitigate covariate risks [7,24]. Previous studies have pointed out several ways through which crop insurance enhances farmers' well-being, and these are: (i) improves farmers' creditworthiness and serves as collateral for crop loans [50], (ii) investing in high-risk and high-profit crops [24], (iii) increase expenditure on agricultural inputs, and thus, higher amount of agricultural output [40,49,61], and (iv) smoothen the farm household's consumption by guaranteeing a minimum income from agriculture [60]. In the case of India, the empirical results are contradictory, i.e., Cariappa et al. [15] report the positive benefits, whereas no evidence is noticed by Cole and Xiong [24] in Telengana and Andhra Pradesh, and similarly, insignificant corroboration is observed in mitigating non-economic loss and damage from drought in Gujarat [4]. Further, the climate change adaptation studies related to farm households highlight the positive impact of crop insurance in driving uptake of several farm-level adaptation options that possibly could increase farmers' resilience capacity [5].

The first crop insurance scheme based on an 'individual approach' to loss assessment was launched in 1972 with the help of the General Insurance Corporation of India [55]. In 1978–79, it was replaced by the 'pilot crop insurance scheme', and it was based on the 'area approach', and only the loanee farmers avail of it [82]. In 1985, it was superseded by the comprehensive crop insurance scheme, which was based on a 'homogeneous area approach' and designed for farmers taking short-term loans [75]. The National Agricultural Insurance Scheme was introduced in 1999, and this was continued until 2016. This covers both loanee and non-loanee farmers, and the loss assessment was calculated

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in two ways, i.e., area and individual basis [76,92]. Meanwhile, various insurance products were also initiated by private banks, for instance, the weather insurance scheme by ICICI Lombard and rainfall insurance by IFCOO-Tokio General Insurance for the farmers in the state of Andhra Pradesh, Karnataka, and Gujarat [64]. In 2016, the national government introduced Restructured Weather Insurance Scheme and Pradhan Mantri Fasal Bima Yojana (PMFBY) in all states of India [57]. In fact, both the national and state governments have been largely subsidising agricultural insurance products. For example, under PMFBY, the farmers have to pay only 2%, 1.5%, and 5% of the sum insured for Kharif season, Rabi season, and commercial and horticulture crops, respectively [73].

Despite its several benefits, restructuring of insurance products to accommodate loss to agricultural crops from both covariate and idiosyncratic risks and subsidised to a great extent, a low adoption is often reported not only in India [38] but also in the developing nations [70]. For instance, just around 5% of farm households in India insured their two major crops, i.e., rice and wheat, during the agricultural year from July 2012 to June 2013 [53]. According to the recent *Land and Livestock Holdings of Households and Situation Assessment of Agricultural Households* by the National Sample Survey Office (NSSO) in 2019, roughly 10%[1] of all farmers had crop insurance, and a similar survey was conducted in 2013 asserts that only 7% of all farmers had crop insurance [57,73], Further, India is yet to achieve the goal of 50% gross cropped area coverage under PMFBY, which covered just 30% of India's gross cropped area in 2016–17 [54]. In sum, Crop insurance uptake has barely increased despite low premiums and significant government subsidies [1,8,15,57,73]. Henceforth, the notion of 'low adoption' has appeared as an area of inquiry for several studies, not only in India but also across the developing nations, over the past couple of decades.

After looking through several studies in India, we find that most of the studies have adopted the expected utility theory framework and have explored different socio-economic, educational, and structural factors influencing crop insurance adoption. Although various experimental studies have been carried out across the developing nations to identify the presence of behavioural biases such as ambiguity aversion, loss aversion, present bias, overconfidence bias, availability bias, certainty effect, and trust [16], it has still not received much attention in India [46]. Moreover, the findings of these studies could provide research avenues for the academic fraternity in India. Thus, for this study, we have reviewed the literature by posing two relevant questions: (a) how do different social, economic, educational, and structural factors affect crop insurance adoption in India? and (b) how do different behavioural anomalies affect farmers' decision to adopt crop insurance?

Based on these two research questions, we have identified various keywords to search for articles in the different sources such as google scholar, web of science, Jstor, etc., and in doing so, this study has collected numerous published manuscripts. Fig. 1 shows the conceptual framework adopted in this study; when there is a long history following expected utility theory to identify the factors influencing farmers' behaviour towards adoption of crop insurance, several studies have come forward in the last two decades to explore the issues associated with low adoption within the behavioural economics discourse. The rest of the paper is structured as follows: the second section lists the factors determining crop insurance adoption in India; the third section discusses behavioural anomalies in crop insurance adoption, and the last section presents concluding observations.

2. Determinants of crop insurance adoption in India

In this section, we organise all the studies into four categories [30,65]: economic factors (price or premium, liquidity, credit constraint, wealth, and income), social and demographic characteristics (caste, gender, age, and household size), educational factors (education, financial literacy, training, and awareness), and structural factors (land documents, basis risk, crop loss, timely indemnity payment, and crop diversification). All these factors and their association with crop insurance adoption are presented in Table 1.

2.1. Economic factors

Crop insurance adoption in India is primarily influenced by economic factors such as liquidity constraints, wealth/income of farmers, credit constraints, and the premium/price of the insurance ([21,22,27]; see Table 1). Because the majority of farmers in India are small and marginal and are frequently located in impoverished households, their lack of income becomes a critical barrier to the purchase of crop insurance [62,73]. Farm households purchase crop insurance during the sowing season when there are numerous competing demands on limited funds. This might raise the opportunity cost of insurance. As a result, crop insurance adoption is hampered by a lack of cash during the sowing season. Field evidence from Andhra Pradesh supports this claim since 80% of farm households could not adopt rainfall insurance due to a lack of funds [37]; however, when households are given enough cash to purchase a rainfall insurance policy, uptake increases by 140% [22]. Even with the recently introduced PMFBY, in Odisha and West Bengal, for instance, only wealthy households are likely to purchase it [62,87]. Further, households with supplementary income, such as livestock, are more likely to get crop insurance than farmers without livestock income [74,79].

There is a favourable link between the wealth of farmers and crop insurance adoption. Farmers' wealth gives them more liquidity or access to credit, allowing them to purchase crop insurance ([33]; see Table 1). Although liquidity constraints are a significant determinant of crop insurance adoption, they can be overcome by the provision of timely formal credit to farmers [27]. The use of short-term agricultural credit acts as a two-way weapon. On the one hand, it provides farmers with adequate liquid money, and, on the other, crop insurance becomes the default choice for farmers who avail of short-term credit since banks tie crop insurance to short-term loans [75,86]. Several studies have discovered that credit is an essential contributing factor to crop insurance adoption [18,36,81], where limited access to credit hampers the demand for rainfall insurance [18,36].

High insurance premiums could be detrimental to crop insurance adoption. Crop insurance premiums are prohibitively high for marginal and small farmers [32]. Several empirical studies on crop insurance have discovered an inverse link between crop insurance and its premiums (see Table 1). For instance, crop insurance has a negative price elasticity of 0.58, making it less adaptable in times of high premiums [41]. Field evidence from Gujarat and Andhra Pradesh shows that a 10% reduction in the premium increases the likelihood of insurance enrolment by 10–12% [22]. Further, Gaurav et al. [32] have introduced a money-back guarantee scheme in crop insurance among farmers in Gujarat, India, which is comparable to a price reduction of an insurance product by approximately 40%, which subsequently drove an increase in crop insurance demand by 7%. In contrast, Matsuda and Kurosaki [51] found that the price or premium of temperature and rainfall insurance is insensitive in influencing farmers' decisions to purchase crop insurance; instead, other non-price factors such as age of the farmer, household size, mathematical ability and land holding influence farmers' insurance purchasing decisions in Madhya Pradesh, India.

2.2. Social and demographic factors

Several studies have noted that farmers' social backgrounds influence crop insurance adoption [1,15,73,74,87]. Farmers belonging to Scheduled Castes (SC), Scheduled Tribes (ST), and Other Backward Classes (OBC) have limited access to crop insurance because most of them have fewer resources and lower chances of getting formal credit

[1] Authors' own calculation based on the *Land and Livestock Holdings of Households and Situation Assessment of Agricultural Households* 2019 (NSSO).

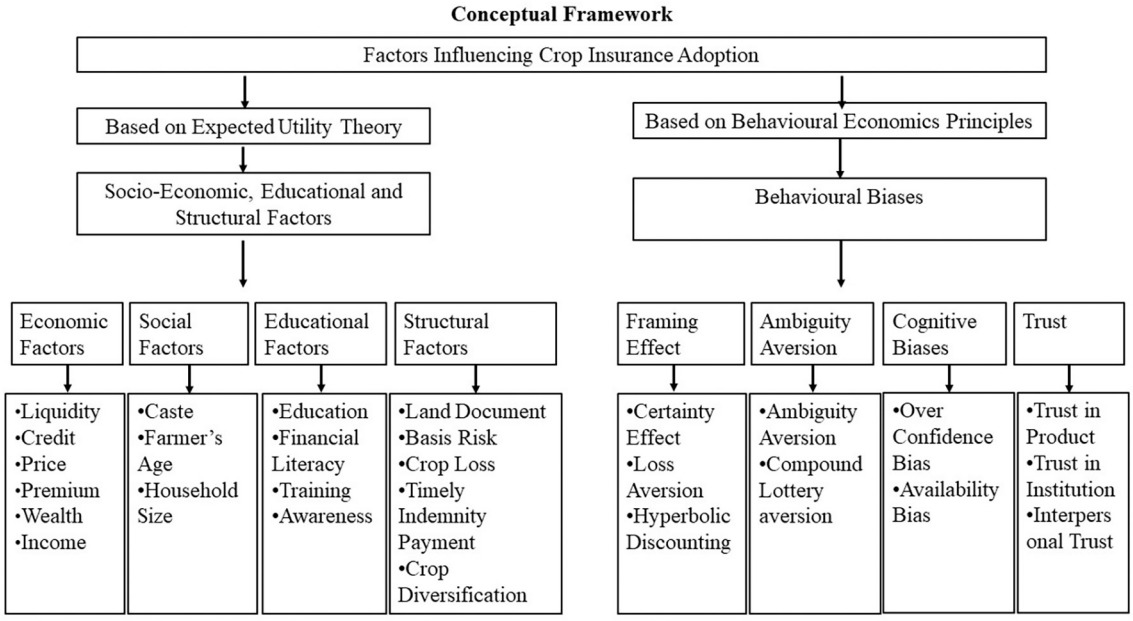

Fig. 1. Conceptual framework

[11]. Hence, they cannot purchase crop insurance [1]. Cariappa et al. [15] have observed that crop insurance adoption decreases by 4 and 6 percentage points for farmers belonging to the OBC and SC/ST categories, respectively, indicating that higher castes are more likely to have crop insurance (see Table 1), [74,84].

Demographic characteristics, including family size and farmer's age, also affect crop insurance adoption. Farmers with large households adopt crop insurance less frequently since they are likely to have other income sources (non-farm income) apart from crops [15]. Similarly, the age of farmers also has an impact on crop insurance uptake. In the literature, contradictory outcomes have been reported. According to Mukhopadhyay et al. [62], elderly farmers have more experience and hence employ crop insurance to mitigate risk. However, Swain and Hembram [87] found that the farmer's age is inversely connected to crop insurance adoption. Because young farmers are more aware of the benefits of crop insurance, they are more likely to purchase it.

2.3. Educational factors

The most crucial part of crop insurance schemes is getting potential and existing farmers to understand them. The basic premise of crop insurance, which involves investing money in return for an uncertain payout to cover a hypothetical adverse occurrence, is not intuitive. Understanding crop insurance products presupposes a certain level of education. Thus, crop insurance enrolment is positively linked with farmers' education, financial literacy, and training ([1,15,22,32,36,66]; see Table 1). Field evidence indicates that low levels of education result in a lack of product understanding among farmers, which leads to poor crop insurance uptake [1,36]. Moreover, multiple additional studies show that financial literacy positively impacts crop insurance uptake [22,32]. Improving farmers' financial literacy and educating them about crop insurance increases the demand for crop insurance since many farmers are unfamiliar with and lack an understanding of insurance [66,83]. According to data from the NSSO's 2013–14 *Situational Assessment Survey*, over 60% of Indian farmers were unaware of crop insurance programmes [57]. Thus, increasing farmer awareness through various formal training programmes can increase insurance purchasing by 5% [41]. Further, offering extension services can expand the opportunities for crop insurance adoption [15].

2.4. Structural factors

The structure of a crop insurance scheme is a determinant of its adoption; in particular, this includes the nature of the crop insurance scheme, the documents required to access crop insurance, loss measurement approach, indemnity payment process, and other risk-sharing instruments clubbed under structural factors [30]. The accessibility of crop insurance in India is based on either access to crop loans or land documents. A farmer having their own land with proper documents can easily avail of crop loans and, by default, get crop insurance. Hence, farmers with more land have a greater chance of adopting crop insurance ([1,15,33,66]; see Table 1); this indicates that large and medium farmers have a high chance of adopting crop insurance [15,66]. In contrast, Nair [63] argued that large farmers adopt crop insurance less frequently because they have more chances of crop diversification. His study revealed that 60% of farmers in India who take crop insurance operate small and medium landholdings. The adoption of crop insurance among landless farmers and tenants is very low. The tenancy has a negative effect on crop insurance adoption because, under PMFBY and WBCIS (Weather Based Crop Insurance Scheme), a tenant has to submit their tenancy agreement document as proof while purchasing crop insurance [73]. Nonetheless, because most tenancy agreements in India are oral, it is quite difficult to produce tenancy documentation [56].

The weather insurance premium is often determined according to historical rainfall data for the concerned area. However, farmers' perceptions may not match the historical data. In most cases, farmers think that the actuarially fair premium is too high compared to the expected indemnity [47]. When the weather-based insurance index does not match a particular farmer's crop loss, basis risk emerges ([19,36,37, 42, 59]; see Table 1). Furthermore, basis risk reduces the demand for weather insurance, especially when farmers are informed about the basis risk in weather insurance [34]. For example, the weather index may reflect adequate rainfall throughout the insured region, despite certain farmers reporting rainfall deficits [63]. Farmers who received insufficient rainfall were unable to get insurance indemnity since the weather index indicated that their area had received adequate rainfall. Consequently, farmers avoid buying weather insurance [19].

Farmers' prior experiences with the previous year's crop loss and timely insurance payouts have a favourable impact on crop insurance demand in the current year (see Table 1). According to Bjerge and

Table 1
Socio-economic, educational, and structural determinants of crop insurance adoption in India.

Variables	Sign of relationship		
	Positive	Negative	Insignificant
Economic Factors			
Availability of Liquidity/Funds/ Cash/Wealth/ Income	Giné et al. [37] Cole et al.[22] Mukhopadhyay et al. [62] Swain and Hembram [87] Rajeev et al. [74] Senapati [79] Gaurav [33]		
Availability of Credit	Dey and Debasish [27] Swain [86] Raju and Chand [75] Gine' et al. [36] Chhikara and Kodan [18] Shirsath et al.[81]		
Price/Premium of Insurance		Gine' et al. [36] Gaurav et al. [32] Mobarak and Rosenzweig [58] Cole et al.[21] Hill et al. [41] Senapati [78]	Matsuda and Kurosaki [51]
Social and Demographic Factors			
Caste		Aditya et al. [1] Singh et al. [84] Rajeev et al. [74] Cariappa et al. [15]	
Household Size		Cariappa et al. [15]	
Age of the Farmer	Mukhopadhyay et al. [62]	Swain and Hembram [87]	
Educational Factor			
Education	Gine' et al. [36] Aditya et al.[1]		
Financial Literacy	Gaurav et al. [32] Cole et al.[22]		
Awareness and Training	Panda [66] Singh and Agrawal [83] Mukherjee and Pal [57] Hill et al.[41]		
Structural Factors			
Land Ownership	Panda [66] Gaurav [33] Aditya et al. [1] Cariappa et al. [15]	Nair [63]	
Basis Risk		Giné et al. [37] Clarke et al. [19] Mobarak and Rosenzweig [59] Hill et al. [42]	
Crop Loss/ Disaster Experience	Bjerge and Trifkovic [10]	Aditya et al. [1] Senapati [78]	
Timely Indemnity Payment	Mahul et al. [50] Cole et al. [23] Nair [63]		
	Patnaik and Swain [68] Mukherjee and Pal [57]		

Source: Authors' Compilation.

Trifkovic [10], high rainfall in the previous harvest year increases rainfall insurance demand in the current year in Gujarat, India. Furthermore, Mahul et al. [50] observed that timely indemnity payments to farmers increased their adoption rates. Likewise, households in villages that had received crop insurance payouts in the past have a higher likelihood of buying crop insurance in the current year [23]. However, delays in insurance claim payments reduce crop insurance demand [57,63,68], and studies show that farmers are willing to pay more than the stipulated premium to prevent claim delays [35,38].

Crop insurance adoption is also influenced by the availability of ex-ante and ex-post risk-management techniques [47]. Farmers in drought-prone locations are more likely to diversify their production by employing conventional risk-management techniques such as inter-cropping, crop diversification, and planting drought-resistant cultivars [1]. For instance, farmers in Odisha, India, have reduced their reliance on crop insurance by adopting crop diversification and livestock breeding and practising non-farm labour. Consequently, despite the significant risk to agricultural output, crop insurance uptake in Odisha was relatively low [78].

3. Behavioural anomalies in crop insurance adoption

Aside from the socio-economic, educational, and structural factors mentioned, multiple studies using behavioural economics principles illustrate how different behavioural biases drive crop insurance adoption [3,9,13,16,17,52,72,85,90]. These studies on the adoption of various types of crop insurance schemes have been carried out in India and many developing countries. They use field experiments, lab-in-field experiments, randomised control trials, field games, frame field experiments, and survey methods. In the following discussion, we review all the behavioural biases listed in Table 2; they are discussed under four broad categories: framing effect, ambiguity aversion, cognitive bias, and trust.

3.1. Framing effect

The framing of insurance premiums is essential to raise the adoption of crop insurance. Rebate frame insurance premium, for which farmers pay the premium at harvest time, encourages crop insurance adoption (see Table 2). If a farmer wants to get crop insurance, they must pay a specific insurance premium in exchange for an uncertain future insurance payout. Certain premium payment practices against uncertain future payout dampen farmers' crop insurance demand because of the certainty effect ([80]; see Table 2). The certainty effect is derived from the Allais paradox [2], where people deviate from the expected utility by overvaluing certainty when comparing a certain outcome with uncertain ones. Using a field experiment in Burkina Faso, Serfilippi et al. [80] explored how the framing of insurance premiums is helpful in the context of the certainty effect. They introduced two types of insurance contracts among farmers. The first contract was a traditional one, under which farmers paid a certain premium during the sowing season and received an uncertain indemnity in the future if they suffered losses. The second was a rebate frame contract, under which farmers did not need to pay a premium in the sowing season and instead paid at harvest time. The field experiment revealed that rebate frame insurance showed a 16% higher demand among farmers than traditional insurance. Rebate

Table 2
Behavioural biases in crop insurance adoption.

Behavioural biases	Author and year	Insurance type	Country	Type of study
Ambiguity Aversion	Carter et al. [16]	Index-Based Insurance	Mali and Burkina Faso	Field experiment
	Belissa et al. [9]	Index-Based Insurance	Ethiopia	Lab in Field experiment
	Elabed and Carter [29]	Index-Based Insurance	Burkina Faso	Framed Field Experiment
	Bryan [13]	Rainfall Insurance	Malawi and Kenya	Randomised Control Trial
Certainty Effect	Serfilippi et al. [80]	Index-based insurance	Burkina Faso	Field Experiment
Over Confidence Bias	Turvey et al. [90]	Crop Insurance	China	Survey Method
	Michaud et al. [52]	Crop Insurances	China	Survey Method
Loss Aversion	Lampe and Würtenberger [46]	Rainfall Index Insurance	India	Randomised Control Trial
Hyperbolic discounting	Casaburi and Willis [17]	Crop Insurance	Kenya	Randomised Control Trial
Availability Bias	Stein [85]	Rainfall Insurance	India	Secondary Customer data
	Karlan et al. [44]	Rainfall Index Insurance	Ghana	Field Experiment
Trust	Patt et al. [67]	Index-based Insurance	India, Africa and South America	Field Games
	Cole et al. [22]	Index-Based Insurance	India	Randomised Field Experiment
	Cole et al. [23]	Rainfall Insurance	India	Field Experiment
	Karlan et al. [44]	Rainfall Index Insurance	Ghana	Field Experiment
	Gine' et al. [36].	Rainfall Insurance	India	Survey Method

Source: Authors' Compilation.

frame insurance allows farmers to access crop insurance at the beginning of cultivation and pay the premium after the crop harvest. In a low yield year, farmers receive their payout after subtracting the premium; in a high yield year, they pay the premium at harvest time after selling their crops [80]. Similarly, many other studies also support the framing of insurance premiums [9,48]. For instance, randomised control experiments among smallholder farmers in Ethiopia have demonstrated that framing is critical for increasing insurance demand; a reframed insurance product indicting a delayed premium payment increases crop insurance uptake ([9]; see Table 2). Moreover, Liu et al. [48] have noticed that the delayed premium payment encourages insurance adoption among rural Chinese farmers.

Loss aversion also impacts farmers' decisions to purchase crop insurance. Typically, farmers regard insurance as a stand-alone investment rather than a loss hedging strategy [26]. Because the premium amount is deducted from the farmers' current wealth, they experience a loss as soon as they pay it. As a result, most farmers become loss averse when considering paying a premium for crop insurance [3]. Loss aversion is associated with prospect theory, which states that the pain of loss is twice as great as the joy of gain. As a result, people are more sensitive to loss than to an equal-sized gain [43]. In India, Lampe and Würtenberger [46] correctly evaluated the premise of loss aversion in crop insurance adoption. In their field experiment, farmers were divided into two groups: those unaware of insurance (the first group) and those aware of it (the second group). The first group of farmers was ignorant of the insurance loss hedging procedure. They considered insurance a risky investment that had little to do with crop loss. They assumed that if there were no crop damage in the future, no indemnity would be given, and the premium deemed a pure loss. In contrast, the second set of farmers comprehended crop insurance's loss hedging mechanism and desired more crop insurance. The researchers noticed that a one-standard-deviation rise in loss aversion affected insurance demand by 2.6 to 3.5 percentage points in the first group of farmers. However, loss aversion could be controlled by disseminating financial education among the first group of farmers [46].

Crop insurance demand is also affected by hyperbolic discounting or present bias [17]. Hyperbolic discounting occurs when a person prefers a smaller and quicker reward over a larger and later payoff. People use hyperbolic discounting because they may like sure things, their needs are changeable, or they may have a pressing need in the present [25]. Similarly, many farmers believe that the current discounting rate of insurance premiums is higher than the predicted indemnity in the future. Hence, the current insurance price is weighted as higher than the expected future benefit, indicating low insurance demand. Casaburi and Willis [17] explored hyperbolic discounting in crop insurance in Kenya, concluding that it is the cause of poor crop insurance adoption because farmers feel that the discounting rate of current insurance premium is higher than the future indemnity. According to their findings, adopting pay-at-harvest insurance could enhance the rate of insurance adoption. Pay-at-harvest insurance shifts the insurance premium from the sowing season to the harvest season, bringing the premium and projected payout closer to parity. In their research, 72% of farmers opted for pay-at-harvest insurance, compared to only 5% for normal insurance [17]. It is observed from the findings of the above studies that framing of the insurance premium, especially rebate frame insurance and pay at harvest insurance, is quite successful in raising adoption in different developing countries. Similar results may be anticipated if it is adopted in India, but this study warrants empirical evidence.

3.2. *Ambiguity aversion*

The WBCIS performs a loss assessment survey for farmers based on a predefined weather index computed by integrating rainfall and temperature data from a given region [20]. The most challenging aspect of weather insurance is basis risk. Basis risk occurs when an individual farmer's loss does not match the weather index. It renders weather insurance partial and probabilistic, making it seem like a compound lottery ticket to farmers [29]. The first stage of the compound lottery shows the trigger of the index (weather loss in a region), while the second stage shows the correlation between the triggered index and the farmers' crop loss [16,29]. According to expected utility theory, a compound lottery can be reduced to a simple lottery by computing suitable final payoffs and probabilities for both stages of the compound lottery [29]. Many people, however, violate this assumption of expected utility theory [14]. Farmers have been observed as being unable to convert compound lotteries to simple lotteries and behaving compound lottery averse or ambiguity averse as if the final odds of a compound lottery or index insurance are uncertain or ambiguous [29]. Individuals who are ambiguity averse prefer known risk to uncertain risk [31].

Elabed and Carter [29], in a field experiment on Malian cotton farmers, explained that compound risk-averse farmers are also ambiguity averse, with over 60% being compound risk-averse or ambiguity averse. These ambiguity averse farmers lead to the dampening of nearly 50% of the crop insurance demand (see Table 2). Similarly, Belissa et al. [9] in Ethiopia and Bryan [13] in Malawi and Kenya observed that ambiguity aversion is the source of low demand for crop insurance. Moreover, risk aversion boosts demand for crop insurance, whereas ambiguity aversion decreases it in Ethiopia [9]. In the Indian context, many studies also pointed out basis risk as one of the causes of low demand for crop insurance [19,36,37,59].

3.3. Cognitive biases

Cognitive biases affect farmers' crop insurance adoption decisions. Here, we discuss two kinds of cognitive bias: overconfidence bias and availability bias. Overconfidence bias occurs when an individual gives more weight to expected gain as compared to actual gain [28]. In practice, farmers give higher weight to expected yield than their actual yield and assume that the current year's harvest will be high. Hence, their crop insurance demand is dampened due to their overconfidence bias [91]. Turvey et al. [90] and Michaud et al. [52] report low demand for crop insurance in China due to farmers' overconfidence bias. Over 80% of farmers overestimate future yields, and 82.31% predict higher revenue in the following year than their historical yields indicate [90]. Farmers' positive estimates for future production are frequently overestimated; this leads to low insurance demand (see Table 2).

In addition to the overconfidence bias, the availability bias can influence crop insurance demand. An availability bias is a cognitive bias in which people rely on the first instances, i.e., availability of information in hand, that immediately come to mind when considering a certain topic, approach, or choice [88]. Karlan et al. [44] observed that availability biases cause low adoption of crop insurance adoption in Ghana. They observed three types of availability biases. First, farmers who experienced good rainfall in the previous year underestimated the probability of drought in the current year and purchased less crop insurance than last year. Second, crop insurance demand increased if the farmer's social network or community received an insurance payout in the previous year. Third, farmers who experienced an indemnity payment in the previous year overestimated the occurrence of the payout in the current year, so they adopted crop insurance as compared to last year [44]. In India, farmers' crop insurance purchasing behaviour is also influenced by an availability or recency bias, in which the previous year's indemnity payment affects crop insurance demand in the current year [85].

3.4. Trust in crop insurance

Lack of trust dampens farmer crop insurance demand since a farmer must trust the insurer while paying the premium for future payouts [22]. Patt et al. [67] identified three categories of trust that prevail in the crop insurance market: trust in the product, trust in the institution, and interpersonal trust. Trust in the product is related to a thorough understanding of the product. A potential client of crop insurance must understand that paying a premium will reward them with indemnity in the event of an adverse shock. Second, trust in the institution is based on previous interactions with the institution. Finally, interpersonal trust is an individual's belief in his friends and neighbours. If a person does not have faith in them, he may be less trusting of others in general. Consequently, he may be unwilling to purchase crop insurance [67].

In a similar vein, Cole et al. [22] and Cole et al. [23], from their field experiment in Gujarat and Andhra Pradesh, India, show that trust in insurance agents and frequent insurance payouts raise crop insurance demand. Employing a locally known agent's positive reputation to advertise insurance improves insurance uptake by 36% [22]. This finding is also supported by Gine' et al. [36] study in Andhra Pradesh, India. Similarly, a field experiment in Ghana showed that farmers who obtained insurance in the previous period had a 4–5% higher insurance demand than those who did not purchase any insurance. On the contrary, the insurance demand of farmers who bought insurance but did not get any indemnity payment was 17% lower than that of farmers who did not purchase any insurance ([44]; see Table 2).

4. Concluding observations

Although crop insurance offers several benefits, its adoption rate is low in India. Over the years, several studies in India have investigated the reasons for the low adoption of crop insurance and have identified various socio-economic, educational, and structural factors as being major determinants of crop insurance adoption. These studies have adopted expected utility maximisation principles to study farmers' behaviour. Nonetheless, a few studies focused on behavioural economics principles to study crop insurance adoption in India. This study presents the factors influencing crop insurance adoption by reviewing two groups of literature: the first group of literature explores the various socio-economic, educational, and structural factors influencing crop insurance adoption, and the second group of literature discusses behavioural biases in crop insurance adoption. The first group of the literature reveals that economic factors such as wealth and income positively affect insurance adoption, whereas credit constraints and high premiums hinder insurance adoption because 80% of farmers in India are marginal and small, with limited income to finance crop insurance. Among the social factors, caste plays a detrimental role in crop insurance adoption; farmers belonging to the marginalised SCs, STs, and OBCs adopt crop insurance less often compared to those from higher castes due to a lack of resources. Further, factors like farmers' education and financial literacy positively impact crop insurance adoption, as more educated and financially literate farmers understand the benefits of crop insurance. Structural factors like land documents, crop diversification, and basis risk negatively impact crop insurance adoption, but crop loss experienced in the previous year enhances crop insurance adoption.

While the factors outlined thus far are crucial for crop insurance adoption, behavioural biases in crop insurance adoption can complement them. Hence, the second group of literature explores several behavioural biases such as ambiguity aversion, certainty effect, overconfidence bias, hyperbolic discounting, availability bias, loss aversion, and trust, which all affect crop insurance adoption. A few studies undertaken in India investigated the behavioural biases that drive farmers' decisions to purchase crop insurance, revealing a significant research gap. The certainty effect, loss aversion, and hyperbolic discounting lower crop insurance demand since farmers perceive purchasing insurance as a loss of wealth because they believe the insurance premium to be fixed and obligatory while the expected indemnity is uncertain. In order to overcome these behavioural biases in crop insurance, the insurance premium must be reframed or redesignated. In this regard, rebate frame insurance has had much success in various developing countries. In the context of India, Lampe and Würtenberger [46] observed that farmer education is a panacea for overcoming loss aversion. Further, ambiguity aversion in crop insurance has not received much attention in India. Evidence from studies conducted in developing countries shows that ambiguity aversion is a potential cause of poor crop insurance adoption, which can be eliminated by lowering the basis risk and adjusting the weather index. Cognitive biases like an overconfidence bias and availability bias in crop insurance are hardly studied in India, but these factors have a potential impact on crop insurance adoption. Providing financial literacy to farmers could reduce an overconfidence bias and availability bias in crop insurance adoption. Finally, trust in the insurance market is critical; building trust among farmers by issuing timely insurance payouts and selling insurance through a local agent raises the possibility of crop insurance adoption. In the Indian context, the trust factor plays a vital role; selling insurance through a trusted agent raises the demand for crop insurance. In the end, we suggest that the effect of behavioural biases on crop insurance adoption should be thoroughly investigated in India to provide tangible evidence. Policymakers should be cautious about behavioural biases while developing and implementing crop insurance programmes in India.

Author credit statement

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