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Exploring the link between insurance behavior and trust in markets *

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Abstract

We propose a model, called β-RDEu (*Rank Dependent Expected Utility*), that explains how distrust in an exchange relationship can lead to zero demand for a good or service—even when it is heavily subsidized. If an agent's preferences, as estimated in a decontextualized environment (i.e., without distrust), are represented by a function V, then the β-RDEu function for a contract l is defined as $\beta u(w_n) + (1 - \beta)V(l)$, and represents the agent's preferences in a market environment where distrust may arise. The parameter β captures the agent's level of distrust, and the wealth level w_n represents an outcome excluded by the contractual relationship but considered plausible by a distrustful agent. We characterize the β-RDEu utility through a set of assumptions about preferences, and then apply the model to agricultural insurance demand. The main prediction is that agricultural insurance demand can be zero at any price if the agent is sufficiently distrustful—even though the contract provides positive net utility when assessed solely through the function V. We discuss the introduction of behavioral interventions aimed at either leveraging or reducing distrust to increase the adoption rate of agricultural insurance products. In particular, we propose a procedure to estimate the distribution of the β parameter within a population, in order to show how knowledge of this distribution can enhance the effectiveness of a subsidy.

Keywords : Willingness to pay; Behavioral insurance, Distrust; Risk aversion, Zero probability distortions, Public policies.

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1 Introduction

Crop insurance is a critical tool for mitigating the economic consequences associated with agricultural risks. However, despite the benefits of agricultural insurance and the subsidies often attached to it, adoption rates remain surprisingly low, particularly in sub-Saharan African countries. In Burkina Faso, a program was launched in 2020 to promote the uptake of insurance products. The initial results fell far short of the target of 5,000 new policyholders per year: only 369 new enrollees in 2020 and 434 in 2021 (PNUD, 2022). In France, the adoption rate of multi-peril crop insurance was only 18% in 2020, despite subsidies covering up to 65% of premium costs (Rozan and Spaeter, 2024). In an empirical study of the determinants of agricultural insurance adoption in Brazil, Carrer et al. (2020) found that the adoption rate stood at only 19.4% during the 2015–2016 season. Similarly, using satellite data to assess the benefits of index-based insurance in the United States, Stigler and Lobell (2020) highlighted its low uptake, with less than 5% of acreage insured.

These findings point to a robust behavioral paradox in the insurance market: why do so many farmers choose not to insure against agricultural risks, even though most exhibit risk-averse preferences? In a context where premiums are heavily subsidized, the decision to forgo insurance suggests a strong inclination toward risk-taking. Yet, the literature has long shown that risk-averse individuals[1] should fully insure when the premium is lower than the expected loss. The tendency toward risk-taking observed in real-world insurance decisions stands in stark contrast to the risk aversion typically observed in decontextualized environments[2] in lab settings.

This "insurance puzzle" has been extensively documented in the empirical literature. Rommel et al. (2019) emphasize the limitations of decontextualized experiments in predicting real-world decision-making, while Charness et al. (2020) find little consistency across different measures of risk attitudes. In a field study conducted in Burkina Faso on willingness to pay for insurance against natural hazards, Zerbo (2025) confirm this paradox, showing that in a population largely composed of risk-averse individuals, most willingness-to-pay estimates fall well below the expected value of potential losses. In a contextualized experimental study replicating an insurance market, Cheston et al. (2014) report low enrollment rates even when premiums are subsidized. Similarly, Dercon et al. (2019) and Elabed and Carter (2015), using both field and lab experiments in Kenya, found that paradoxically, individuals with higher levels of risk aversion demonstrated lower demand for insurance.

Traditionally, non-insurance behavior has been attributed to factors such as low income levels among

[1] An individual is risk-averse if they prefer the certain value of a risky prospect to facing the risk itself.

[2] A laboratory experiment is considered decontextualized when the lottery choices presented to participants lack any specific decision-making context, such as in the protocol proposed by Holt and Laury (2002).

farmers, high premiums charged by insurers, or lack of information about available insurance products. However, none of these standard explanations satisfactorily account for why individuals who are generally averse to risk would adopt risk-seeking behavior in the specific context of insurance[3].

In this paper, we present distrust as a central explanatory key to insurance behavior. An insurance contract is a promise made by the insurer to the insured to pay monetary compensation conditional on the occurrence of a loss. In this respect, insurance is a trust good par excellence: to take out a contract, the agent must believe in the insurer's promise of future contingent compensation. If the agent has doubts about the veracity of the insurer's promise, then the service provided by the insurer appears less attractive. An agent is distrustful if he has doubts about the enforceability of the contract: a distrustful agent considers that there is a good chance that the insurer will not honor his promise. On the other hand, an agent is perfectly confident if he fully believes in the insurer's promise. An agent may have doubts about the insurer's promise because he or she has observed situations where no compensation is paid in the event of a claim. (Ribeiro and Koloma, 2016; Tiemtore, 2018; Courbage and Nicolas, 2019) or because the insurer offers a sophisticated contract containing complex clauses that make the direct relationship between the occurrence of a loss and compensation less evident.(Guiso, 2012; Kvalnes, 2011; Van Boom et al., 2016). We propose a new model, called $RDEu$ with distrust or $\beta - RDEu$ model, which explains non-insurance behavior in agricultural insurance markets based on farmers' distrust in insurance companies. The general interpretation of this model is as follows. The β-RDEu model is a decision-making model under risk that allows for the weighting of null-probability events. If an agent's preferences, elicited in a decontextualized environment, are represented by a function V[4], then the function $\beta u(w_n) + (1 - \beta)V(l)$ represents the agent's preferences in a market environment where distrust may arise. The behavioral parameter $\beta \in [0, 1]$ captures the agent's degree of distrust—that is, their belief in the enforceability of the contract. An agent with $\beta = 0$ is perfectly confident, whereas an agent with $\beta = 1$ is fully distrustful.

The wealth level w_n corresponds to an outcome excluded by the contractual relationship thus with a null probability but which the agent considers plausible if distrustful. The β-RDEu model can be applied to a wide range of exchange situations to explain how distrust hampers demand for a good or service. For instance, suppose a public authority declares that consuming organic agricultural products is beneficial for health. If an agent doubts this claim and considers that consuming such products might in fact pose serious health risks, their demand for these products may be zero despite subsidized prices if their level of distrust is sufficiently high.

[3] It is worth noting that while lack of information may explain why risk attitudes vary by context, it does not indicate whether individuals tend to overestimate or underestimate the likelihood of adverse events.

[4] We assume a purely decontextualized environment, which is theoretically defined as one in which the agent is perfectly confident. Note that a laboratory experiment does not necessarily constitute a purely decontextualized environment, as the subject may develop distrust toward the experimenter. In this paper, we assume that the utility function V is a rank-dependent expected utility function ($RDEu$), which justifies the name β-RDEu for our model.

In some markets, widespread distrust acts as a powerful barrier to exchange, as a significant portion of potential buyers may opt out of market participation, even when the good or service yields a net positive utility according to function V. This is precisely the case in agricultural insurance markets. When facing an insurance choice, an agent may hold a belief β that is, a degree of distrust regarding the insurer's promise: the agent entertains the possibility that the insurer may not pay out in the event of a claim.

A distrustful agent considers three possible states within an insurance contract: (1) no occurrence of the insured event, (2) occurrence of the event coupled with compensation from the insurer, and (3) occurrence of the event without compensation. For any insurance contract l, the rank-dependent utility with distrust is given by $W(l) = \beta u(w_3) + (1-\beta)V(l)$ where w_3 denotes the agent's level of wealth in the case where they have paid the insurance premium but receive no compensation following a loss event.

The rank-dependent expected utility with distrust ($RDEu$ with distrust) can be simply interpreted as a weighted average—governed by the distrust parameter—between the agent's dissatisfaction when the insurer fails to fulfill the contract and the decontextualized utility when the insurer does fulfill it. In this model, we assume that the objective probability of the insurer failing to honor the contract is zero, as this information is provided directly by the insurer. Thus, distrust is modeled as a distortion of a null-probability event. When the agent is distrustful: (1) State 3 is considered a plausible outcome; (2) full insurance no longer equalizes wealth across all three states; (3) increasing wealth in state 2 comes at the expense of wealth in states 2 and 3; (4) as a result, the relationship between the concavity of the von Neumann utility function and the insurance decision is no longer monotonic. If the agent experiences partial distrust, that is $0 < \beta < 1$, then an insurance contract is perceived as less effective in eliminating risk, thereby reducing the agent's incentive to seek coverage. For an agent who is typically risk-averse, the emergence of distrust—triggered by facing an insurance decision—can paradoxically stimulate a preference for risk-taking. In the β-RDEu model, risk attitude depends on three distinct components: von Neumann utility (u), probability weighting (ω), and distrust (β).

The model's central prediction is that, for any given premium, insurance demand will be zero if the agent's level of distrust is sufficiently high. While non-insurance behavior has been rationalized in previous literature—most notably by the $RDEu$ model, which assumes an optimistic and fully confident agent—our model stands apart by identifying distrust as the primary explanatory factor for the lack of insurance uptake.

This finds significant implications in terms of public policy. If optimism is the primary explanatory factor behind non-insurance behavior, then disseminating information about the frequency of adverse events is likely to influence farmers' insurance decisions. However, if non-insurance behavior stems, at least in part, from farmers' distrust, then such informational interventions will have only a limited effect on insurance uptake. We show that incorporating distrust into the design of policy measures aimed at promoting insurance adoption can enhance their effectiveness.

We propose a new, straightforward procedure for estimating the distribution of the distrust parameter within a given population. This mapping of distrust can then be used to more accurately calibrate subsidy schemes: we demonstrate that a marginal increase in the subsidy can significantly raise the adoption rate when agents exhibit "all-or-nothing" behavior. However, the cost of such subsidies may be prohibitive in populations characterized by high levels of distrust. Therefore, we also explore complementary behavioral interventions aimed at directly reducing farmers' distrust. In particular, the β-RDEu model enables us to estimate, for a given adoption rate, the marginal reduction in distrust that would be equivalent in effect to a financially effective subsidy.

The remainder of the paper is organized as follows. Section 2 reviews the relevant literature on the puzzle of non-insurance behavior. Section 3 formally introduces the β-RDEu model and outlines its main predictions. Section 4 applies the β-RDEu framework specifically to insurance behavior. Section 5 discusses public policy measures that account for agents' distrust and aim to stimulate the adoption of insurance products. Section 6 concludes.

2 Literature review

Several studies have identified the paradox of low insurance demand. Using carefully supervised field experiments among cotton producers in southern Mali, Elabed and Carter (2015) showed that farmers exhibited low demand for index insurance, despite nearly 60% of them being risk-averse. Netusil et al. (2021) also identified this paradox through stated preferences collected in a field survey in the United States. They found that the willingness to pay (WTP) of residents living in 100-year floodplains represented only 47% to 59% of the median flood insurance premium. Similarly, Roder et al. (2019) observed this paradox in an online survey conducted in the Veneto region (northeastern Italy), where the average amount individuals were willing to pay was €250 likely well below actuarially fair premiums, which would exceed €800. Dercon et al. (2019), using both field and lab experiments in Kenya, found that insurance demand actually decreases with risk aversion. Cole et al. (2013) further showed that more than half of rural households in India did not purchase rainfall insurance, even when the policy was offered at a price significantly below its actuarial value. In a meta-analysis on the valuation of insurance against low-probability risks, Mankaï et al. (2024) found that the average WTP for insurance amounted to 87% of the expected loss.

A given observed behavior may be explained by vastly different and heterogeneous factors, and insurance demand is no exception. The literature has identified several possible explanations for this paradox. First, traditional determinants such as low income (Ribeiro, 2021), the high cost of insurance (Tadesse et al., 2017; Roder et al., 2019), and behavioral factors like optimism and risk-seeking preferences. Second, aversion to zero outcomes or anticipated regret (Cheston et al., 2014), the utility cost of background risk dominating decisions (Clarke, 2016), and a lack of familiarity or incomplete understanding of the insurance product (Giné et al., 2008). Lastly, reluctance to experiment with new and untested financial products, lack of information or financial literacy (Cole et al., 2013), and lack of trust (Cheston et al., 2014; Dercon et al., 2019). However, while these factors are relevant, they appear to have limited explanatory power.

First, although income is a significant determinant of insurance demand, it has limited power to explain the paradox. Index insurance is not necessarily an inferior good (Clarke, 2016). Moreover, the model of Mossin (1968) assumes that the size of the loss is independent of the insured's initial wealth. When this assumption is relaxed, insurance may become a normal good, such that demand is low for agents with limited income—even though empirical evidence in developed countries shows that insurance demand increases with wealth (Giné et al., 2008). Binswanger-Mkhize (2012) also demonstrated that wealthier farmers are less likely to demand insurance because they are already effectively covered by informal mechanisms. Numerous observations have shown that, despite heavily subsidized premiums, demand for insurance remains low (PNUD, 2022; Grislain-Letrémy et al., 2024). This suggests that price is not the primary factor behind the low demand for insurance. Although index insurance demand is sensitive to price, price reductions alone are insufficient to drive widespread adoption (Cole et al., 2013).

Second, the empirical literature has consistently shown that most individuals are risk-averse, which limits the explanatory role of "risk preference" as a factor. The literature offers more nuanced insights into optimism, since optimistic individuals are not necessarily risk-seeking. For example, the inverse-S-shaped weighting functions[5] predict that people are optimistic and therefore seek risk in lotteries with low-probability gains (Diecidue and Wakker, 2001). Third, the impact of knowledge gaps, lack of education, or limited financial literacy on insurance demand has proven mixed or limited. This is due to issues of duration, intensity, or implementation of educational interventions, as well as present bias. Zerbo (2025) found that the demand for insurance increases with the level of education. However, Cole et al. (2013) found ambiguous effects of education on insurance uptake, and Dercon et al. (2019) showed that demand does not respond to financial education training. Similarly, Cheston et al. (2014) reported a low insurance uptake rate (15.9%) despite the fact that 91.3% of participants were familiar with the concept of insurance.

[5]Subjects give disproportionate attention to best and worst outcomes, while underweighting intermediate outcomes.

We also draw on the literature that invokes lack of trust to explain low insurance demand. However, what distinguishes our approach is the way in which we model the effect of trust on insurance behavior. We argue that trust is a key determinant shaping insurance decisions.

Market efficiency depends heavily on mutual trust, and virtually all market transactions involve some degree of trust, especially those that unfold over time (Algan, 2011; Bucciol et al., 2019). For investment and exchange opportunities to materialize, a minimum level of trust must exist between the parties, due to informational asymmetries, time lags, or geographic distance that allow one party to potentially exploit the exchange to the detriment of the other (Algan, 2011). Trust is particularly critical in insurance markets, where risk transfer relies on the promise of future compensation in the event of a loss. Trust in insurance institutions is a significant determinant of insurance demand (Reynaud et al., 2018; Tadesse et al., 2017). Cheston et al. (2014) found that 84.1% of participants had never purchased an insurance contract, but 64.6% of them did so when the contract was offered by institutions they trusted.

The literature provides many definitions of trust. Gambetta (2000) defines trust as the subjective probability with which one believes another party will act as expected. For Mayer et al. (1995), trust refers to one's perception of another's responsibility, integrity, competence, or capacity. Trust has also been defined as the willingness of one party to be vulnerable to the actions of another, based on the expectation that the other will act in a beneficial or non-opportunistic way (Aljazzaf et al., 2010). In this article, we adopt a general definition of trust as: the degree of belief or perceived likelihood that a proposition is true.

Building on this general definition, the literature has identified three main types of trust : self- trust (belief in the adoption of a specific behavior, locus of control), trust in others (trust in the behavior that other individuals will adopt, in their goodwill/capacity) and trust in institutions (belief in the veracity of the information provided by the institution) (Brookes and Facchini, 2022).

3 Model

An agent has $\succsim$ preferences over a set of lotteries denoted $\mathcal{L}^*$. In the following sections, we will interpret each lottery as a transformed risk, i.e. an insurance contract offered by an insurance company. We begin by precisely defining the set $\mathcal{L}^*$ by associating five properties with it. Then, three assumptions on preferences are formulated to obtain an RDEu representation with distrust.

Definition 3.1 (Set of lotteries)

The lotteries as a whole $\mathcal{L}^*$ regroup all the lotteries $l = (c_1, c_2, \ldots, c_n; p_1, p_2, \ldots, p_n)$ verifying the following five properties:

(P1) n is a finite number ($n \geq 2$)

(P2) The consequences $c_{i \in \{1,2,\ldots n\}} \in \mathbb{R}$ sont telles que $c_1 > c_2, \ldots > c_n$

(P3) The probabilities $p_{i \in \{1,2,\ldots n\}} \geq 0$, such that $\sum_{i=1}^{n} p_i = 1$

(P4) $p_n = 0$

(P5) Not all lotteries l_1 and l_2 in $\mathcal{L}^*$ are comparable according to first-order stochastic dominance[6].

The first three properties are standard in the literature and imply that we are considering finite lotteries, with outcomes ranked in decreasing order. Probabilities are given and assumed to be perfectly known by the agent. Without any real loss of generality, the fourth property requires that a zero-probability is assigned to the worst outcome c_n in every lottery within the set $\mathcal{L}^*$. Formally, the support of the probability distribution for any lottery in $\mathcal{L}^*$ always excludes the outcome c_n. This property is neutral when the agent pays no attention to zero-probability outcomes. However, if the agent does assign particular attention to certain zero-probability consequences, it becomes necessary to explicitly specify which such outcomes attract the agent's attention. Assumption H2 on preferences will indicate that the only zero-probability outcome potentially receiving special attention from the agent is precisely the worst outcome c_n.

The fifth property restricts the set $\mathcal{L}^*$ to lotteries that are not first-order stochastically comparable. This condition is fundamental. As noted by Diecidue and Wakker (2001), first-order stochastic dominance implies the absence of distortion over zero-probability events.[7] The fifth property thus shapes the domain $\mathcal{L}^*$ to allow for zero-probability distortions. In the next section, which focuses on the insurance market, we will emphasize that the set of contracts typically offered by insurers is modeled as a set of lotteries that are not pairwise comparable under first-order stochastic dominance. Finally, note that the definition of $\mathcal{L}^*$ in particular the fifth property implies that $\mathcal{L}^*$ can contain at most one degenerate lottery, i.e., a lottery whose support consists of a single outcome. This occurs when $\mathcal{L}^*$ represents a set of insurance contracts, in which case the only degenerate lottery corresponds to the full insurance contract.

Definition 3.2 (RDEu)

[6] First-order stochastic dominance implies that the transfer of a positive probability mass from one consequence c_i to a larger consequence $c_{i-k} (0 < k < i \leq n\,)$ increases the agent's utility.

[7] If distortion of zero-probability events is allowed, then an agent might prefer a strictly dominated lottery in the sense of first-order stochastic dominance. For instance, consider two lotteries: $l_1 = (10, -10; 1, 0)$ and $l_2 = (8, 5; 1, 0)$. Lottery l_1 stochastically dominates l_2 at the first order. However, if the agent assigns attention to worst-case scenarios—even with zero probability lottery l_2 might be preferred.

A Rank-dependent expected utility is a function V defined on $\mathcal{L}^*$ with values in $\mathbb{R}$ such that $\forall l \in \mathcal{L}^*$:

$$V(l) = \sum_{i=1}^{n} [\omega(p_1 + p_2 + ... + p_i) - \omega(p_1 + p_2 + ... + p_{i-1})]u(c_i) \tag{1}$$

• $u : \mathbb{R} \to \mathbb{R}$ a strictly increasing consequence deformation.

• $\omega : [0; 1] \to [0; 1]$ a strictly increasing probability distortion, $\omega(0) = 0, \omega(1) = 1$.

• The rank r_i of a consequence c_i represents the probability of obtaining at most this consequence. : $\forall i \in \{1, ..., n\}, r_i = p_i + p_{i+1} + ... + p_n$.

• $\forall i \in \{1, ..., n\}, \pi_i = \omega(p_1 + p_2 + ... + p_i) - \omega(p_1 + p_2 + ... + p_{i-1}) = \omega(1 - r_i + p_i) - \omega(1 - r_i)$ is called the decision weight of the consequence c_i. The weight pi_i depends only on the probability p_i and the rank r_i.

The Rank-Dependent Utility Expectancy (RDEu) model is a general preference representation that is more general than the Utility Expectation (Eu) model, in the sense that it can predict a wider range of behaviors. The RDEu model is a utility expectation where the weight associated with each consequence can be different from its probability. A decision weight intuitively reflects the attention given by the agent to a consequence. A pessimistic agent will pay more attention to an unfavorable consequence. In the RDEu model, attention depends not only on the probability of the consequence, but also on its desirability relative to other possible consequences. What's more, if a consequence has a probability of zero, then the agent's attention to it is zero[8]. Diecidue and Wakker (2001) illustrate this intuition with the following example. A pessimistic agent evaluates the lottery $l = (30, 20, 10, -10; \frac{1}{3}, \frac{1}{3}, \frac{1}{3}, 0)$. The attention paid to consequence -10 is zero ($\pi_4 = 0$). The agent gives more attention to consequence 10, relatively unfavorable compared to 20 and 30, and let's consider this attention equal to $\pi_3 = \frac{1}{2}$. Consequently, the remaining attention equals $\pi_1 + \pi_2 = \frac{1}{2}$ is focused on the more favorable outcomes 20 and 30. Being pessimistic, the agent gives more attention to 20 (saying $\pi_2 = \frac{1}{3}$) than 30 ($\pi_1 = \frac{1}{6}$). On the contrary, if consequence 20 is replaced by 0 and the agent evaluates the lottery $l' = (30, 10, 0, -10; \frac{1}{3}, \frac{1}{3}, \frac{1}{3}, 0)$, then consequence 10 no longer appears unfavorable relative to 0, and a pessimistic agent will give it less attention. In this last lottery, the rank of consequence 10 increased by $r_3 = \frac{1}{3}$ to $r_2 = \frac{2}{3}$. Formally, an agent is pessimistic if increasing the rank of a consequence c_i leads to giving it less attention. In other words, since $\pi_i = \omega(1 - r_i + p_i) - \omega(1 - r_i)$, an agent is pessimistic if the function ω is strictly convex. Conversely, an agent is optimistic if increasing the rank of a consequence c_i leads to paying more attention to it, i.e., if the ω function is strictly concave. An agent who is not sensitive to rank has prefer-

[8]Note that if $p_i = 0$ $(\forall \in \{1, \dots, n\})$, then the agent's focus on the consequence c_i is $\pi_i = \omega(p_1 + p_2 + ... + p_i) - \omega(p_1 + p_2 + ... + p_{i-1})$ =0.

ences represented by the utility expectation.

Definition 3.3 (RDEu with distrust)

A Rank-dependent expected utility with distrust is a function W defined on $\mathcal{L}^*$ to values in $\mathbb{R}$ such as $\forall l \in \mathcal{L}^*$:

$$W(l) = \beta u(c_n) + (1-\beta)V(l) \tag{2}$$

• V is a utility expectation depending on rank defined on $\mathcal{L}^*$ to values in $\mathbb{R}$.

• u is a von Neumann utility $(u : \mathbb{R} \to \mathbb{R})$ strictly increasing.

• $\beta \in [0, 1]$ is a parameter of distrust :

-If $\beta = 0$, the agent is completely trustworthy $W(l) = V(l)$ is an expectation of utility depending on rank.

-If $\beta = 1$, the agent is perfectly distrusting $W(l) = u(c_n)$: blthough the probability of c_n is zero, the agent evaluates lottery l only based on the utility conferred by this worst outcome.

The RDEu model with distrust is a generalization of the standard RDEu model that allows for distortions of zero-probability events, provided that the outcome in question is the worst possible outcome. In the RDEu model, the agent's attitude toward risk results from the properties of two functions: the utility function u (distortion of outcomes) and the probability weighting function ω (distortion of probabilities). In contrast, in the RDEu model with distrust, risk attitudes are shaped by three distinct preference components: the functions u, ω, and a distrust parameter β. In the next section, we will interpret an increase in the parameter β as reflecting a higher level of doubt on the part of the agent regarding indemnification in the event of a loss. Consequently, an increase in β corresponds to a reduction in risk aversion: distrust decreases the desirability of an insurance contract. We impose three assumptions on the agent's preferences to obtain a representation consistent with the RDEu model with distrust. Diecidue and Wakker (2001) propose a characterization of the standard RDEu model based on two assumptions. Our Assumption H1 is taken directly from Diecidue and Wakker (2001), while Assumption H2 is slightly modified to introduce the possibility of distrust. Following the approach initiated by Diecidue and Wakker (2001), our first two assumptions are not expressed axiomatically, to simplify the notation. Wakker (1991) offers several axiomatic formulations for Assumption H1. Our third assumption enables us to capture distrust using a single parameter β. This assumption is formulated axiomatically, making it amenable to empirical testing in laboratory experiments or field surveys.

Assumption 1: General representation of preferences

Preferences are represented by generalized expectation $EG(l) = \sum_{i=1}^{n} \pi_i u(c_i)$ with $\sum_{i=1}^{n} \pi_i = 1$, and π_i is a non-negative decision weight, $\forall i \in \{1, 2, ..., n\}$.

Assumption 2: Generalized RDEu

For any clue $i \in \{1, 2, \ldots, n-1\}$, The decision weight π_i depends only on the associated probability p_i and the rank. r_i.

Assumption 3: distrust

Let us consider lotteries $l_1 = (c_{11}, \ldots, c_{1(n_1-1)}, x; p_1, \ldots, p_{n_1-1}, 0), l_2 = (c_{21}, \ldots, c_{2(n_2-1)}, x; q_1, \ldots, q_{n_2-1}, 0)$, $l_3 = (c_{11}, \ldots, c_{1(n_1-1)}, z; p_1, \ldots, p_{n_1-1}, 0), l_4 = (c_{21}, \ldots, c_{2(n_2-1)}, z; q_1, \ldots, q_{n_2-1}, 0) \in \mathcal{L}^*(n_1, n_2 \in \mathbb{N}^* - \{1\}$ such as $x \neq z$ and $x, z < min\{c_{1(n_1-1)}, c_{2(n_2-1)}\}$:

$$l_1 \sim l_2 \Rightarrow l_3 \sim l_4$$

Assumption H1 proposes a representation of preferences that differs significantly from utility expectations. Indeed, in generalized utility expectations, decision weights $\{\pi_i\}_{i\in\{1,\ldots,n\}}$ are not necessarily equal to probabilities $\{p_i\}_{i\in\{1,\ldots,n\}}$ of the lottery. If $\pi_i = p_i \quad (\forall i \in \{1, 2, ...n\})$ then generalized expectation is reduced to utility expectation. In contrast, if $\pi_i \neq p_i$, the agent distorts the objective probability, meaning they assign a different decision weight to the outcome c_i. This decision weight reflects the degree of attention the agent gives to that particular outcome. In our primary application related to insurance, the objective probabilities are announced by the insurer and reflect the individual risk of the insured as perceived by the insurer. However, the agent may assign a different decision weight than the announced probability because (i) the agent may hold private information, or (ii) certain outcomes may appear more salient or psychologically significant in the decision-making process. For instance, if a lottery l represents an insurance contract, the insured may possess private information (i.e., characteristics unobservable to the insurer) regarding their true individual risk, whereas the insurer bases the probability distribution on the agent's observable risk class. This private information may lead the agent to evaluate the likelihood of a loss differently from the probability stated by the insurer. Additionally, some loss events, though objectively unlikely, may lead to severe consequences for the insured (Lopes and Oden, 1999). For example, a storm could entirely destroy a farmer's crop. In such a case, the agent's attention may be drawn to this worst-case scenario when evaluating the agricultural loss risk. As a result, the agent may assign it a higher decision weight than a favorable scenario of equal probability. Lopes (1987) refers to a psychological safety factor—which expresses the fact that individuals attach greater importance to worst-case scenarios when making risky decisions—and a psychological potential factor—which emphasizes that individuals also pay close attention to the best-case scenarios of a risky decision.

Assumption H2 restricts the values that decision weights can take. $\{\pi_i\}_{i\in\{1,\dots,n\}}$. If two decision weights are associated with two consequences that have the same probability and rank, then H2 implies that the two weights must be equal. Consider the following two lotteries : $l_1 = (40, 30, 10, 0; \frac{1}{3}, \frac{1}{3}, \frac{1}{3}, 0)$ and $l_2 = (40, 25, -10; \frac{2}{3}, \frac{1}{3}, 0)$. Consequences 10 and 25 have the same probability. ($\frac{1}{3}$) and the same rank ($\frac{1}{3}$). Assumption H2 implies that the agent must give equal weight to these two consequences in their decision-making. However, in both lotteries $l'_1 = (50, 30, 10, 0; \frac{1}{3}, \frac{1}{3}, \frac{1}{3}, 0)$ and $l'_2 = (40, 30, 15, -10; \frac{5}{12}, \frac{1}{3}, \frac{1}{4}, 0)$, Consequence 30 does not have the same rank, so the decision weights assigned to this consequence may differ. Note that on the whole $\mathcal{L}^*$, Assumption H2 also implies the following property: for all $i \in \{1, 2, ...n - 1\}$, if $p_i = 0$ then $\pi_i = 0$. This means that, for any outcome other than c_n, the agent does not distort the probability if it is zero. Assumption H2 offers a more general representation of preferences than representation by rank-dependent expected utility. Indeed, the weight π_n associated with consequence c_n is not restricted, unlike the other decision weights. However, note that H1 requires that the sum of the decision weights always be equal to one.

Assumption H3 is introduced to constrain the weight π_n, i.e., to assign a specific form to distrust in the form of a single parameter β. Note that assumptions H1 and H2 are sufficient to represent distrust with a single parameter β in only two specific cases. First, when the agent evaluates two lotteries $l = (c_1, c_2, ..., c_n; p_1, p_2, ..., 0)$ and $l' = (c'_1, c'_2, ..., c'_n; p_1, p_2, ..., 0)$, where all consequences c_i and $c'_i (\forall i \neq n)$ have the same probability and rank, assumptions H1 and H2 imply retaining the same decision weight for the worst consequences. c_n and $c'_n (\pi_n = \pi'_n)$. Secondly, if a single decision weight $\pi_i (i \in \{1, 2, ..., n - 1\})$ is strictly positive, which is the case when (i) the agent is perfectly pessimistic or perfectly optimistic, or (ii) the supports of the probability distributions are all reduced to a single element, the latter case being de facto excluded by the definition of $\mathcal{L}^*$, then assumptions H1 and H2 again imply that the same decision weight should be retained for the worst consequences c_n and $c'_n (\pi_n = \pi'_n)$. In all other cases, the decision weight associated with the worst consequence is not constrained by H1 and H2, and may therefore differ from one lottery to another. Assumption H3 is formulated to ensure that the agent always assigns the same positive or zero weight $\pi_n = \beta \geq 0$ to all consequences c_n of the lotteries in the set $\mathcal{L}^*$. Assumption H3 is formulated based on any two lotteries $l_1 = (c_{11}, ..., c_{1(n_1-1)}, x; p_1, ..., p_{n_1-1}, 0)$ and $l_2 = (c_{21}, ..., c_{2(n_1-1)}, x; q_1, ..., q_{n_2-1}, 0)$ in the sense that the consequences $c_i (\forall i \neq n_1 \text{ ou } n_2)$ do not necessarily have the same probability or rank. If the agent is indifferent between l_1 and l'_1 , then assumption H3 requires that the agent always be indifferent regardless of the value of the worst consequence x.[9]

Theorem 3.1

The preferences $\succsim$ verify assumptions H1, H2, and H3 if and only if the RDEu function with distrust W represents the preferences : $\forall n_1, n_2 \in \mathbb{N}^* - \{1\}$,

$\forall l_1 = (c_{11}, ..., c_{1n_1}; p_{11}, ..., p_{1n_1} = 0), l_2 = (c_{21}, ..., c_{2n_2}; p_{21}, ..., p_{2n_2} = 0) \in \mathcal{L}^*$,

$$l_1 \succsim l_2 \Leftrightarrow W(l_1) = \beta u(c_{1n_1}) + (1-\beta)V(l_1) \geq W(l_2) = \beta u(c_{2n_2}) + (1-\beta)V(l_2)$$

where u is defined up to an increasing affine transformation, $\beta \in [0; 1]$ is unique, V is an RDEu utility with probability transformation function ω that is unique such that $\omega(0) = 0, \omega(1) = 1$ and ω is increasing on $[0; 1]$.

To conclude this section, consider the following example. An agent evaluates the lottery $l = (e^5, e^3, e^2; \frac{1}{2}, \frac{1}{2}, 0)$. The von Neumann utility is $u(c) = \ln(c)$ and the probability distortion is $\omega(p) = p^2$. If the agent's preferences are represented by a utility expectation depending on rank $W(l) = V(l)$ ($\beta = 0$), so the weight given to the utility of e^5 is $\pi_1 = \omega(\frac{1}{2}) - \omega(0) = \frac{1}{4}$, the weight assigned to the utility of e^3 is $\pi_2 = \omega(1) - \omega(\frac{1}{2}) = \frac{3}{4}$ and the weight assigned to the utility of e^2 is $\pi_3 = \omega(1) - \omega(1) = 0$. The utility of the lottery l is $W(l) = \frac{1}{4} * \ln e^5 + \frac{3}{4} * \ln e^3 + 0 * \ln e^2 = \frac{7}{2}$. The agent is pessimistic because he overestimates the likelihood of the unfavorable consequence e^3 and underestimates the likelihood of the favorable consequence e^5. The agent pays no attention to the consequence e^2 because its probability is zero. If the agent's preferences are represented by a Rank-dependent expected utility with distrust $\beta = 0.5$, then $W(l) = 0.5u(e^2) + 0.5V(l)$. The agent believes that there is a 50% chance that he will obtain a consequence e^2. The weight assigned to the utility of e^5 is $\pi_1 = 0.5[\omega(\frac{1}{2}) - \omega(0)] = \frac{1}{8}$, the weight assigned to the utility of e^3 is $\pi_2 = 0.5[\omega(1) - \omega(\frac{1}{2})] = \frac{3}{8}$ and the weight assigned to the utility of e^2 is $\pi_3 = 0.5 + 0.5[\omega(1) - \omega(1)] = \frac{1}{2}$. The utility of lottery l is $W(l) = \frac{1}{8} * \ln e^5 + \frac{3}{8} * \ln e^3 + \frac{1}{2} * \ln e^2 = \frac{11}{4}$. The lottery is less attractive to the agent because he considers the possibility of receiving consequence e^2: he assigns a strictly positive decision weight to a consequence with zero probability.

[9] Note that the assumptions of the RDEu model (H1 and H2 extended for $i \in \{1, 2, ..., n\}$ involve assumption H3 by imposing a single weight $\beta = 0$.

4 Application

Trust is a fundamental mechanism underlying all transactions in insurance markets. An insurance contract is, by its very nature, a prototypical trust-based good: the agent pays a premium in exchange for a promise of future compensation, conditional on the occurrence of a loss event (Guiso, 2012). An agent is said to be distrustful if they doubt the insurer's promise to provide compensation should the insured event occur. Distrust undermines the appeal of insurance contracts: a distrustful agent perceives insurance as an inadequate risk-mitigation tool, since the contract may result in a situation where the insured simultaneously suffers a loss and pays a premium without receiving compensation in return. As a result, distrust reduces the agent's willingness to pay, which may partially explain the limited volume of transactions in such markets. Zerbo (2025), in a field study conducted in Burkina Faso, documented the paradox of willingness to pay: while most farmers exhibit risk aversion—measured using decontextualized lottery-based choices following the approach of Holt and Laury (2002), their willingness to pay for insurance is often lower than the expected value of the insured loss. This apparent paradox suggests that agents' attitudes toward risk are shaped by multiple preference components. The Rank-Dependent Expected Utility (RDEU) model provides a rationalization of low willingness to pay by incorporating the assumption of optimism. An agent is optimistic when they perceive the likelihood of a loss event as significantly lower than its objective probability. Such optimism may stem from a belief that disasters are more likely to affect others a phenomenon referred to in the literature as comparative optimism (Coats and Bajtelsmit, 2021; Hoorens et al., 2008, 2022) or simply from a lack of knowledge regarding the frequency of extreme weather events (Botzen et al., 2009; Krawczyk et al., 2017). However, under the assumption of optimism, the RDEU model fails to account for the widespread evidence of risk aversion observed in field experiments. In this section, we model insurance demand by assuming that agents' preferences follow a Rank-Dependent Expected Utility framework with distrust. The RDEU model with distrust resolves the aforementioned paradox. In decontextualized decision environments, the agent is not distrustful and displays conventional risk aversion. In contrast, when considering insurance decisions, the agent harbors doubts about the insurer's promise, which alters their risk attitude and lowers their willingness to pay. We show that the insurance demand predictions of this extended RDEU model differ significantly from those of the standard RDEU framework. In particular, the RDEU model with distrust predicts that : (i) for any given premium, demand is zero if the agent is sufficiently distrustful; (ii) insurance demand is highly sensitive to the agent's level of distrust; and (iii) the behavior of an agent whose distrust changes marginally can be approximated by a binary "all-or-nothing" decision pattern.

We consider a model in Mossin (1968) in which an agent has an initial wealth of w_0. The agent faces a risk of loss $\tilde{L} = (0, L; 1-p, p)$ où $L \in]0; w_0]$ denotes damage with probability $p > 0$. A set of insurance contracts is available: the agent pays a premium $\Pi = m\alpha pL$ – where $m > 0$ denotes the loading factor and $\alpha \in [0; 1]$ represents the coverage rate – and receives compensation $I = \alpha L$ in the event of a claim. The price charged by the insurer is proportional to the expected claim amount. $E(\tilde{L})$ and equal to $m * E(\tilde{L})$. If the loading factor is $m > 1$, then the price is loaded. The contract is declared fully enforceable by the insurer: the probability that the agent will not be compensated in the event of a claim is zero. This probability is said to be objective in the sense that two agents approaching an insurer will make their decision based on the same information. On the other hand, if these two agents do not have the same level of confidence in this promise of compensation, then it is justified to consider zero probability distortions. The contract represents a random final wealth: (1) with probability p, the final wealth is $w_0 - L - \Pi + I$, (2) with probability $1-p$, the final wealth is $w_0 - \Pi$ and (3) with zero probability, the final wealth is $w_0 - L - \Pi$. The set L^* includes all insurance contracts $l(\alpha)$, i.e., transformed risks that involve the mediation of an insurer managing these risks.

Definition 4.1 (set of insurance contracts)
An insurance contract is a lottery $l(\alpha)$ belonging to the set $\mathcal{L}^*$ such that :

$$\mathcal{L}^* = \{l(\alpha), \alpha \in [0;1] : l(\alpha) = (w_0 - mpL\alpha, w_0 - L + (1-mp)L\alpha, w_0 - L - mpL\alpha; 1-p, p, 0), \\ 0 < m < \frac{1}{p}, 0 < L \leq w_0\}$$

ll contracts $\mathcal{L}^*$ satisfy the five properties listed in the previous section. In particular, two contracts $l(\alpha_1)$ and $l(\alpha_2)(\alpha_1 \neq \alpha_2)$ are not comparable according to first-order stochastic dominance. The price of contract m is bounded by $\frac{1}{p}$ because if $m \geq \frac{1}{p}$ so any rational agent would prefer not to take out insurance. The lottery status $l(\alpha = 0)$ is singular: let us note that $l(\alpha = 0) \in \mathcal{L}^*$ even though it is an untransformed risk. We note that $l(\alpha = 0) = (w_0, w_0 - L, w_0 - L; 1-p, p, 0)$ and note that this is the only lottery for which the worst-case scenario does not have a probability of zero.

If the agent has preferences represented by a utility f, then the agent's optimal decision $\alpha_f^*(m)$ is the solution to the program. $\max_{\alpha \in [0,1]} f(l(\alpha))$. The agent's preferences are fully summarized by the marginal rate of substitution. $TMS_f(\alpha)$. Specifically, for an agent who is completely trusting and doesn't care about the state of the world with a disaster and no compensation (called state 3), $TMS_f(\alpha)$ indicates the maximum amount of wealth that the agent is willing to give up in the state of the world without a disaster (called state 1) in order to obtain an infinitesimal increase in his wealth in the state of the world with a disaster where the agent is compensated (called state 2). The decision $\alpha_f^*(m)$ therefore depends only on the comparison between

$TMS_f(\alpha)$, indicating the desirability of transferring an additional unit of wealth to state 2, and a price ratio indicating the relative cost of transferring that unit of wealth. On the other hand, a distrustful agent whose preferences are RDEu with distrust will pay attention to state 3. Consequently, for this agent, the infinitesimal increase in the decision α characterizing an increase in wealth in state 2 implies not only a reduction in wealth 1 but also a reduction in wealth in state 3, generating a disutility for the agent. For a distrustful agent, $TMS_f(\alpha)$ therefore indicates the maximum amount of wealth that the agent is willing to give up in states 1 and 3 to obtain an infinitesimal increase in wealth in state 2. All other things being equal, the desirability for an RDEu agent with distrust of an additional unit of coverage is therefore lower than that for a perfectly confident RDEu agent.

We will describe the optimal decision $\alpha_f^*(m)$ for different representations of preferences. Observation 1 generally characterizes the solution $\alpha_f^*(m)$ of the Mossin model and observation 2 specifies the insurance demands $\alpha_U^*(m)$ and $\alpha_V^*(m)$ in the expected utility (Eu) and RDEu models. These first two observations reflect well-known results in the literature. Observation 3 is the central result of this section and characterizes the insurance demand $\alpha_W^*(m)$ in the RDEu model with distrust.

Observation 4.1 (Mossin's model solution)

$\max_{\alpha\in[0;1]} f(l(\alpha))$

- If $m \leq m_f^1$ therefore $\alpha_f^* = 1$
- If $m_f^1 < m < m_f^0$ then $0 < \alpha_f^* < 1$ such that $TMS_f(\alpha^*) = \frac{mp}{1-mp}$
- Si $m \geq m_f^0$ then α_f^* =0

with

$$m_f^1 = \frac{1}{p}\frac{TMS_f(1)}{1+TMS_f(1)} \tag{3}$$

and

$$m_f^0 = \frac{1}{p}\frac{TMS_f(0)}{1+TMS_f(0)}, m_f^0 \in [m_f^1; \frac{1}{p}] \tag{4}$$

The amount m_f^1 is called the full insurance threshold. For any load factor $m \leq m_f^1$, the agent requests full insurance ($\alpha_f^* = 1$) . The amount m_f^0 is called the no insurance threshold. For any load factor $m \geq m_f^0$, the agent does not request insurance ($\alpha_f^* = 0$). For any load factor between these two thresholds, the agent requests incomplete insurance ($0 < \alpha_f^* < 1$). We observe that the values of these two thresholds are entirely governed by the probability of loss and the agent's preferences, embodied by the marginal rate of substitution.

The amounts of these two thresholds therefore differ significantly depending on the preferences chosen.

Observation 4.2 (Solutions Eu and RDEu)[10]

- Expected utility (with u concave)

$$f(l_\alpha) = U(l_\alpha) = pu(w_0 - L + (1 - mp)\alpha L) + (1 - p)u(w_0 - mp\alpha L) \tag{5}$$

Characterization of the interior solution $\alpha_U^*(m_U^1 < m < m_U^0)$:

$$TMS_U(\alpha_U^*) = \frac{pu'(w_0 - L + (1 - mp)L\alpha_U^*)}{(1 - p)u'(w_0 - mpL\alpha_U^*)} = \frac{mp}{1 - mp} \tag{6}$$

with,

$$m_U^1 = \frac{1}{p}\frac{TMS_U(1)}{1 + TMS_U(1)} = 1 \tag{7}$$

and

$$m_U^0 = \frac{1}{p}\frac{TMS_U(0)}{1 + TMS_U(0)}(\lim_{TMS_U(0)\to\frac{p}{1-p}} m_U^0 = 1, \lim_{TMS_U(0)\to\infty} m_U^0 = \frac{1}{p}), m_U^0 \in [1; \frac{1}{p}] \tag{8}$$

- Rank-dependent expected utility (with concave u)

$$f(l_\alpha) = V(l_\alpha) = (1 - \omega(1 - p))u(w_0 - L + (1 - mp)\alpha L) + \omega(1 - p)u(w_0 - mp\alpha L) \tag{9}$$

Characterization of the interior solution $\alpha_V^*(m_V^1 < m < m_V^0)$:

$$TMS_V(\alpha_V^*) = \frac{[1 - \omega(1 - p)]u'(w_0 - L + (1 - mp)L\alpha_V^*)}{\omega(1 - p)u'(w_0 - L - mpL\alpha_V^*)} = \frac{mp}{1 - mp} \tag{10}$$

[10] In both the EU and RDEu models, we focus on the case where the agent has a concave von Neumann utility of class C_2. If the agent has a convex or linear von Neumann utility, then it adopts an "all or nothing" behavior. An agent with a convex von Neumann utility does not insure if $m > \frac{\Pi(l_0)+E(\tilde{l})}{E(\tilde{l})}$ and fully insures itself if $m < \frac{\Pi(l_0)+E(\tilde{l})}{E(\tilde{l})}$ (where $\Pi(l_0) = E(l_0) - E_c(l_0)$ denotes the risk premium and $E_c(l_0)$ denotes the certain equivalent of lottery l_0). We can deduce that $m_f^o = m_f^1 = \frac{\Pi(l_0)+E(\tilde{l})}{E(\tilde{l})}$ for an agent with a convex von Neumann utility. Note that, if in the Eu model the payoff $\Pi(l_0)$ is negative, then $\frac{\Pi(l_0)+E(\tilde{l})}{E(\tilde{l})} < 1$, the situation is more complex in the RDEu model because $\Pi(l_0)$ can be negative, positive, or zero depending on the expression of the function ω. An agent with linear von Neumann utility does not insure if $m > \frac{\pi_2}{p}$ and fully insures itself if $m < \frac{\pi_2}{p}$ où π_2 designates the decision weight given to the state with claim. We can deduce that $m_f^0 = m_f^1 = \frac{\pi_2}{p}$ for an agent with linear von Neumann utility. In the Eu model, $m_f^0 = m_f^1 = 1$ and, in the RDEu model $m_f^0 = m_f^1 > 1$ if and only if the agent is pessimistic.

With

$$m_V^1 = \frac{1}{p}\frac{TMS_V(1)}{1+TMS_V(1)}, m_V^1 > m_U^1 \text{ ssi } \omega(1-p) < 1-p \tag{11}$$

and

$$m_V^0 = \frac{1}{p}\frac{TMS_V(0)}{1+TMS_V(0)}, m_V^0 > m_U^0 \text{ ssi } \omega(1-p) < 1-p \tag{12}$$

In the Eu model, risk attitude is fully captured by von Neumann utility : the agent is risk averse if and only if his von Neumann utility is concave. An agent will only demand full insurance if the price is not high ($m \leq 1$). In the RDEu model, risk attitude depends jointly on von Neumann utility and probability distortion. The main prediction of the RDEu model is that, for any price $m > 1$, an agent (u concave, ω convex) will demand full insurance if he is sufficiently pessimistic. Similarly, for any price $m < 1$, the agent (u concave, ω concave) does not demand insurance if he is sufficiently optimistic. Note that, in both models, the threshold for full insurance does not depend on von Neumann utility. In fact, in this case, the agent has the same level of wealth in the states of the world he considers.

Observation 4.3 (insurance application with RDEu with distrust)

$$\begin{aligned} f(l_\alpha) = W(l_\alpha) \quad &= \beta u(w_0 - L - mp\alpha L) + (1-\beta)[(1-\omega(1-p))u(w_0 - L + (1-mp)\alpha L) \\ &+ \omega(1-p)u(w_0 - mp\alpha L)] \end{aligned} \tag{13}$$

Characterization of the interior solution $\alpha_W^*(m_1(\beta) < m < m_0(\beta))$:

$$\begin{aligned} TMS_W(\alpha_W^*) = \quad &\frac{(1-\beta)(1-\omega(1-p))u'(w_0 - L + (1-mp)L\alpha_W^*)}{\beta u'(w_0 - L - mpL\alpha_W^*) + (1-\beta)\omega(1-p)u'(w_0 - mpL\alpha_W^*)} = \frac{mp}{1-mp}(\beta < 1) \\ &\Leftrightarrow TMS_V(\alpha_W^*) = \frac{mp}{1-mp}\lambda(\beta, \alpha_W^*)(\beta < 1) \end{aligned} \tag{14}$$

[11]

with

$$\lambda(\beta, \alpha_W^*) = 1 + (\frac{\beta}{1-\beta})\frac{1}{\omega(1-p)}g(\alpha_W^*) > 1 \text{ où } g(\alpha_W^*) = \frac{u'(w_0 - L - mpL\alpha_W^*)}{u'(w_0 - mpL\alpha_W^*)} \tag{15}$$

[11] If $\beta = 1$ then the insurance request is null : $\alpha_W^*(m) = 0$ for any price $m \in]0; \frac{1}{p}[$.

with

$$m_W^1(\beta) : m_W^1(\beta) = \frac{1}{p}\frac{TMS_W(1)}{1+TMS_W(1)}^{12}, m_W^1 < m_V^1 \text{ si } \beta > 0 \quad (16)$$

and

$$m_W^0(\beta) = \frac{1}{p}\frac{TMS_W(0)}{1+TMS_W(0)}, m_W^0 < m_V^0 \text{ si } \beta > 0 \quad (17)$$

In the RDEu model with distrust, attitude toward risk now depends on three elements : von Neumann utility (u), probability distortion (ω), and distrust (β). The RDEu model with distrust first predicts that the greater the distrust, the lower the demand for insurance. In particular, for any price $m \in]m_1(\beta); m_0(\beta)[$, the demand of an agent $(u, \omega, \beta > 0)$ is strictly lower than the demand of an agent (u, ω). Indeed, for any decision $\alpha \in [0; 1]$, the marginal substitution rate with distrust $TMS_W(\alpha)$ is strictly lower than the marginal rate of a perfectly trusting agent $TMS_V(\alpha)$. The equation characterizing the optimal demand of an agent (u, ω, β) can be formulated based on the marginal substitution rate of an agent (u, ω), which decreases with the decision α. Since the factor $\lambda(\beta, \alpha_W^*)$ is greater than 1 and increases with distrust β , we can deduce that $\alpha_W^*(m) < \alpha_V^*(m)$ for $m \in]m_1(\beta); m_0(\beta)[$. Note that the factor $\lambda(\beta, \alpha_W^*)$ increases with the concavity of von Neumann utility and with pessimism.

In the RDEU model with distrust, the non-insurance threshold $m_W^0(\beta)$ now depends on the agent's level of distrust. This threshold $m_W^0(\beta)$ decreases with β, such that $m_W^0(0) = m_V^0$ and $m_W^0(1) = 0$. Consequently, a distrustful agent $(u, \omega, \beta > 0)$ has a strictly lower non-insurance threshold than a fully trusting agent $(u, \omega, \beta = 0)$. The model's central prediction is the following: for any price $m \in]0; \frac{1}{p}[$, the insurance demand of an agent (u, ω, β) is zero if the agent's level of distrust is sufficiently high. Thus, it is not necessary to invoke the assumption of optimism to rationalize non-insurance behavior in the presence of highly subsidized prices: the demand of a pessimistic agent with concave utility may still be zero even if the price m is below unity. The third prediction of the RDEU model with distrust emphasizes that, unlike $\alpha_U^*(m)$ and $\alpha_V^*(m)$, the insurance demand $\alpha_W^*(m)$ oes not necessarily increase with the concavity of the von Neumann utility function. Indeed, the distrustful agent now considers three possible states of the world. An increase in utility concavity enhances the satisfaction derived from transferring a marginal unit of wealth from the no-loss state to the state with loss and indemnification. However, it simultaneously increases the disutility associated with a reduction in wealth in

[12] Let us note that the full insurance threshold $m_W^1(\beta)$ is not equal to $\frac{1}{p}\frac{TMS_W(1)}{1+TMS_W(1)}$ but precisely solution of the equation $m_W^1(\beta) = \frac{1}{p}\frac{TMS_W(1)}{1+TMS_W(1)}$. Indeed $TMS_W(1) = \frac{(1-\beta)(1-\omega(1-p))u'(w_0-mpL)}{\beta u'(w_0-L-mpL)+(1-\beta)\omega(1-p)u'(w_0-mpL)}$ depend on the price m because full insurance does not equal wealth in all three states.

the loss state without indemnification. Moreover, unlike the thresholds $m_U^1(\beta)$ and $m_V^1(\beta)$, the full-insurance threshold $m_W^1(\beta)$ depends on the von Neumann utility function. When choosing full insurance, the agent no longer equalizes wealth across all states considered relevant. Although wealth is equalized between the no-loss state and the state with loss and indemnification, wealth in the state with loss and no indemnification is significantly reduced. This implies that the full-insurance threshold $m_W^1(\beta)$ is lower than the corresponding threshold $m_V^1(\beta)$ for a fully trusting agent. The next result characterizes full-insurance and non-insurance behavior directly as a function of the agent's degree of distrust.

Corollary 4.1

■ For a given $m > 0$,

- If $\beta \leq \underline{\beta}, \alpha_W^* = 1$
- If $\beta \in]\underline{\beta}, \bar{\beta}[, \alpha_W^* \in]0;1[$
- If $\beta \geq \bar{\beta}, \alpha_W^* = 0$

$$\text{with } \underline{\beta} = \frac{[1 - mp - \omega(1-p)]}{[1 - mp - \omega(1-p)] + mp * g(1)} \tag{18}$$

$$\text{and } \bar{\beta} = \frac{\frac{(1-mp)}{mp} * TMS_V(0) - 1}{\frac{1-\omega(1-p)(1-mp)}{[1-\omega(1-p)]mp} * TMS_V(0) - 1} \tag{19}$$

$$\underline{\beta}, \bar{\beta} \in]0;1[\text{ and } \bar{\beta} > \underline{\beta} \text{ and } g(1) = \frac{u'(w_0 - L - mpL)}{u'(w_0 - mpL)}$$

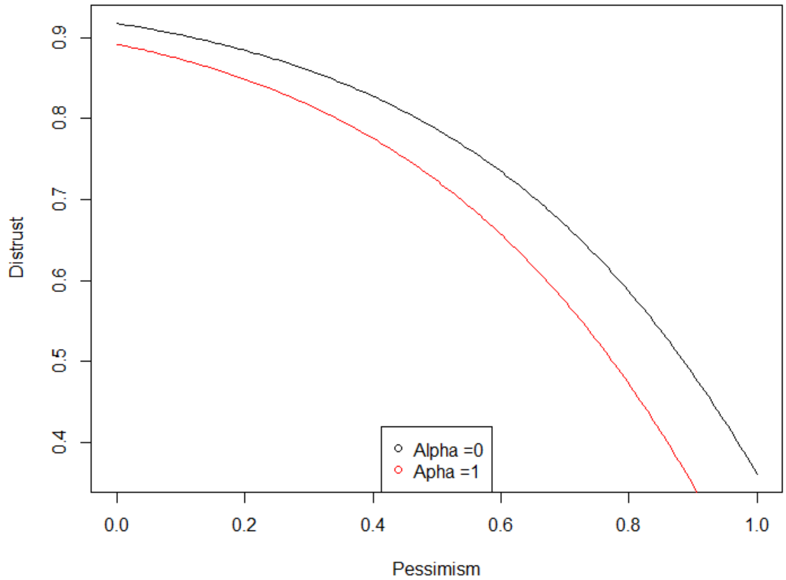
■ The threshold $\underline{\beta}$ increases with pessimism and decreases with the concavity of von Neumann utility.

■ The threshold $\bar{\beta}$ increases with pessimism and increases with the concavity of von Neumann utility.

■ The thresholds $\underline{\beta}$ and $\bar{\beta}$ are decreasing functions of the price m.

The threshold $\underline{\beta}$ represents the maximum level of distrust for agent (u, ω, β) to decide to adopt a complete contract at price m. Let us note that $g(1) = \frac{u'(w_0 - L - mpL)}{u'(w_0 - mpL)}$ indicates the relative disutility of not being compensated when the agent chooses a comprehensive contract. If this disutility increases, which is the case when the concavity of von Neumann utility increases, then the range of degrees of distrust compatible with comprehensive insurance is reduced. The threshold $\bar{\beta}$ represents the level of distrust at which the agent (u, ω, β) decides not to insure at price m. The $TMS_V(0)$ represents the satisfaction of an agent (u, ω) in transferring wealth units to the state with loss and compensation when the latter is not covered. If this satisfaction increases, then the set of degrees of distrust compatible with zero insurance is reduced. If the two thresholds are positively related to pessimism, the threshold $\underline{\beta}$ is negatively related to the concavity of von Neumann utility, while the threshold $\bar{\beta}$ is positively related to the concavity of von Neumann utility. This observation can be explained as follows: the concavity of von Neumann utility simultaneously influences the three states of the world, while pessimism only modifies the decision weights of states 1 and 2. Indeed, in the RDEu model with distrust, the decision weights are $\pi_1 = (1-\beta)\omega(1-p)$, $\pi_2 = (1-\beta)(1-\omega(1-p))$ and $\pi_3 = \beta$. A more pessimistic agent will assign greater weight to state 2 compared to state 1 and will therefore be more inclined to seek insurance. This is why, all other things being equal, the thresholds for full insurance and no insurance increase with pessimism, as shown in figure 1 below[13].

Figure 1: Relationship between pessimism and the threshold for full insurance $\underline{\beta}$ and the threshold for non-insurance $\bar{\beta}$



Note on the graph : Pessimism : $\omega(p) = e^{-(-\ln p)^{\theta}}$. The values on the x-axis are the possible values taken by the parameter. θ.

On the contrast, the concavity of von Neumann utility influences all three states : it determines the desirability of transferring wealth units from state 1 to state 2 but, at the same time, influences the discomfort associated with transferring wealth to state 3. When the agent is uninsured, the marginal utility of transferring a unit of

[13]Let's note that the more the parameter that adjusts the shape of the weighting function decreases, the more pessimistic the individual becomes.

wealth in state 2 outweighs the marginal disutility of the decrease in wealth in state 3. This implies, in this case, that the uninsured threshold increases with von Neumann concavity, as shown in figure2 below. However, when the agent has a high level of coverage, the marginal disutility of the decline in wealth in state 3 outweighs the marginal utility of the transfer of wealth to state 2. The threshold for full insurance decreases with the concavity of von Neumann utility, as shown in figure 3 below.

Figure 2: Relationship between concavity of the function and non-insurance threshold $\bar{\beta}$

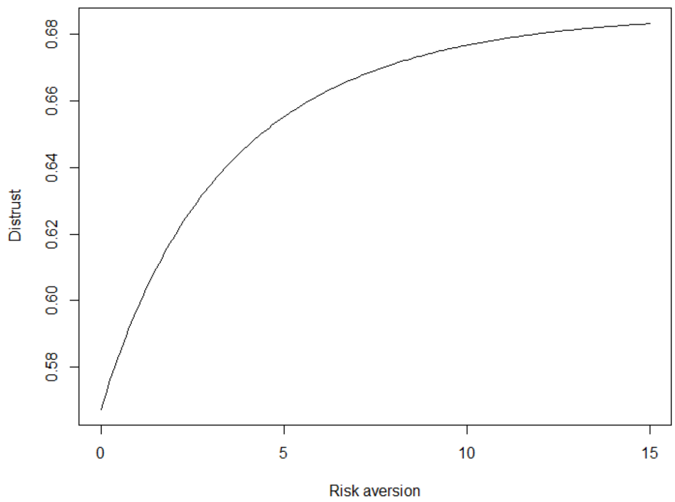
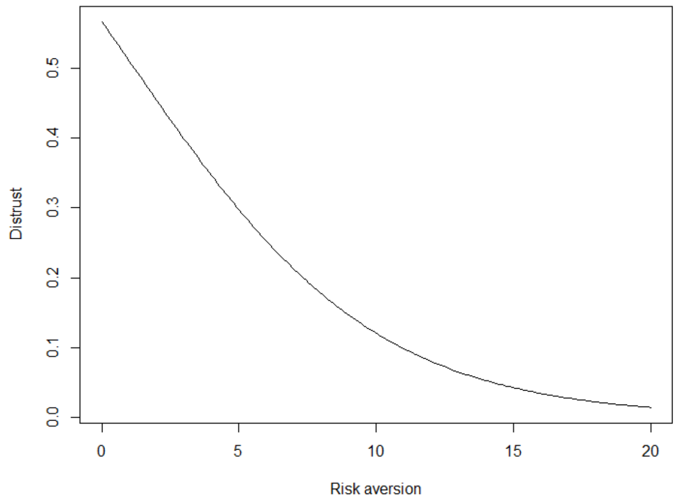


Figure 3: Relationship between concavity of the function and full insurance threshold $\underline{\beta}$



Note on the graph : Risk aversion : $u(c) = \frac{c^{1-\gamma}}{1-\gamma}$ The values on the x-axis are the possible values taken by the parameter. γ.

Example

For an initial price charged $m = 1.5$, three agents $(u, \omega, \beta_i)_{(i \in 1,2,3)}$ with the same wealth $w_0 = 200$, of which the von Neumann utility is $u(c) = \frac{c^{1-\gamma}}{1-\gamma}$ ($\gamma = 1.5$) and the probability distortion is $\omega(p) = e^{-(-\ln p)^{\theta}}$ ($\theta = 0.65$) and exposed to the same risk of loss $L = 100$ with a probability of loss $p = 0.1$, have the same full insurance threshold $\underline{\beta}(m) = 0.11$ and the same threshold for non-insurance $\bar{\beta}(m) = 0.48$. If $\beta_1 = 0.1, \beta_2 = 0.2$ and $\beta_3 = 0.5$, then the first agent will insure completely, the second agent will adopt partial insurance, and the last agent will not insure. If a subsidy reduces the price to $m = 1$, then the new thresholds are $\underline{\beta}(m) = 0.26$ and $\bar{\beta}(m) = 0.62$. In the last case, the first two agents will insure themselves fully, while the last agent will take out partial insurance. The thresholds for full insurance and no insurance $\underline{\beta}(m)$ and $\bar{\beta}$, can be mobilized in the development of public policies. By retaining the same functions u and ω, equalities $\underline{\beta}(m = 0.75) = 0.375$ and $\bar{\beta}(m = 0.75) = 0.7$ carry a highly intuitive interpretation. If the policymaker considers subsidizing premiums by 50%, then only agents who believe that the contract is non-executable with a probability lower than 0.7 will choose to purchase insurance. Similarly, only agents whose level of doubt is below 0.375 will opt for full insurance coverage. This is precisely the focus of the next section, which examines these implications in greater detail.

5 Recommendations

Farmers' insurance decisions depend, among other factors, on the price of the insurance contract and their trust in the enforceability of the contract. This final section discusses how public policymakers can leverage these two factors to increase the adoption rate of agricultural insurance products. A growing body of literature has shown that adopting agricultural insurance significantly increases farmers' expected income (Serfilippi et al., 2020; Bhuiyan et al., 2022; Ashimwe, 2016). The increasing severity and frequency of agricultural risks make it imperative to achieve broad insurance coverage among the farming population. We demonstrate that incorporating trust into the design of public policies enhances their effectiveness. This can be achieved through two main channels. First, pricing policies can take advantage of farmers' distrust to improve the calibration of subsidies tied to insurance contracts. These measures primarily involve surveys aimed at mapping distrust—that is, better understanding the distribution of the β parameter within the farmer population. The RDEu model with distrust predicts the minimum level of subsidy required for an agent (u, ω, β) to adopt the insurance product, whether partially or fully. However, if farmers exhibit a high degree of distrust overall, increasing adoption through subsidies alone can become prohibitively expensive. This is why pricing policies may be complemented by a second type of intervention: behavioral policies aimed directly at reducing farmers' distrust. The goal of such measures is to lower the required subsidy levels needed to reach a target adoption rate. Behavioral interventions can take various forms—such as simplifying insurance contracts—and also rely on "all-or-nothing" behavioral patterns: a marginal increase in a farmer's trust can trigger a shift from complete non-insurance to full insurance adoption. The RDEu model with distrust predicts (1) the subsidy savings generated by a marginal reduction in an agent's distrust (u, ω, β), and (2) the precise reduction in distrust required for a farmer with a non-insurance threshold $(u, \omega, \bar{\beta})$ to switch to full insurance adoption.

5.1 Introducing trust into public policy-making

In the previous section, we demonstrated that an agent's distrust can explain uninsured behavior, which raises two key questions. Firstly, why identify distrust as the main explanatory key to uninsured behavior when the RDEu model predicts this behavior for sufficiently optimistic and perfectly trusting agents? Furthermore, why would an agent exposed to risk doubt the enforceability of an insurance contract ?

The literature proposes several models that rationalize uninsured behavior when prices are subsidized. For example, an optimistic and perfectly trusting agent considers the likelihood of a claim occurring to be very low. He will therefore be willing to pay a low premium, which may be lower than the expected loss, to cover himself against the risk. So why consider distrust as an explanation for uninsured behavior? Firstly, optimism does not satisfactorily resolve the willingness-to-pay paradox. Indeed, while the RDEu model predicts that, for any price, a sufficiently optimistic agent can adopt uninsured behavior, it cannot explain why, in the vast majority of field surveys or laboratory experiments, subjects' decisions reveal risk aversion. What's more, and more fundamentally, identifying the determinants of behavior is essential to designing effective public policy measures. If the public decision-maker wishes to develop the adoption of an insurance product, it seems crucial to understand why agents decide not to insure themselves. One measure regularly cited in the literature to encourage the adoption of insurance products is to disseminate information on the occurrence of claims to farmers (Hallegatte et al., 2010). If the main explanatory source of non-insurance behaviour is optimism - which would result from a lack of knowledge of the true probability of a claim occurring - then the dissemination of claim occurrence frequencies is likely to modify farmers' insurance behaviour. On the other hand, if non-insurance behaviour is at least partly the result of farmers' distrust, then the dissemination of information on the occurrence of claims will have a very limited effect on farmers' insurance behaviour. Bocoum et al. (2019) and Cofie et al. (2013) show that information dissemination has contrasting effects on the adoption of insurance products. Cole et al. (2013) emphasize that farmers have a good knowledge of loss probabilities[14] suggesting that the distortion of probabilities does not result from a lack of knowledge of probabilities but rather from psychological considerations. At the same time, Dercon et al. (2019) and Guiso (2012) report, in a field study, that farmers have limited trust in insurers[15]. For example, in a survey on trust in mutual insurance companies in France 2018, 33% of respondents said they had no trust in mutual insurance companies.[16]. This research suggests that taking distrust into account in the design of public policy is necessary to stimulate the adoption of insurance.

If insurance demand depends on agents' distrust, then a second-order question arises: what are the key determinants of distrust? Any behavioral policy aimed at restoring trust in market exchange must begin by understanding the reasons that led to its breakdown in the first place, in order to implement effective measures. The β-RDEu model does not address the origin of distrust: why would an agent doubt the insurer's promise, i.e., the enforceability of the contract?

The literature has identified several potential drivers of distrust. Doubt regarding the insurer's promise arises naturally from the fact that insurance is a prototypical credence good. The agent pays a premium for a future and contingent service (Cole et al., 2013; Cheston et al., 2014; Peter and Ying, 2020). Cheston et al. (2014)

[14] In studying barriers to risk management, these authors found that farmers on average have a good estimate of true probabilities (72% correct answers to questions),

[15] In a study on trust, van der Hulst et al. (2023a) found that 22% of respondents had no trust in health insurers.

[16] https://www.statista.com/statistics/1104259/trust-in-mutual-insurances-france/ .

refer to zero aversion—the frustration felt by an insured individual who receives no payout because the insured event did not occur. Such doubt may also stem from the agent's past experiences when the market relationship is embedded in repeated interactions. If an agent observes, either personally or through others' experiences, that claims are not honored when a loss occurs, they may update their beliefs and assign a positive probability to non-indemnification—even when the insurer claims this outcome has zero probability (Ribeiro and Koloma, 2016; Tiemtore, 2018; Courbage and Nicolas, 2019). These failures to indemnify may result from dishonesty, insurer insolvency, or disputes between the insurer and insured (Guiso, 2012; Brookes and Facchini, 2022; Bourgeon and Picard, 2014). A large body of experimental literature using trust games has shown that trust is influenced by the social proximity of the exchange participants (Binzel and Fehr, 2013; Etang et al., 2011). Moreover, Johnson and Mislin (2011) found that individuals tend to trust institutions significantly less than anonymous individuals in such games, suggesting that institutional distrust is generally stronger than interpersonal distrust (Krastev et al., 2023).

In our view, one of the most fundamental determinants of distrust toward insurers is the complexity of insurance contracts. A sophisticated contract typically includes complex, ambiguous, or fine-print clauses (Kvalnes, 2011). These clauses may condition indemnity on specific behaviors—such as risk prevention—or exclude coverage under extraordinary circumstances—like extreme weather events. Such contracts function as tools for mitigating moral hazard or managing systemic risk, but they also weaken the perceived link between event occurrence and compensation. This ambiguity implies that signing a contract may no longer be sufficient to convey the trust necessary for market exchange. Depending on their preferences, an agent may believe that suffering a loss does not guarantee compensation. In this context, ambiguity aversion reflects a belief that indemnity may not be paid even when a loss occurs. Similarly, under bounded rationality, agents may rely on heuristics that present the contract simply as a potentially non-enforceable agreement. Kvalnes (2011) examines how vague promises from a principal affect an agent's willingness to enter a contractual relationship. He shows that unclear commitments erode the agent's trust in the principal and reduce their participation. Likewise, Van Boom et al. (2016) show that simplifying financial contracts enhances agents' trust in the product. In the final part of this paper, we will discuss the importance of accounting for these various potential sources of distrust when designing public policies aimed at restoring trust in insurance markets.

5.2 Exploiting distrust

The example of the Burkinabe government's insurance demand support program (2020–2022) demonstrates that heavily subsidizing the insurance market does not necessarily lead to widespread adoption of insurance products. The report by PNUD (2022) shows that, among a population of several tens of thousands of farmers, introducing a 50% premium subsidy resulted in only a few hundred new policyholders per year. Incorporating distrust into the design of insurance demand support measures first requires mapping the level of distrust within the population of agents exposed to a common risk. We show that improving knowledge of the distribution of distrust among such agents increases the effectiveness of subsidies by (1) enabling more accurate calibration of the subsidy amount and (2) leveraging the “all-or-nothing” behavior exhibited by distrustful agents. A substantial body of research has sought to estimate the distribution of distrust across populations. Among these, two main approaches can be distinguished: field studies that use self-reported survey data to construct trust indices (van der Hulst et al., 2023b; Reynaud et al., 2018; Cheston et al., 2014), and laboratory experiments that estimate distrust through experimental games, particularly the Trust Game (Binzel and Fehr, 2013; Cadsby et al., 2008). We propose an alternative method for estimating the distribution of distrust. This method combines observed behavior in the insurance market with the theoretical predictions of the β-RDEu model, particularly its insurance demand thresholds—namely, the non-insurance and full-insurance cutoffs.

Observation 5.1

Let’s consider a population of agents (u, ω) exposed to the same risk, differentiated only by their degree of distrust β. If :

(i) all agents are perfectly aware of the existence of the contract (I, Π) proposed by the insurer. (ii) the distrust parameter (β) is normally distributed within the population: $\beta \rightarrow \mathcal{N}(\mu, \sigma^2)$

(iii) For a price m^* charged on an insurance market, the proportion of fully insured agents is $k_1(m^*)$ and the proportion of uninsured agents is $k_2(m^*)$ such that the proportion of partially insured agents is non-zero $(1 - k_1(m^*) \neq k_2(m^*))$.

So :

$$\mu = \frac{P^{-1}(1 - k_1(m^*))}{h(m^*)} \bar{\beta}(m^*) - \frac{P^{-1}(k_2(m^*))}{h(m^*)} \underline{\beta}(m^*) \tag{20}$$

$$\sigma = \frac{\bar{\beta}(m^*) - \underline{\beta}(m^*)}{h(m^*)} \tag{21}$$

where P^{-1} is the application which associates with any proportion a single reduced centered distrust value $\frac{\beta - \mu}{\sigma}$ and $h(m^*) = P^{-1}(1 - k_1(m^*)) - P^{-1}(k_2(m^*))$.

In the $\beta - RDEu$ model, distrust is represented by a single parameter indicating the likelihood, from the agent's perspective, that the insurer will fail to fulfill its promise of compensation. Observation 5.1 offers a simple procedure for estimating the distribution of the β parameter within a population. This estimation only requires collecting two observations on the insurance market under study - the proportion of uninsured agents and the proportion of fully insured agents - and calculating the theoretical thresholds for uninsurance. $\bar{\beta}$ and of full insurance. $\underline{\beta}$. The main advantage of our method for estimating the distribution of distrust is that it does not depend on the market price m^*: whether the price is subsidized or not, the procedure yields the same estimates of the parameters μ and σ. This method relies on several assumptions.

First, we assume that agents differ only in their degree of distrust[17]. This assumption allows us to compute a single pair of insurance thresholds—non-insurance and full-insurance—for the entire population.

Furthermore, in order to estimate the proportions $k_1(m^)$ and $k_2(m^)$, it is necessary to clearly delineate the subset of agents who remain uninsured. To simplify this task, we assume that all agents are fully aware of the existence of the insurance contract, so that non-insurance behavior results from a deliberate choice rather than from lack of information.

We also assume that the β parameter follows a normal distribution and aim to estimate the corresponding parameters. For instance, let us suppose that, at a market price $m^* = 1$, 20% of agents are fully insured while 50% remain uninsured. Using the calibration provided in Table 5.1 below, we obtain: $\underline{\beta}(m^*) = 0, \bar{\beta}(m^*) = 0.18, P^{-1}(1 - k_1(m^*) = 0.8) = 0.84$ and $P^{-1}(k_2(m^*) = 0.5) = 0$. This results in the following parameter estimate : $\mu = \bar{\beta}(m^*) = 0.18 \;\; et \;\; \sigma = 0.21$.

Mapping the β parameter helps improve the calibration of subsidies aimed at increasing the adoption rate of insurance contracts. Given a distribution of the β parameter, the β-RDEu model provides an explanation for the limited success of the Burkinabe government's insurance demand support program (2020–2022). We propose a calibration that replicates this program and shows that, despite a 50% subsidy, the predicted non-insurance rate remains high. This is because the subsidy level determines a theoretical non-insurance threshold ($\bar{\beta}(0.75)$) that falls below the distrust level of the majority of farmers. However, this finding should not be interpreted as grounds for rejecting the use of subsidies to stimulate insurance demand. On the contrary, we show that if the public policymaker had opted for a 66.67% subsidy, then most farmers would have had a distrust level below the full insurance threshold ($\underline{\beta}(0.5)$). For the calibration[18], we rely on data from the PNUD (2022) report, which provides information on average loss (L), average insured crop value (w_0), and loss probability (p), assuming

[17] Agents may exhibit varying attitudes toward risk, but heterogeneity is captured solely through differences in distrust.
[18] We also performed alternative calibrations using different parameter values, as presented in Tables 2, 3, 4, and 5 in the appendix.

an initially charged premium at 50% of actuarial value. The values for risk aversion and pessimism are drawn from Serfilippi et al. (2020), which examines farmers' willingness to pay for insurance in Burkina Faso under premium payment uncertainty. We assume a CRRA (Constant Relative Risk Aversion) utility function and use the Prelec probability weighting function, which is widely employed in empirical work (Ojala et al., 2018; Takahashi et al., 2007).

Table 1: Calibration[19]

Risk aversion : $u(c) = \frac{c^{1-\gamma}}{1-\gamma}$, with $\gamma = 1.2$	Initial wealth : $w_0 = 1000$
Pessimism : $\omega(p) = e^{-(-\ln p)^{\theta}}$ with $\theta = 1$	Damage : $L = 200$
Probability of loss : $p = 0.07$	

- **Scenario 1 : subsidy of 50%**

Distribution of the β parameter: $\beta \rightarrow \mathcal{N}(\mu = 0.4, \sigma^2 = 0.01)$.

$k_2(0.75) = P(\frac{\beta-\mu}{\sigma} \leq \frac{0.4-0.3557}{0.1}) = 0.672$ et $k_1(0.75) = 1 - P(\frac{\beta-\mu}{\sigma} \leq \frac{0.4-0.2027}{0.1}) = 0.0243$

$\bar{\beta}(0,75) = 0.3557; \quad \underline{\beta}(0.75) = 0.202689$

- **Scenario 2 : subsidy of 66.67%**

Distribution of the β parameter $\beta \rightarrow \mathcal{N}(\mu = 0.4, \sigma^2 = 0.01)$.

$k_2(0.5) = P(\frac{\beta-\mu}{\sigma} \leq \frac{0.4-0.549}{0.1}) = 0.0681$ and $k_1(0.5) = 1 - P(\frac{\beta-\mu}{\sigma} \leq \frac{0.4-0.4333}{0.1}) = 0.6293$

$\bar{\beta}(0.5) = 0.549; \quad \underline{\beta}(0.5) = 0.433$

Scenario 1 replicates the conditions of the insurance market in Burkina Faso following the implementation of the government insurance demand support program. Scenario 2 reflects a hypothetical situation in which a 66.67% subsidy is applied instead of the 50

The model predicts that introducing a 50% subsidy on the premium does not lead to widespread adoption of the insurance product: more than two-thirds of farmers would remain uninsured. It also predicts that only 2.5% of farmers would purchase full insurance coverage. In contrast, the model forecasts that introducing a 66.67% subsidy would completely transform the insurance market: nearly two-thirds of farmers would opt for full insurance, and only 7% would remain uninsured. This calibration shows that, in a market where agents are generally distrustful, the effectiveness of a subsidy measure critically depends on the mapping of distrust within the population. A change in the subsidy amount can either have a negligible impact on insurance demand or

[19]To calculate the probability of loss, we used the expression for the premium : $\Pi = m\alpha pL$. As the market price is charged 50%, $\Pi = 1,5 * \alpha pL$. so, $p = \frac{20}{1,5*190} = 0,07$, assuming that $\alpha = 1$.

significantly increase it, depending on how it shifts the non-insurance and full-insurance thresholds. Specifically, the effectiveness of a subsidy increase depends on the width of the interval $[m^1_W(\beta); m^0_W(\beta)]$. If this interval is narrow, then a small increase in the subsidy—starting from an initial subsidized price just above $m^0_W(\beta)$ (associated with non-insurance behavior)—may lower the price below $m^1_W(\beta)$, thus inducing full insurance adoption. Finally, the β-RDEu model also provides a clear answer to the question: what level of subsidy is required to achieve a full insurance adoption rate of k%? For example, to reach an 80% full adoption rate under the above calibration, the model yields a required price of $m \simeq 0.4487$, corresponding to a 70% subsidy on the initial premium. m=1.5[20]

5.3 Reducing distrust

We show that, in a population whose level of impairment is high, an important subvention calibrée without considering the distribution of the impairment is susceptible to inefficiency. In addition, to encourage agents fortement unable to provide, the subvention amount can be prohibitive: the failure to provide a subvention makes it incredibly costly to have a massive adhésion to the products of assurance. Consequently, a second aspect of the integration of trust lies not in exploiting the distribution of distrust to better calibrate a subsidy, but rather in directly reducing distrust in order to reduce the amount of a subsidy. Specifically, for a given take-up rate, we wish to estimate the reduction in the cost of a public fare policy that could be induced by the marginal reduction in distrust. The $\beta - RDEu$ model predicts that a reduction in no-confidence increases the agent's demand for insurance if $\beta \in [\underline{\beta}; \bar{\beta}]$

How can farmers' distrust be directly reduced ? Several instruments have been proposed in the literature, depending on the identified source of distrust. If distrust primarily stems from past observations of claim denials—whether due to insurer insolvency, dishonest behavior, or frequent litigation—then state-backed guarantees can help limit such negative anecdotes, where the insured observes a lack of indemnity despite the occurrence of a loss. These guarantees may take various forms: reserve funds, legal sanctions for fraudulent behavior, or judicial support mechanisms (Guiso, 2012; Asmat and Tennyson, 2014). What these measures share is the goal of reducing the occurrence of non-indemnification events in the agent's experience, so that indemnity is perceived as the norm rather than the exception[21] If agents' doubts originate from institutional distrust, intro-

[20]We are looking for m such that $P(\beta \leq \underline{\beta}(m)) = P(\frac{\beta - 0.4}{0.1} \leq \frac{\underline{\beta}(m) - 0.4}{0.1}) = 0.8$. ie., $\frac{\underline{\beta}(m) - 0.4}{0.1} = 0.84 \Leftrightarrow \underline{\beta}(m) = 0.484$ with $\underline{\beta}(m) = \frac{[0.07 - 0.07m]}{[0.07 - 0.07m] + 0.07m * (\frac{1000 - 14m}{800 - 14m})^{1.2}}$.

[21]This objective can be reinforced by disseminating information not about the frequency of losses, but about insurers' indemnification rates.

ducing an intermediary into the contractual relationship may help restore confidence in the insurance product. The source of the promise is not neutral concerning the agent's level of distrust: intermediaries are typically local authorities who have built long-term trust with the target population and effectively transfer that trust into the insurance contract. The intermediary endorses the insurer's promise and can take over key responsibilities in the relationship with the agent: collecting premiums, coordinating damage assessments, disbursing claims, or communicating information about insured risks.

In field experiments, Cole et al. (2013), Cofie et al. (2013), and Belissa et al. (2019) show that appointing a village chief as intermediary has a positive impact on insurance demand, while PNUD (2022) suggests making indemnity payments in public spaces to anchor trust. If distrust arises instead from the complexity of insurance contracts, regulatory guidelines aimed at contract standardization and simplification can help restore trust. This includes limiting exclusion clauses and reducing ambiguity in contract language (Kvalnes, 2011; Van Boom et al., 2016). Considering these various behavioral interventions to reduce distrust, it becomes possible to estimate—for a given level of subsidy—the corresponding reduction in population-wide distrust that would enhance the effectiveness of pricing policies. In other words : what is the reduction in the parameter β that is equivalent to a marginal increase in the subsidy ? Previously, we showed that in a scenario replicating the conditions of the Burkinabe insurance market following a government program, increasing the subsidy from 50% to 66.67% would raise the insurance adoption rate from 33% to 63%. We now determine the equivalent reduction in distrust, that is, the change in the distribution of the β parameter that would allow a 50% subsidy to reach the same 63% adoption target. Formally, this corresponds to identifying the set of parameter pairs (μ, σ) that satisfy the following condition :

$$P(\beta < \bar{\beta}(0.5)) = P(\frac{\beta - \mu^*}{\sigma^*} \leq \frac{\bar{\beta}(0.75) - \mu^*}{\sigma^*}) = 0.63$$

Using the calibration in Table 5.1, we obtain$\bar{\beta}(0.75) = 0.3557$ et il vient $\mu^* = 0.3557 - 0.33\sigma^*$. For example, consider a behavioral intervention that reduces the average distrust in the population by 0.06 points and also lowers the dispersion by 0.05. This intervention shifts the distribution from $\mathcal{N}(\mu = 0.4, \sigma = 0.1)$ to $\mathcal{N}(\mu^* = 0.34, \sigma^* = 0.05)$. As a result, the gross cost[22] of a policy targeting a 63% adoption rate is reduced by 16.67 percentage points. To make the impact of such a behavioral measure more intuitive, one may assume that it only shifts the mean of the distribution without affecting the standard deviation (i.e., $\sigma^* = \sigma$). In this case, the intervention can be interpreted as uniformly lowering the distrust level across all farmers, such that $\mu^* = \mu - \epsilon$

[22]The behavioral measure may entail its own implementation cost, which should be subtracted from the subsidy savings to compute the net cost reduction.

(with $\epsilon > 0$).[23] For instance, if $\sigma^* = 0.1$, then a target adoption rate of 63% corresponds to a new mean distrust level $\mu^* = 0.3227$. In other words, a mere 0.0773-point reduction in average distrust is equivalent to a 33.34 percentage point increase in the subsidy. This result can be explained by the fact that, under our calibration, the proportion of farmers whose initial β lies within the interval $[\bar{\beta}(0.75) = 0.3557; \underline{\beta}(0.5) = 0.433 = 0.3557 + 0.0773]$ accounts for approximately one-third of the population $(P(0.3557 \leq \beta \leq 0.433) = 0.3013)$.

6 Conclusion

The β-RDEu model is a decision-making framework under risk that accounts for distrust, defined as the distortion of objectively null probabilities. In certain markets, such as the agricultural insurance market, distrust acts as a major barrier to exchange. A substantial share of potential buyers are unwilling to purchase subsidized insurance contracts, even when the good or service provides positive net utility when evaluated solely through the standard RDEu (Rank-Dependent Expected Utility) function.

The model predicts that insurance demand decreases as distrust increases, and can even fall to zero regardless of price if distrust is sufficiently high. We identify two key thresholds based on the parameter β: the full insurance threshold $\underline{\beta}$ and the non-insurance threshold $\bar{\beta}$. These thresholds depend on the von Neumann utility function u, the probability distortion function ω, and the price m. They provide a clear characterization of insurance behavior as a function of β and can be effectively leveraged in the design of public policies aimed at stimulating the adoption of insurance products. Both thresholds are decreasing functions of the price m, suggesting that policymakers can utilize this property to raise the adoption rate of agricultural insurance. Additionally, the thresholds increase with the degree of pessimism, which explains why information campaigns about loss probabilities aimed at reducing farmers' excessive optimism can help boost uptake rates. While the full insurance threshold decreases with the concavity of the von Neumann utility function, the non-insurance threshold increases with it. This implies that in markets where potential policyholders have utility functions with low concavity, they are likely to exhibit "all-or-nothing" behavior. Such behavior can be strategically addressed through targeted subsidy schemes. Finally, the β-RDEu model emphasizes the importance of the policymaker having detailed knowledge of the distribution of the parameter β within the target population. A better understanding of this distribution allows for more precise subsidy calibration, thereby reducing the overall cost of policies intended to stimulate insurance demand. While we propose a simple estimation method for the

[23] The assumption that a behavioral intervention reduces distrust by the same amount for all farmers is debatable. In practice, the intervention may affect different subgroups unevenly. For instance, it may be easier to build trust among farmers who are already somewhat confident in the product than among those who are entirely distrustful. In this latter case, the behavioral measure not only alters the parameters μ and σ but may also transform the functional form of the distribution of β. Nonetheless, the assumption $\sigma^* = \sigma$ does not necessarily imply $\mu^* = \mu - \epsilon$.

distribution of β based on market observations and model predictions, we argue that systematic survey efforts are necessary to refine this knowledge and improve the effectiveness of subsidy policies that take distrust into account.

Appendix

Proof of the theorem 3.1

If the agent is perfectly pessimistic/optimistic, then according to H1 and H2, we have $\pi_{n_1} = \pi_{n_2}$. Similarly, if the set $\mathcal{L}^*$ is constructed solely from lotteries where all consequences c_i and c'_i ($\forall i \neq n$) have the same probability and the same rank, then H1 and H2 imply $\pi_{n_1} = \pi_{n_2}$. In other cases, H1 and H2 are not sufficient to guarantee that the agent will pay the same attention to the worst-case scenario in each lottery. We show that adding the hypothesis H3 guarantees that the agent will always pay the same attention β to the worst consequence. For any lottery $l_1 = (c_{11}, ..., c_{1(n_1-1)}, x; p_1, ..., p_{n_1-1}, 0) \in \mathcal{L}^*$ and all consequences $(c_{21}, ..., c_{2(n_2-1)}, x)$ such that l_1 and l_2 are not comparable according to first-order stochastic dominance, note that there exists a probability distribution $(q_1, ..., q_{n_2})$ such that $l_1 \sim l_2 = (c_{21}, ..., c_{2(n_1-1)}, x; q_1, ..., q_{n_1-1}, 0)$.

According H1, $EG(l_1) = \sum_{i=1}^{n_1-1} \pi_i u(c_{1i}) + \pi_{n_1} u(x) = \sum_{i=1}^{n_2-1} \pi'_i u(c_{2i}) + \pi'_{n_2} u(x) = EG(l_2)$. Furthermore, H3 implies $l_3 \sim l_4$, which is equivalent under assumptions H1 and H2 to equality. $EG(l_3) = \sum_{i=1}^{n_1-1} \pi_i u(c_{1i}) + \pi^{*'}_{n_1} u(z) = \sum_{i=1}^{n_2-1} \pi'_i u(c_{2i}) + \pi^{*'}_{n_2} u(z) = EG(l_4)$. Let us note that, since the sum of the decision weights is always equal to unity, $\pi_{n_1} = \pi^*_{n_1}$ and $\pi_{n_2} = \pi^{*'}_{n_2}$. Let's assume $\pi_{n_1} \neq \pi'_{n_2}$, il vient $u(z) = \frac{\sum_{i=1}^{n_1-1} \pi_i u(c_{1i}) - \sum_{i=1}^{n_2-1} \pi'_i u(c_{2i})}{\pi'_{n_2} - \pi_{n_1}}$. And yet, indifference $l_1 \sim l_2$ also implies
$u(x) = \frac{\sum_{i=1}^{n_1-1} \pi_i u(c_{1i}) - \sum_{i=1}^{n_2-1} \pi'_i u(c_{2i})}{\pi'_{n_2} - \pi_{n_1}}$ and $u(x) = u(z)$ contradicts the monotony axiom (H1) if $x \neq z$. We can deduce that $\pi_{n_1} = \pi'_{n_2}$. Let's note $\pi_{n_1} = \beta \geq 0$ et d'après H1, $\beta \leq 1$. According Diecidue and Wakker (2001), H1 and H2 implies for $i \neq n, \pi_i = (1-\beta)[\omega(p_1 + ... + p_i) - \omega(p_1 + ... + p_i - 1)]$ with $\omega(1) = 1, \omega(0) = 0$ and ω a strictly increasing function on $[0; 1]$.

Proof of observation 3.1

By definition, increasing the decision α infinitesimally increases the wealth of state 2 by $(1 - mp)L\alpha$ and reduces the wealth in state 1 and state 3 by $mpL\alpha$. We can deduce that the opportunity cost of a marginal increase in wealth in state 2 is equal to mpL, while the opportunity cost of a marginal increase in wealth in state 1 or state 3 is equal to $(1 - mp)L$. The price ratio is therefore $\frac{mp}{1-mp}$. By definition, $TMS_f(\alpha)$ represents the maximum wealth that the agent is willing to give up simultaneously in states 1 and 3 to obtain an infinitesimal additional amount of wealth in state 2. If $TMS_f(\alpha) > \frac{mp}{1-mp}$, then the marginal utility of increasing wealth in state 2—relative to the disutility of losing wealth in states 1 and 3—is greater than the relative cost of increasing wealth in state 2: we can therefore deduce that any rational agent must increase decision α. If $TMS_f(\alpha) < \frac{mp}{1-mp}$, then any rational agent must reduce the decision α. If there is an interior solution denoted

α_f^*, we can deduce that $TMS_f(\alpha) = \frac{mp}{1-mp}$. Furthermore, by definition :

$$m_f^1 : \frac{\partial f(l(\alpha))}{\partial \alpha}|_{\alpha=1} = 0 \Leftrightarrow (1 - m_f^1 p)TMS_f(1) = m_f^1 p \Leftrightarrow m_f^1 = \frac{1}{p}\frac{TMS_f(1)}{1 + TMS_f(1)} \tag{22}$$

$$m_f^0 : \frac{\partial f(l(\alpha))}{\partial \alpha}|_{\alpha=0} = 0 \Leftrightarrow (1 - m_f^0 p)TMS_f(0) = m_f^0 p \Leftrightarrow m_f^0 = \frac{1}{p}\frac{TMS_f(0)}{1 + TMS_f(0)} \tag{23}$$

We note that the price ratio is an increasing function of m. First, $TMS_f(0)$ does not depend on m because $l(\alpha = 0) = (w_0, w_0 - L, w_0 - L; 1 - p, p, 0)$ does not depend on m. This implies that for any price $m > m_f^0, TMS_f(\alpha_f^* = 0) = \frac{m_f^0 p}{1-m_f^0 p} < \frac{mp}{1-mp}$ so the agent does not request insurance. On the other hand, $TMS_f(1)$ is likely to depend on m if the agent pays attention to state 3 with $l(\alpha = 1) = (w_0 - mpL, w_0 - mpL, w_0 - L - mpL; 1 - p, p, 0)$. We say that the agent pays attention to state 3 if the loss of wealth in state 3 following an increase in decision α causes disutility to the agent. If the agent pays no attention to state 3, then $TMS_f(1)$ is constant and, for any price $m < m_f^1, TMS_f(\alpha_f^* = 1) = \frac{m_f^1 p}{1-m_f^1 p} > \frac{mp}{1-mp}$ so the agent demands full insurance. If the agent pays attention to state 3, $TMS_f(1)$ is no longer necessarily constant because full insurance does not equalize the three levels of wealth.

Proof of observation 3.2

If the agent's preferences are represented by the expected utility U, then the agent pays no attention to state 3. According to observation 3.1, if $m_U^1 < m < m_U^0$, then there exists an interior solution α_U^*. By definition $TMS_U(\alpha) = \frac{pu'(w_0-L+(1-mp)L\alpha)}{(1-p)u'(w_0-mpL\alpha)}$ for all $\alpha \in [0;1]$ therefore α_U^* is such tah $TMS_U(\alpha_U^*) = \frac{pu'(w_0-L+(1-mp)L\alpha_U^*)}{(1-p)u'(w_0-mpL\alpha_U^*)} = \frac{mp}{1-mp}$. In addition, $TMS_U(1) = \frac{p}{1-p}$ $m_U^1 = \frac{1}{p}\frac{TMS_U(1)}{1+TMS_U(1)} = 1$ and $TMS_u(0) = \frac{pu'(w_0-L)}{(1-p)u'(w_0)}$ therefore $m_u^0 = \frac{u'(w_0-L)}{E_{u'}(l\alpha=0))}$ où $E_{u'}(l\alpha = 0)) = pu'(w_0 - L) + (1 - p)u'(w_0)$ enotes the expected marginal utility of the lottery $l(\alpha = 0)$. The limit calculations are immediate. The result $\lim_{TMS_U(0)\to\frac{p}{1-p}} m_U^0 = 1$ can be interpreted as follows : when $TMS_U(0) \to \frac{p}{1-p}$, The agent becomes neutral towards risk, and the threshold for non-insurance is confused with the threshold for full insurance.

The result $\lim_{TMS_U(0)\to\infty} m_U^0 = \frac{1}{p}$ means that when the agent's risk aversion becomes arbitrarily large, the uninsured threshold tends toward the highest price ($\frac{1}{p}$) that a rational agent is willing to pay to insure against risk. If preferences are represented by rank-dependent expected utility V, then the agent pays no attention to state 3 and the optimal decision is α_V^* for all price m such that $m_V^1 < m < m_V^0$ is such that $\frac{(1-\omega(1-p))u'(w_0-L+(1-mp)L\alpha_V^*)}{\omega(1-p)u'(w_0-mpL\alpha_V^*)} = \frac{mp}{1-mp}$. Let's note that if the agent (u, ω) is pessimistic (or optimistic), then for any interior solution $\alpha_U^*, TMS_V(\alpha_U^*) > TMS_U(\alpha_U^*) = \frac{mp}{1-mp}$ (respectively $TMS_V(\alpha_U^*) <$

$TMS_U(\alpha_U^*) = \frac{mp}{1-mp}$) and, like to TMS_V s a decreasing function of α, it follows that$\alpha_V^* > \alpha_U^*$ (respectively $\alpha_V^* < \alpha_U^*$). Furthermore, $TMS_V(1) = \frac{(1-\omega(1-p))}{\omega(1-p)}$ therefore, $m_V^1 = \frac{(1-\omega(1-p))}{p}$ and $TMS_V(0) = \frac{(1-\omega(1-p))u'(w_0-L)}{\omega(1-p)u'(w_0)}$ therefore $m_V^0 = \frac{(1-\omega(1-p))}{p}\frac{u'(w_0-L)}{E_{u'}^{\pi}(l(\alpha=0))}$ where $E_{u'}^{\pi}(l(\alpha = 0)) = (1-\omega(1-p))u'(w_0 - L) + \omega(1-p)u'(w_0)$ denotes the subjective expected marginal utility of the lottery $l(\alpha = 0)$ (the expectation is subjective because the decision weights used to calculate the expectation are not necessarily equal to the probabilities). Finally, $m_V^1 > m_U^1$ if and only if $\frac{1-\omega(1-p)}{p} > 1$, that is, if and only if the agent is pessimistic. Similarly, $m_V^0 > m_U^0$ if and only if $\frac{(1-\omega(1-p))}{p}\frac{u'(w_0-L)}{E_{u'}^{\pi}(l(\alpha=0))} > \frac{u'(w_0-L)}{E_{u'}(l(\alpha=0))}$ equivalent to $1-p > \omega(1-p)$, that is, if and only if the agent is pessimistic.

Proof of observation 3.3

First, note that the result is restricted to non-IARA von Neumann utilities (*Increasing Absolute Risk Aversion*). According to observation 3.1, it is necessary to apply a restriction on the von Neumann utility of an agent that pays attention to state 3, so that $TMS_W(1)$ is not an increasing function of price m. Let us observe that $\frac{\partial TMS_W(1)}{\partial m} \leq 0 \Leftrightarrow -\frac{u''(w_0-mpL)}{u'(w_0-mpL)} \leq -\frac{u''(w_0-L-mpL)}{u'(w_0-mpL)}$. For non-IARA concave von Neumann utilities, $m_W^1(\beta)$ can be interpreted as a full insurance threshold. By immediate calculation, we obtain for any price m such that $m_W^1(\beta) < m < m_W^0(\beta)$, the optimal decision α_W^* is such that $TMS_W(\alpha_W^*) = \frac{(1-\beta)(1-\omega(1-p))u'(w_0-L+(1-mp)L\alpha_W^*)}{\beta u'(w_0-L-mpL\alpha_W^*)+(1-\beta)\omega(1-p)u'(w_0-mpL\alpha_W^*)} = \frac{mp}{1-mp}(\beta < 1)$. If the agent is perfectly trustful ($\beta = 0$, $TMS_W(\alpha_W^*) = TMS_W(\alpha_V^*)$) If the agent is perfectly distrustful ($\beta = 1$, $TMS_W(\alpha) = 0 < \frac{mp}{1-mp}$ ($\forall\alpha \in [0;1]$) therefore $\alpha_W^* = 0$. The equation (14), $TMS_V(\alpha_W^*) = \frac{mp}{1-mp}\lambda(\beta, \alpha_W^*)$, allows us to characterize the solution α_W^* based on the marginal substitution rate RDEu. This equation can therefore be used to compare α_W^* and α_V^*. Let us observe that $\lambda(\beta, \alpha_W^*)$ s greater than or equal to 1 ($\beta = 0$) and increases with β. Therefore, for any price m such that $m_W^1(\beta) < m < m_W^0(\beta)$, we obtain $\frac{mp}{1-mp} = TMS_V(\alpha_V^* = \alpha_W^*(\beta = 0)) < TMS_V(\alpha_W^*(\beta > 0)) = \frac{mp}{1-mp}\lambda(\beta > 0, \alpha_W^*)$ this implies $\alpha_V^* > \alpha_W^*(\beta > 0)$ and, for $0 < \beta_0 < \beta_1 < 1$, $\frac{mp}{1-mp}\lambda(\beta_0, \alpha_W^*(\beta_0)) = TMS_V(\alpha_W^*(\beta_0)) < TMS_V(\alpha_W^*(\beta_1)) = \frac{mp}{1-mp}\lambda(\beta_1, \alpha_W^*(\beta_1))$ which implies that $\alpha_W^*(\beta_1) < \alpha_W^*(\beta_0)$. The interpretation is as follows: the marginal substitution rate TMS_W decreases with β because a distrustful agent finds it more disutile to transfer wealth units to state 2 (loss with compensation) than a perfectly trusting agent, since the former pays attention to state 3 (loss without compensation). The non-insurance threshold is $m_W^0(\beta) = \frac{(1-\beta)(1-\omega(1-p))}{p}\frac{u'(w_0-l)}{E_{u'}^{\pi,\beta}(l(\alpha=0))}$
où $E_{u'}^{\pi,\beta}(l(\alpha = 0)) = (1-\beta)(1-\omega(1-p))u'(w_0 - L) + \beta u'(w_0 - L) + (1-\beta)\omega(1-p)u'(w_0)$ denotes the subjective expectation with marginal utility distrust of the lottery $l(\alpha = 0)$ (the expectation is subjective because the decision weights used to calculate the expectation are not necessarily equal to the probabilities and are weighted by the distrust parameter). Let us note that $m_W^0 < m_V^0$ if $E_{u'}^{\pi}(l(\alpha = 0)) < E_{u'}^{\pi,\beta}(l(\alpha = 0))$ that

is to say if $\beta > 0$. Finally, observation 3.3 does not give a precise expression for $m_W^1(\beta)$ because $TMS_W(1)$ is a function that depends on price (since the wealth of state 3 differs from that of the other two states). We note that $m_W^1 < m_V^1$ if $\frac{1}{p}\frac{TMS_W(1)}{1+TMS_W(1)} < \frac{1}{p}\frac{TMS_V(1)}{1+TMS_V(1)}$, that is to say if $TMS_W(1) < TMS_V(1)$, inequality verified when $\beta > 0$.

Proof of the corollary 3.1

The full insurance threshold $\underline{\beta}$ defines a set of values for the parameter β that implies full insurance behavior. : $\forall\beta \leq \underline{\beta}, \alpha_W^*(\beta) = 1$. By definition, the threshold $\underline{\beta}(m)$ is zero when $m \geq m_V^1$ and positive when $m < m_V^1$. To determine $\underline{\beta}(m)$, we start from the equation $\frac{\partial W(l(\alpha))}{\partial\alpha}|_{\alpha=1} = 0$ and isolate the parameter β. It follows that

$$\underline{\beta}(m) = \quad \frac{1 - mp - \omega(1-p)}{1 - mp - \omega(1-p) + mp * g(1)} \tag{24}$$

$$\text{with} \qquad g(1) = \frac{u'(w_0 - L - mpL)}{u'(w_0 - mpL)} \text{ which is always less than one.}$$

The non-insurance threshold $\bar{\beta}$ defines a set of values for the parameter β that implies non-insurance behavior: $\forall\beta \geq \bar{\beta}, \alpha_W^*(\beta) = 0$. By definition, the threshold $\bar{\beta}(m)$ is zero when $m \geq m_V^0$ and positive when $m < m_V^0$. To determine $\bar{\beta}$, we start from the equation : $\frac{\partial W(l(\alpha))}{\partial\alpha}|_{\alpha=0} = 0$ and let's isolate the parameter β. It follows that

$$\bar{\beta} = \frac{\frac{1-mp}{mp}\frac{1-\omega(1-p)}{\omega(1-p)} * TMS_V(0) - 1}{\frac{1-\omega(1-p)(1-mp)}{\omega(1-p)mp} * TMS_V(0) - 1} \text{ which is always less than one.} \tag{25}$$

Lemma : If $v(x) = w \circ u(\alpha)(\alpha \in [0;1])$ where w is a strictly concave function, then

$$g_v(\alpha) = \frac{v'(w_0 - L - mpL\alpha)}{v'(w_0 - mpL\alpha)} = \frac{u'(w_0 - L - mpL\alpha)}{u'(w_0 - mpL\alpha)} * \frac{w' \circ u(w_0 - L - mpL\alpha)}{w' \circ u(w_0 - mpL\alpha)} > \frac{u'(w_0 - L - mpL\alpha)}{u'(w_0 - mpL\alpha)} = g_u(\alpha). \tag{26}$$

Since $u(w_0 - L - mpL\alpha) < u(w_0 - mpL\alpha)$ and as w is concave, we can deduce that $w' \circ u(w_0 - L - mpL\alpha) > w' \circ u(w_0 - mpL\alpha)$ and $g_v(\alpha) > g_u(\alpha)$.

$$\frac{\partial\underline{\beta}}{\partial g(1)} = -\frac{mp * [1 - mp - \omega(1-p)]}{([1 - mp - \omega(1-p)] + mp * g(1))^2} < 0$$

This expression is negative, implying that the threshold for full insurance decreases with the degree of concavity of the von Neumann utility.

$$\frac{\partial\underline{\beta}}{\partial\omega(1-p)} = -\frac{mp * g(1)}{(1 - mp - \omega(1-p) + mp * g(1))^2} < 0 \tag{27}$$

If pessimism increases, then $\underline{\beta}$ increases. This means that the range of degrees of distrust $[0;\underline{\beta}]$ compatible with full assurance is greater when the agent is pessimistic.

$$\frac{\partial\underline{\beta}}{\partial m} = -p\frac{v + u(g(1) - 1)}{(v)^2}(u = 1 - mp - \omega(1-p); v = 1 - mp - \omega(1-p) + mp * g(1)) < 0 \tag{28}$$

The full insurance threshold decreases with price m. This means that if a public decision-maker subsidizes the insurance contract, the full insurance threshold increases : more agents will be inclined to adopt the insurance product.

$$\frac{\partial\bar{\beta}}{\partial\omega(1-p)} = - \quad ((1-mp)g(0)+mp)\frac{[V]-[U]}{(V)^2} < 0 \tag{29}$$

with
$$U = \frac{(1-mp)}{mp} * TMS_V(0) - 1;$$
$$V = \frac{1-\omega(1-p)(1-mp)}{[1-\omega(1-p)]mp} * TMS_V(0) - 1$$

If pessimism increases, then $\bar{\beta}$ increases. This means that the set of degrees of distrust $[\bar{\beta}; 1]$ characterizing non-insurance behavior is smaller when the agent is pessimistic. Let us note that

$$\bar{\beta} = \frac{(1-\omega(1-p))(1-mp) * g(0) - mp\omega(1-p)}{[1-\omega(1-p))(1-pm)] * g(0) - mp\omega(1-p)} \tag{30}$$

$$\frac{\partial\bar{\beta}}{\partial g(0)} = \frac{(mp)^2\omega(1-p)}{([1-\omega(1-p)(1-mp)] * g(0) - mp\omega(1-p))^2} > 0 \tag{31}$$

When the degree of concavity of von Neumann utility increases, the threshold for non-insurance increases. It follows that a reduction in the degree of concavity of von Neumann utility decreases the amplitude of the interval. $[\underline{\beta}; \bar{\beta}]$.

$$\frac{\partial\bar{\beta}}{\partial m} = \frac{(\frac{-1}{pm^2}) * [1-\omega(1-p)]mp * TMS_V(0)[TMS_V(0) - mp]}{(\frac{1-\omega(1-p)(1-mp)}{[1-\omega(1-p)]mp} * TMS_V(0) - 1)^2} < 0 \tag{32}$$

The non-insurance threshold decreases with price m. This means that if a public decision-maker subsidizes the insurance contract, the non-insurance threshold increases : fewer agents will decide not to insure themselves.

Proof of observation 5.1

Hypothesis (i) allows us to precisely identify the proportions of insured and uninsured individuals based on the number of insured individuals. Assuming that within a given population, all agents are fully aware of the insurance product, we can deduce from observing non-insurance behavior that this is the result of a decision and not simply a lack of knowledge about the existence of such a product. Given that agents differ only in their degree of distrust (all agents are of type (u, ω)), all agents therefore have the same thresholds for non-insurance $\bar{\beta}(m)$ and full insurance $\underline{\beta}(m)$. Since $\beta \to \mathcal{N}(\mu, \sigma^2)$, the proportions $k_1(m)$ (proportion of fully insured agents) and $k_2(m)$ (proportion of uninsured agents) are defined as follows :

$$P(\beta \leq \underline{\beta}(m) = k_1(m) \Leftrightarrow P(\frac{\beta-\mu}{\sigma} \leq \frac{\mu - \underline{\beta}(m)}{\sigma}) = 1 - k_1(m) \tag{33}$$

$$P(\beta \geq \bar{\beta}(m) = k_2(m) \Leftrightarrow P(\frac{\beta - \mu}{\sigma} \leq \frac{\mu - \bar{\beta}(m)}{\sigma}) = 1 - k_2(m) \tag{34}$$

Consequently, $\mu = \underline{\beta}(m) + P^{-1}(1 - k_1(m))\sigma = \bar{\beta}(m) + P^{-1}(k_2(m))\sigma$ avec $h(m) = P^{-1}(1 - k_1(m)) - P^{-1}(k_2(m)) \neq 0$ car $k_1(m) + k_2(m) < 1$. we can deduce that :

$$\mu = \frac{P^{-1}(1 - k_1(m))}{h(m)}\bar{\beta}(m) - \frac{P^{-1}(k_2(m))}{h(m)}\underline{\beta}(m) \tag{35}$$

$$\sigma = \frac{\beta(\bar{m}) - \underline{\beta}(m)}{P^{-1}(1 - k_1(m)) - P^{-1}(k_2(m))} = \frac{\beta(\bar{m}) - \underline{\beta}(m)}{h(m)} \tag{36}$$

Let us note that we have assumed that $1 - k_1(m) \neq k_2(m)$. This inequality implies the presence of agents on the market who are partially insured. If $1 - k_1(m) = k_2(m)$, then $\bar{\beta}(m) = \underline{\beta}(m)$ and all agents adopt an "all-or-nothing" behavior. As a result, the dispersion of the parameter β can no longer be estimated by our method because, regardless of the dispersion, 50% of farmers will take out full insurance and 50% of farmers will not insure themselves, according to the assumption that β follows a normal distribution. Furthermore, our procedure for estimating the parameters μ and σ does not depend on the price m^* observed on the market. Indeed, consider any observation $m^* \in]0; \frac{1}{p}[$:

$$\begin{aligned}
\frac{P^{-1}(1-k_1(m)^*)}{h(m^*)}\bar{\beta}(m^*) - \quad \frac{P^{-1}(k_2(m^*))}{h(m^*)}\underline{\beta}(m^*) &= \frac{\frac{\mu - \underline{\beta}(m^*)}{\sigma}}{\frac{\mu - \underline{\beta}(m^*)}{\sigma} - \frac{\mu - \bar{\beta}(m^*)}{\sigma}} * \bar{\beta}(m^*) - \frac{\frac{\mu - \bar{\beta}(m^*)}{\sigma}}{\frac{\mu - \underline{\beta}(m^*)}{\sigma} - \frac{\mu - \bar{\beta}(m^*)}{\sigma}} * \underline{\beta}(m^*) \\
&= \frac{\mu - \underline{\beta}(m^*)}{\bar{\beta}(m^*) - \underline{\beta}(m^*)} * \bar{\beta}(m^*) - \frac{\mu - \bar{\beta}(m^*)}{\bar{\beta}(m^*) - \underline{\beta}(m^*)} * \underline{\beta}(m^*) \\
&= \frac{\bar{\beta}(m^*)\mu - \bar{\beta}(m^*)\underline{\beta}(m^*) - \underline{\beta}(m^*)\mu + \bar{\beta}(m^*)\underline{\beta}(m^*)}{\bar{\beta}(m^*) - \underline{\beta}(m^*)} = \mu
\end{aligned} \tag{37}$$

likewise,

$$\frac{\bar{\beta}(m^*) - \underline{\beta}(m^*)}{h(m^*)} = \frac{\bar{\beta}(m^*) - \underline{\beta}(m^*)}{\frac{\mu - \underline{\beta}(m^*)}{\sigma} - \frac{\mu - \bar{\beta}(m^*)}{\sigma}} = \frac{\bar{\beta}(m^*) - \underline{\beta}(m^*)}{\mu - \underline{\beta}(m^*) - \mu + \bar{\beta}(m^*)}\sigma = \sigma \tag{38}$$

Table 2: Effect of pessimism and risk aversion on distrust[24] $\alpha = 0$ **and** $\alpha = 1$

[24] The value $\theta = 0.8$ is taken from the paper by Takahashi et al. (2007) and the value $\theta = 0.65$ is taken from the paper by Prelec (1998).

Subsidy	$\alpha = 0$	$\alpha = 1$	$\alpha = 0; \gamma = 1.29$	$\alpha = 0; \mu = 0.65$	$\alpha = 1; \gamma = 1.29$	$\alpha = 1; \mu = 0.65$
10%	0.2839905	0.1500817	0.3067853	0.4802421	0.1415651	0.3771089
20%	0.3545435	0.2299185	0.3731257	0.5335408	0.2180615	0.4386005
30%	0.4650336	0.3129592	0.4418071	0.5878768	0.2985138	0.5018607
40%	0.5018124	0.3993747	0.5129556	0.6432806	0.3832035	0.5669537
50%	0.5787103	0.4893477	0.5867066	0.6997839	0.4724391	0.6339465
60%	0.6579145	0.5830749	0.6632056	0.7574199	0.5665601	0.7029095
70%	0.7395301	0.6807674	0.742609	0.816223	0.6659406	0.7739166
80%	0.8236691	0.7826524	0.8250855	0.8762289	0.7709938	0.8470456
90%	0.9104502	0.8889751	0.910817	0.937475	0.8821775	0.9223781

In this table, we have varied the values relative to the values $\gamma = 0.99$ and $\mu = 0.8$ in columns 1 and 2.

As can be seen, in line with the comparative statics and the graphical analysis, the thresholds for full insurance and no insurance increase with the degree of pessimism. In contrast, the no-insurance threshold rises with the level of risk aversion, whereas the full insurance threshold decreases. It can also be observed that the impact of an increase in pessimism on the thresholds is more pronounced than the impact of a rise in risk aversion. These interpretations remain valid when the solution is interior, as shown in Tables 2, 3, and 4.

Table 3: Effect of pessimism and risk aversion on distrust when the solution is interior[25] $0 < \alpha < 1$

α	Sub=10%	Sub=20%	Sub=30%	Sub=40%	Sub=50%	Sub=60%	Sub=70%	Sub=80%	Sub=90%
10%	0.2701763	0.341729	0.415421	0.491348	0.5696116	0.6503197	0.7335867	0.8195346	0.908293
20%	0.2564573	0.3289936	0.4037845	0.4809332	0.5605494	0.6427498	0.7276584	0.8154075	0.9061379
30%	0.2428332	0.3163371	0.3922116	0.4705677	0.5515235	0.6352047	0.7217452	0.8112878	0.903985
40%	0.2293034	0.303759	0.380702	0.4602514	0.5425338	0.6276843	0.7158468	0.8071753	0.9018344
50%	0.2158675	0.291259	0.3692555	0.4499841	0.5335802	0.6201885	0.7099634	0.8030702	0.8996858
60%	0.2025251	0.2788368	0.3578718	0.4397655	0.5246624	0.6127171	0.7040948	0.7989723	0.8975395
70%	0.1892757	0.2664919	0.3465505	0.4295954	0.5157805	0.6052702	0.6982409	0.7948816	0.8953952
80%	0.176119	0.2542241	0.3352915	0.4194737	0.5069341	0.5978476	0.6924017	0.790798	0.8932531
90%	0.1630544	0.2420331	0.3240945	0.4094002	0.4981232	0.5904492	0.6865773	0.7867217	0.8911131

Table 4: Effect of increased risk aversion on distrust when the solution is interior $0 < \alpha < 1$ **et** $\gamma = 1.29$

[25] $\gamma = 0.99; \theta = 0.8$

α	Sub=10%	Sub=20%	Sub=30%	Sub=40%	Sub=50%	Sub=60%	Sub=70%	Sub=80%	Sub=90%
10%	0.289878	0.3573423	0.427301	0.4998931	0.5752683	0.6535877	0.7350249	0.8197678	0.9080195
20%	0.2730472	0.3416118	0.4128262	0.486843	0.5638266	0.6439545	0.7274189	0.8144275	0.9052062
30%	0.2562966	0.3259377	0.3983859	0.4738079	0.5523837	0.6343081	0.7197922	0.8090655	0.9023775
40%	0.2396298	0.3103234	0.3839833	0.4607908	0.5409421	0.6246502	0.7121464	0.8036827	0.8995338
50%	0.2230501	0.294772	0.3696212	0.4477941	0.529504	0.6149827	0.7044827	0.7982799	0.8966755
60%	0.2065607	0.2792867	0.3553025	0.4348205	0.5180716	0.6053073	0.6968025	0.7928579	0.893803
70%	0.1901647	0.2638703	0.3410299	0.4218724	0.5066469	0.5956258	0.689107	0.7874175	0.8909165
80%	0.173865	0.2485255	0.326806	0.408952	0.495232	0.5859397	0.6813974	0.7819595	0.8880166
90%	0.1576642	0.2332551	0.3126332	0.3960617	0.4838288	0.5762506	0.6736749	0.7764847	0.8851035

In this table, we examined the effect of an increase in risk aversion on coverage and subsidy levels when the solution is interior.

Table 5: Effect of increased pessimism on distrust when the solution is interior $0 < \alpha < 1$ **and** $\theta = 0.65$

α	Sub=10%	Sub=20%	Sub=30%	Sub=40%	Sub=50%	Sub=60%	Sub=70%	Sub=80%	Sub=90%
10%	0.469704	0.5238621	00.5791279	00.6355349	0.6931179	0.7519133	0.8119589	0.8732942	0.9359602
20%	0.4592161	0.5142248	0.570412	0.6278145	0.6864703	0.7464191	0.8077023	0.8703631	0.9344467
30%	0.4487784	0.5046286	0.561729	0.6201193	0.679841	0.7409373	0.8034532	0.8674357	0.9329342
40%	0.4383907	0.4950734	0.5530787	0.6124493	0.6732301	0.7354679	0.7992115	0.864512	0.9314229
50%	0.4280529	0.4855593	0.5444611	0.6048044	0.6666375	0.7300109	0.7949773	0.861592	0.9299127
60%	0.4177649	0.4760861	0.5358761	0.5971845	0.6600631	0.7245661	0.7907505	0.8586755	0.9284036
70%	0.4075266	0.4666537	0.5273236	0.5895895	0.6535068	0.7191337	0.786531	0.8557627	0.9268956
80%	0.3973379	0.457262	0.5188036	0.5820194	0.6469686	0.7137134	0.7823189	0.8528534	0.9253887
90%	0.3871987	0.447911	0.510316	0.5744742	0.6404486	0.7083054	0.7781141	0.8499477	0.9238829

In this table, we examined the effect of an increase in pessimism on coverage and subsidy levels when the solution is interior.

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