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Richard Koenig

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# Crop insurance: from perception and adoption issues to adaptation challenges

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## THÈSE

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Par **RICHARD KOENIG**

Sous la direction de **MARIELLE BRUNETTE**

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### Membres du jury

Directrice de thèse : MME. MARIELLE BRUNETTE Directrice de recherche INRAE, BETA

Président de jury : M. GEOFFROY ENJOLRAS Professeur des universités, IAE  
Université Grenoble Alpes, CERAG

Rapporteurs : M. ALEXANDRE GOHIN Directeur de recherche INRAE,  
SMART

MME. ANNE ROZAN Professeure, ENGEES, GEST

Examinatrice : MME. MARIANNE LEFEBVRE Maitresse de conférences, Université  
d'Angers, GRANEM



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# CROP INSURANCE: FROM PERCEPTION AND ADOPTION ISSUES TO ADAPTATION CHALLENGES

Weather hazards are a major concern for farmers. They come in many forms and threaten crops throughout the growing season. Like the other risks to which farmers are exposed, weather hazards require the use of a range of risk management tools. Together, these tools form what is known as a risk management strategy. This strategy relies on mechanisms of prevention, risk transfer and catastrophe cover. Given the strategic nature of agricultural activity and the nature of the risk covered, the public authorities put in place various mechanisms to support and encourage the implementation of these instruments. There is an emerging trend towards increasing public support for risk transfer instruments and crop insurance in particular. By introducing subsidies for insurance premiums, public authorities are trying to encourage farmers to insure their crops as much as possible.

In France, despite major efforts (65% subsidy), the take-up of crop insurance remains particularly low (around 33% of agricultural area excluding grassland in 2020), with significant differences between crops. The aim of this thesis is to study the place of crop insurance in the risk management strategy of French farmers and to assess the place of this instrument in their strategy for adapting to climate change.

This thesis is divided into 4 chapters covering two areas of analysis. The first area looks at the evolution of the insurance offer, its various reforms, its legal framework and possible improvements based on other crop insurance schemes abroad. The second area, based on survey data, examines farmers' perceptions of insurance in order to identify both the determinants and the barriers to its adoption, and to profile farmers in terms of risk management strategy today and adaptation strategy tomorrow.

The first chapter traces the history of the French crop insurance scheme since the introduction of the agricultural disaster scheme and the first premium subsidies in 1964. Secondly, this chapter compares the French scheme with those in place in Italy and Spain. Finally, a review of the literature on the adoption of crop insurance is carried out in order to identify possible explanations for the low adoption rate of insurance in France.

The second chapter is based on part of the data from an online survey of French farmers carried out during the thesis. The aim of this chapter is to empirically test the elements identified in the first chapter. In particular, using behavioural economics methods, we show the differences in perception between insured and non-insured farmers and identify a number of determinants and barriers to the adoption of crop insurance. Specifically, we highlight differences in farmers' self-assessments of their exposure to meteorological hazards. We show that the occurrence of recent losses, the introduction of diversification, and perceptions of the characteristics of insurance contracts all have a significant influence on the process of deciding whether or not to take out crop insurance.

The third chapter is a policy paper which aims to measure the impact of the introduction of a support component for weather risk management instruments in the Common Agricultural Policy on national crop insurance schemes. We begin by tracing the introduction and development of the CAP framework for crop insurance subsidies and discuss the influence that these European guidelines may have had on the reforms implemented at national level. We show that, despite a common policy, strategies differ between Member States. While France has adopted the strategy of a single, simple subsidised contract for all, Spain and Italy have decided to gradually increase the number of subsidised offers in order to provide more specific contracts, the success of which varies notably between the two countries.

Finally, the fourth and final chapter looks at farmers' perception and expectations of climate

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change. Based on a part of the survey not used in the second chapter, we analyse in three parts the perception of climate change, the expected impacts in terms of variations in intensity and frequency of the main hazards, and the main adaptation strategies that farmers intend to implement. We show that farmers are particularly aware of climate change and that most already feel affected by it. Using correlation matrices, we show that farmers perceive an increase in certain hazards that are correlated with others, in particular one that is currently uninsurable: the risk of disease, pests and weeds. With regard to the main categories of adaptation strategies, we identify two main trends. On the one hand, farmers who consider themselves to be relatively less exposed to weather risks today, with specific constraints on the farm (label or employees), will adapt through on-farm strategies, in particular by changing their cropping practices. On the other hand, there are farmers who consider themselves to be relatively more exposed to weather risks and who want to decouple their income more from climatic variations in the future by adopting an adaptation strategy based on income diversification. In this context, crop insurance is struggling to find its place as an adaptation tool. In the light of the expectations expressed, we discuss the potentially interesting directions that the offer could take.

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# L'ASSURANCE RÉCOLTE : DE SA PERCEPTION ET DES PROBLÈMES D'ADOPTION AUX ENJEUX D'ADAPTATION

Les aléas climatiques sont une préoccupation majeure pour les agriculteurs. Ils se présentent sous de nombreuses formes et menacent les cultures tout au long de la phase de croissance. Au même titre que les autres risques auxquels les agriculteurs sont exposés, les aléas climatiques requièrent l'utilisation d'un ensemble d'instruments de gestion du risque. L'ensemble de ces instruments constitue ce que l'on appelle une stratégie de gestion des risques. Cette stratégie repose sur des mécanismes de prévention, de transfert des risques et de couverture catastrophique. Compte tenu du caractère stratégique de l'activité agricole et de la nature du risque couvert, les pouvoirs publics mettent en place différents mécanismes pour soutenir et encourager la mise en place de ces instruments. Une tendance se dessine en faveur d'un soutien public accru aux instruments de transfert de risques et en particulier, à l'assurance récolte. En instaurant des subventions pour les primes d'assurance, les autorités publiques tentent d'encourager les agriculteurs à assurer leurs récoltes autant que possible.

En France, malgré des efforts importants (65% de subvention), le recours à l'assurance récolte reste particulièrement faible (environ 33% de la surface agricole hors prairie en 2020), avec des différences importantes selon les cultures. L'objectif de cette thèse est d'étudier la place de l'assurance récolte dans la stratégie de gestion des risques des agriculteurs français et d'évaluer la place de cet instrument dans leur stratégie d'adaptation au changement climatique.

Cette thèse est divisée en 4 chapitres couvrant deux axes d'analyse. Le premier axe porte sur l'évolution de l'offre d'assurance, ses différentes réformes, son cadre juridique et ses améliorations possibles en s'inspirant d'autres régimes d'assurance récolte à l'étranger. Le second axe, basé sur des données d'enquête, examine la perception de l'assurance par les agriculteurs afin d'identifier à la fois les déterminants et les barrières à son adoption, et de dresser des profils d'agriculteurs selon leur stratégie de gestion des risques aujourd'hui et leur stratégie d'adaptation demain.

Le premier chapitre retrace l'histoire du régime français d'assurance récolte depuis la mise en place du régime des calamités agricoles et des premières subventions à la prime en 1964. Ce chapitre compare ensuite le régime français avec ceux mis en place en Italie et en Espagne. Enfin, une revue de la littérature sur l'adoption de l'assurance récolte complète l'analyse afin d'identifier les potentielles explications au faible taux d'adoption de l'assurance en France.

Le deuxième chapitre est basé sur une partie des données d'une enquête menée en ligne auprès d'agriculteurs français au cours de la thèse. L'objectif de ce chapitre est de tester empiriquement les éléments identifiés dans le premier chapitre. En particulier, en utilisant des méthodes issues de l'économie comportementale, nous montrons des différences de perception entre agriculteurs assurés et non assurés et identifions un certain nombre de déterminants et de barrières à l'adoption de l'assurance récolte. Nous mettons en évidence des différences dans l'auto-évaluation par les agriculteurs de leur exposition aux risques météorologiques. Nous montrons que l'occurrence de pertes récentes, leur niveau de diversification et la perception des caractéristiques des contrats d'assurance ont tous une influence significative sur le processus de décision de souscrire ou non une assurance récolte.

Le troisième chapitre est un *policy paper* qui vise à mesurer l'impact que l'introduction d'une composante de soutien aux instruments de gestion des risques météorologiques dans la Politique Agricole Commune a pu avoir sur les régimes nationaux d'assurance récolte. Nous commençons par retracer l'introduction et le développement du cadre de la PAC pour les subventions à l'assurance récolte et discutons de l'influence que ces orientations européennes ont pu avoir sur les réformes instaurées au niveau national. Nous montrons que, malgré l'influence d'une politique commune, les stratégies divergent entre États membres. Alors que la France a adopté la stratégie d'avoir un contrat subventionné unique et simple pour tous, l'Espagne et l'Italie ont

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décidé de diversifier progressivement les offres subventionnées afin de proposer des contrats plus spécifiques aux agriculteurs, dont l'efficacité varie considérablement entre les deux pays.

Enfin, le quatrième et dernier chapitre s'intéresse à la perception et aux anticipations des agriculteurs face au changement climatique. En s'appuyant sur une section de l'enquête non exploitée dans le deuxième chapitre, nous analysons en trois parties la perception du changement climatique, les impacts attendus en termes de variations d'intensité et de fréquence des principaux aléas, et les principales stratégies d'adaptation que les agriculteurs ont l'intention de mettre en place. Nous montrons que les agriculteurs sont particulièrement conscients du changement climatique et que la plupart d'entre eux se sentent déjà affectés par celui-ci. A l'aide de matrices de corrélation, nous montrons une corrélation des anticipations des agriculteurs entre certains aléas, en particulier pour un aléa qui n'est actuellement pas assurable : le risque de maladies, de ravageurs et d'adventices. En ce qui concerne les grandes catégories de stratégies d'adaptation, nous identifions deux tendances principales. D'une part, des agriculteurs qui se considèrent aujourd'hui relativement moins exposés aux risques météorologiques, avec des contraintes spécifiques sur l'exploitation (label ou salariés), qui s'adapteront par des stratégies sur l'exploitation, notamment en modifiant leurs pratiques culturales. D'autre part, des agriculteurs qui se considèrent relativement plus exposés aux risques météorologiques et qui souhaitent découpler davantage leurs revenus des variations climatiques à l'avenir en adoptant une stratégie d'adaptation basée sur la diversification des revenus. Dans ce contexte, l'assurance récolte peine à trouver sa place en tant qu'outil d'adaptation. A la lumière des anticipations exprimées, nous discutons des orientations potentiellement intéressantes que pourrait prendre l'offre.



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*À mon frère.*



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# PUBLICATIONS

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## Working Papers from this thesis

Koenig R., Brunette M. (2023). Climate change perception, impact and adaptation: Implications for crop insurance. WP BETA 2023-36. Online soon.

Koenig R., Brunette M. (2023). Subjective barriers and determinants to crop insurance Adoption. WP BETA 2023-25.  
<https://beta-economics.fr/working-papers/2023-25/>

## Other publications

Kouakou E., Brunette M., Delacote P., Koenig R. (2023). Crop Yield Risks and Nitrogen Fertilisation in French Agriculture: Implications for Crop Insurance. Miméo BETA.

Koenig R., Brunette M. (2023). Aléas météorologiques et assurance récolte : une histoire de partage du risque. *Regards Croisés sur l'économie*, 33.

Kouakou E., Brunette M., Delacote P., Koenig R. (2022). Les risques de rendements en agriculture française: une analyse du lien entre fertilisation azotée et assurance récolte. *Climat et Débats*, Chaire Économie du Climat.  
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# Introduction





## 0.1 Context

*“L’agriculteur n’ignore pas que cette fluctuation des rendements est dans l’ordre des choses..., il accepte un destin rendu souvent précaire par les caprices de la nature et les lois du marché. Mais il arrive cependant que les accidents naturels ont une gravité exceptionnelle et anéantissent parfois en quelques instants récolte, verger ou troupeau. En présence de ces risques qui ne peuvent plus être considérés comme “risques professionnels”, le paysan est désarmé et ne bénéficie pratiquement d’aucune protection. L’agriculture, en effet, est un des domaines où les risques ne trouvent pas leur contrepartie dans des profits réguliers et globalement intéressants. Les risques, en l’espèce, ne peuvent être calculés car ils sont, hélas ! imprévisibles. Contre l’eau, le gel, les glissements de terrain, l’inondation, la sécheresse, on ne lutte pas ; on ne peut que secourir les victimes”.*<sup>1</sup>

In these words, Mr Marcel Bousseau, Member of Parliament for the 2nd constituency of the Vendée from 1962 to 1973, quotes Mr Kléber Loustau author of an information report presented to the Production and Trade Commission. These words were spoken in the Chamber of the Assemblée Nationale (national assembly) on Thursday 16 April 1964 during discussions on the draft guarantee scheme against agricultural calamities ([Journal Officiel de la République Française, 1964](#)). This speech and the exchanges between Members of Parliament and government representatives mark the institutionalisation of public intervention to support farmers in the face of economic losses caused by meteorological hazards. Agriculture is a risky business, but as Mr Georges Juskiwenski emphasised during the same session, quoting Professor Jules Milhau, *“le risque est inhérent à toutes les formes de l’activité économique et, d’une façon générale, à toutes les formes de l’activité humaine ; mais c’est probablement la vie agricole qui réunit les risques les plus nombreux et graves”.*<sup>2</sup>

At the outcome of the discussions, the French agricultural disaster guarantee scheme was voted through and established by the Law of 10 July 1964 and the creation of the National Agricultural Disaster Guarantee Fund (FNGCA).

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<sup>1</sup>*“Farmers are well aware that this fluctuation in yields is the order of things... They accept a fate that is often made precarious by the caprices of nature and the laws of the market. However, natural accidents can be exceptionally serious, sometimes wiping out a crop, an orchard or a herd in a matter of moments. In the face of these risks, which can no longer be considered “occupational risks” , farmers are helpless and have virtually no protection. Farming is one of those fields where the risks are not offset by regular and generally attractive profits. In this case, the risks cannot be calculated because they are, alas, unpredictable. You can’t fight water, frost, landslides, floods or drought; you can only help the victims”.*

<sup>2</sup>*“risk is inherent in all forms of economic activity and, more generally, in all forms of human activity; but it is probably agricultural life that brings together the most numerous and serious risks”.*

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Feeding the population is, and will remain, an absolute political priority. A few years after the end of the World War II, this priority materialised in the establishment of the Common Agricultural Policy (CAP), whose missions were defined in the 1957 Treaty of Rome when the European Economic Community was set up: increase productivity, farmers' incomes, market stability and security of supply, and ensure reasonable prices for consumers (art. 39). The CAP came into force in 1962, with a productionist approach based on strong guaranteed prices and a protectionist policy. However, this policy is based on supporting and enhancing production, but what about farmers who are victims of meteorological events that wipe out their crops? The need for a concomitant national policy to at least "save" these farmers through minimal compensation contributed to the 1964 Law.

The FNGCA is the first public response to meteorological risks, a central concern in the production process of all farmers, which will be based on two pillars: a public fund for catastrophic events and an incentive to take out insurance.

However, the first evidence suggesting, in France, the application of insurance principles long known in other sectors (Boyer, 2008) comes from two anonymous letters signed by "*Des soucis d'un ami des champs*"<sup>3</sup> published in *Le Journal de Paris* respectively on 23 June 1785 and 18 September 1788 (Hamon, 1930). In the first one, this mysterious author says that the farmer "*trouve sa ruine sur la terre. Ce sont les grêles, les vents, les pluies, les sécheresses, les gelées, les inondations, qui en sont la cause, et, s'il était possible de soumettre au calcul les ravages dus à l'intempérie des saisons, on pourrait donner une théorie exacte à cette espèce d'assurance*"<sup>4</sup> and in the second one, he pointed out the existence of fire and life insurance companies and expressed his dissatisfaction by pointing out that "*les spéculateurs des villes n'ont pas songé à créer des compagnies d'assurance contre la grêle*"<sup>5</sup> (Hamon, 1930).

This farmer's expectations would begin to be partially met at the beginning of the 19<sup>th</sup> century, some twenty years later. The first insurance company was founded in Toulouse around 1800-1801. This company covered local farmers against losses caused by hail within a radius of "40 lieues" around Toulouse, i.e. around 160 kilometres. In the 4<sup>th</sup> year of existence of this offer, the company reported an average premium of 3% of the capital insured, which was considered insufficient insofar as the company reported a deficit in the ratio between indemnities paid and premiums received (precise rate not available), which, as we will see, seems to be a timeless

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<sup>3</sup>"Concerns from a friend in the fields".

<sup>4</sup>"finds its ruin on the land. Hail, wind, rain, drought, frost and floods are the causes, and if it were possible to calculate the ravages caused by the inclemency of the seasons, we could give an exact theory to this kind of insurance".

<sup>5</sup>"the speculators in the cities had not thought of creating hail insurance companies".

constant. Two pillars of crop insurance should be mentioned here. The first is mentioned in particular by Mr Barrau, director of this company, whose comments are reported in [Hamon \(1930\)](#): the expertise challenge. Since its earliest forms, crop insurance has been based on an expert's assessment of damage in the field (which is still the case in the majority of cases today). Today, commissioning an expert entails substantial costs (one of the main arguments put forward by the promoters of index insurance), but in 1800, it is easy to imagine that this constraint was even greater impacting insurance coverage and claims files.

The second issue, which is becoming more important by the day, is the question of the scale of pooling, which unfortunately was not mentioned in the director's speech. One of the fundamental principles of insurability is that the occurrence of risk is distributed independently between policyholders ([Berliner, 1985](#); [Miranda and Glauber, 1997](#)). In other words, a systemic risk cannot be insured. In this specific case, the company offers farmers in the same geographical area (due in particular to the constraints of expertise and contract administration) the opportunity to insure against the same meteorological hazard. The occurrence of a hailstorm is one of those events that easily impacts a large group of individuals, probably partly explaining the deficit observed in the company's accounts. However, of all the meteorological hazards, hail is perhaps one of the most localised. This principle seems to have been taken on board by this director, in that he said he found it *"impraticable la garantie des autres risques qui pouvaient endommager les récoltes tels que les gelées, les inondations, etc."*<sup>6</sup>

Hail insurance was born and developed in the 19<sup>th</sup> century. However, at the same time, farmers relied on a principle of local solidarity which, at the end of the same century, took the form of local agricultural credit unions (the starting point of the French Crédit Agricole group). Although, these local mutual aid funds were certainly subject to the same problem of synchronising losses.

Coverage of the other hazards, as intended by the anonymous author of the letters published in the *Journal de Paris*, will have to wait about 200 years more.

From this starting point, what are the development challenges for crop insurance? The article by [Ebersolt \(1930\)](#) gives an overview of farmers' expectations. On 7 August 1929, a devastating storm hit the Beaujolais region and in particular the sub-prefecture of Villefranche. Combining violent winds, heavy rain and hailstones, local people reported losing their entire crops in 5 to 10 minutes. A well-known French expression, taken from the 1871 novel by the

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<sup>6</sup>*"impracticable to cover other risks that could damage crops, such as frost, floods, etc"*.

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Comtesse de Ségur, reads “*Après la pluie, le beau temps*” (“After the rain, the good weather”). But for these farmers: after the rain, the record of losses. The cereals have been decimated and the number of hectolitres of wine that can be produced is derisory. Even more worrying than a year without a harvest is the damage to the vines, which could have an impact over the next two or three years. The losses are estimated at between 40 and 50 million francs at the time (i.e. between 25.3 and 31.6 million in 2022 euros according to the INSEE converter taking inflation and currency erosion into account). To support farmers in the face of these losses, the state and local authorities intervene indirectly by granting reductions in property tax and tax on the following year’s agricultural profits. Hail insurance was available for these farmers. However, as insurers were well aware of the climatic situation and the recurrence of this type of weather phenomenon, average premiums amounted to more than 10% of the insured production (Eber-solt, 1930). A more than significant amount which dissuades a large proportion of farmers from taking out insurance and leads to another consistent problem over time, the low take-up rate of insurance and a tendency towards adverse selection. Adverse selection implies an asymmetry of information between the farmer and the insurer, whereby the farmer knows that he is more at risk than the premium rate implies (Skees and Reed, 1986). Thus, such a low pool of policy-holders due to a high average premium is a pool composed more of “risky” farmers. A vicious cycle of over-indemnification resulting in a deficit for the insurer, leading to an overvaluation of premiums the following year, is likely to set in. The idea of compulsory insurance to counter this kind of phenomenon had already been put forward by Beaujolais farmers. But the most fervent opponents were farmers from other regions less prone to this type of phenomenon, who did not wish to pay for their neighbours’ losses. Thus, local opinion, supported by agricultural representatives, called for exceptional state intervention. At the time, there was a generic State budget, managed by the Ministry of the Interior. In 1930, it was endowed with 200 million francs to compensate capital (not specifically agricultural) destroyed by natural forces. Funds from this type of scheme are therefore easily called on for infrastructure or property losses, and more difficult for crops in the process of growing. Unfortunately, the amount released by the public authorities for these farmers is not available, but it must not have exceeded 3 or 4 million francs, at least that’s what the author anticipated when he wrote this article in 1930. The author concludes by mentioning that some farmers, encouraged by the rise of mutualist issues (no doubt referring to the emergence of workers’ and employees’ mutual benefit funds (Simon, 1987), whose successive reforms also institutionalised risk-sharing between employers, employees and the State (Bruna, 2022)), were pushing for the creation of a vast national disaster fund to intervene after this kind of devastating episode. In the author’s last words, he calls: “*Espérons*

*que ce ne sera pas simplement un voeu platonique de quelques agriculteurs prévoyants.”*<sup>7</sup>

Therefore, this wish was not simply a platonic one, but would really come to life only 34 years later through the agricultural disasters scheme and the FNGCA.

State intervention to support farmers in the face of meteorological events seems essential. Both to intervene in devastating events where no insurance would have the scope and capacity to pay compensation, and to make crop insurance affordable for everyone. This is why, from 1964 onwards, the FNGCA was tasked not only with compensating for agricultural disasters, but also with subsidising (on a sliding scale) hail insurance<sup>8</sup> premiums to help establish a functioning market. As the economic literature on crop insurance has developed and case studies have been carried out, a consensus has emerged around the fact that state intervention by providing a (particularly large) subsidy is a necessity in order to hope for the existence of a market (Coble and Barnett, 2013).

A high level of public intervention and a substantial subsidy rate are precisely what characterise the current French crop insurance scheme. Since 2005, the crop insurance offer in France has been characterised by a single subsidised offer: the multi-risk climatic crop contract (MRC). This contract offers cover for crop losses due to more than fifteen different meteorological hazards, regardless of crop or location. The contract, the specifications for which are defined each year by the government, entitles farmers to a 70% subsidy on the insurance premium (from 2023, previously 65%). However, despite major subsidy efforts and successive reforms, MRC insurance is struggling to spread. In 2020, the covering rate was just 32.8% of the French utilised agricultural area (excluding grassland), despite already being 22.4% in the first year of the policy in 2005. Furthermore, the MRC offer suffers from major disparities in distribution between crops. While 33.3% of field crops and 34% of vines are insured in the MRC, only 3.1% of the fruit-growing area is covered in 2020. The development stakes are important. This low distribution rate is associated with a structurally loss-making claims-to-premiums ratio (loss ratio) for insurers, with an average of 101% over the 2005-2020 period, while insurance continues to be the agricultural risk management tool most encouraged by the State. This observation is the starting point for this thesis. And the main question of this thesis is why do farmers take out so little insurance? To understand the current difficulties, we need to understand the historical development of the offer.

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<sup>7</sup>*“Let’s hope it’s not just a platonic wish from a few far-sighted farmers”.*

<sup>8</sup>Which was, at that time, still the only crop insurance policy available in France.

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Starting from this pivotal date in 1964, an analysis of the development of the crop insurance market requires us to look at public intervention, both in terms of covering catastrophic events and supporting the proposed insurance market, but also at insurers' proposals and, above all, farmers' expectations. The challenge behind how farmers are covered against weather-related economic losses is timeless but certainly growing. Weather hazards are set to increase as a result of climate change, even though farmers play a decisive role in sequestering emissions.

The stakes behind the cover can be distinguished on several levels. Firstly, there is the question of securing an income for the farmer and, above all, preventing the farm from going out of business or going bankrupt. Beyond the direct consequences for the farmer and his household, there is also the question of protecting all agricultural employees. To give an idea of the scale of the French agricultural landscape, we can use Agreste data from the 2020 agricultural census. In 2020, there were around 416,000 farms in France, with an average surface area of 65 hectares. These farms employed 814,000 people full time, including 523,000 people working as farmers and farm co-operators. Together, these farms produced the equivalent of €77 billion worth of agricultural output in 2019, making France Europe's leading agricultural power. Agriculture is a strategic sector for France, since, combined with the agri-food sector, it accounted for 3.4% of French GDP in 2019. Moreover, agriculture has a huge impact geographically and on rural dynamics: 52% of mainland France is farmland (45% of which is used for field crops). Maintaining rural landscapes, providing a large number of ecosystem services, sequestering carbon in agricultural soils, securing food supplies for towns and cities, maintaining biodiversity and much more - these are all crucial issues that French agriculture has to deal with, and they depend to a large extent on the fact that all these farmers are in operation. Securing these activities is therefore vital not only for them, but for the economy and society as a whole.

Estimating the losses actually suffered by French farmers as a result of the meteorological events is an almost impossible task. The hazards involved are so diverse in nature and location, and the failures to report and claim compensation so numerous, that it is necessary to use proxy indicators to get an idea of the situation. In 2020, for example, the FNGRA (*Fonds National de Gestion des Risques en Agriculture*, the successor to the FNGCA) spent €184.5 million on agricultural disasters. Well in excess of the annual budget available to this fund (between €85 and €90 million), the government had to (as it does almost every year) make an additional contribution of a particularly high amount this year, amounting to €150 million (Husson, 2021). This amount is hardly representative of the reality on the ground, firstly because this fund only intervenes (or rather was supposed to intervene) for crops considered to be uninsurable. In other words, 96% of French agricultural area (excluding grassland) was excluded from its

scope.<sup>9</sup> In addition, compensation was capped at 35% of losses, but was in fact 28% on average. If the €184.5 million paid out in compensation for events classified by decree as agricultural disasters in 2020 (such as storm Alex in the Alpes-Maritimes and a drought in the eastern Lyonnais region) represents only 28% of actual losses, a simple calculation would put losses for the farmers concerned at €659 million (representing not only crop losses but also losses of assets compensated by the fund). As mentioned above, the fund only intervenes for crops deemed uninsurable by interministerial decree<sup>10</sup>. To get an idea of the scope of intervention and the orders of magnitude of the crop insurance market, it is worth looking at the insurers' balance sheets. In the [Descrozaille \(2021\)](#) report, the appendix contains information on the cost of claims between 2016 and 2020 for Groupama, the main insurer in the French crop insurance market. The total amounts paid out by this insurer to its policyholders sometimes vary by as much as double from one year to the next. In 2016, €420 million in compensation was paid out (57% for excess water and 19% for hail losses). In 2017, the total amount was €190 million, 50% of which was due to frost. For 2020, the total is expected to exceed €300 million, with drought accounting for 55% of this amount. Over the period 2017-2019, the insurer deplors an overall loss ratio of 98% on average. A simple assessment of these few years, taking into account aggregated data for mainland France and all sectors combined, shows that there are major variations between years, and that the main devastating hazards also fluctuate.

The effectiveness and resilience of crop insurance in its current state seems to be questionable. Yet crop insurance is a tool that is promoted and supported by the majority of countries, and is also identified as an essential tool for adapting to climate change in both developed and developing countries ([Intergovernmental Panel on Climate Change, 2022](#)).

Moreover, climate change is certain to worsen weather conditions and therefore call into question the insurability of these weather hazards, or at least impact the cost of insurance. In mainland France, the simulations used by the World Bank indicate increases in temperature leading to more heat waves, episodes of intense rain and risks of flooding. In an agricultural context, these meteorological variations are all the more disruptive. In addition to the risk of seeing their crops destroyed by devastating episodes, farmers will have to cope with disrupted growth periods, altered exposure intervals to the risk of frost for vines or fruits, for example, and unprecedented constraints in terms of access to water.

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<sup>9</sup>The past tense indicates the disappearance of this fund with the 2023 reform.

<sup>10</sup>Arrêté du 17 septembre 2010 déterminant les conditions générales d'indemnisation des calamités agricoles et de prise en charge des frais afférents.

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## 0.2 Thesis: objectives and analytical framework

In this context, the aim of this thesis is to gain a better understanding of farmers' relationship with crop insurance and to assess the place of this instrument in their risk management strategy today and in the future. Over the course of the 4 chapters of this thesis, I will try to retrace the history of the development of this insurance tool, both from an institutional point of view, by looking at the various reforms and their impact, and from the subjective perception that different profiles of farmers may have. With this objective in mind, a two-pronged approach is being pursued, which I hope will complement each other.

The first concerns the institutional and legislative framework of the French crop insurance scheme. In France, crop insurance is particularly regulated and supervised by the State. Administering substantial subsidy rates and trying, as best it can, to establish a synergy between the various supports provided to farmers, the State is the main protagonist of market developments and in particular of supply design. In constant dialogue with insurers and other agricultural representatives, it defines what is subsidised and what is not, and above all, precisely defines the characteristics of contracts that qualify for subsidy. In order to lead to relevant discussions and in the hope of successfully carrying out future reforms, which are certainly necessary, we need to look at what other countries are doing in addition to the French case. A triptych analysis is used in the first and third chapters. A particular focus is placed on the crop insurance systems in place in Spain and Italy in order to draw analogies and differences with the French case on the strengths and weaknesses of each that can be mutually advantageous.

The second approach focuses on the adoption of crop insurance. Both to understand the relationship between farmers and crop insurance today, but also to ask whether farmers will take out more insurance in the future when the weather deteriorates further as a result of climate change.

In reality, the "why" farmers insure themselves so little implies a multitude of facets to be explored. In order to know where to start, the first chapter also proposes a review of the literature on the determinants of the adoption of crop insurance, leading to a list of hypotheses that the second chapter will test empirically. These many facets refer to mechanisms in action involving determinants and brakes linked to the characteristics of the contracts, the objective characteristics of the farm and the farmer, but also elements of the governance of the crop insurance scheme and elements of the perception of the needs and solutions proposed by the insurance, which are subjective to each farmer. These same factors come into play when we want to anticipate the role of crop insurance in farmers' strategies for adapting to climate change. However,



other parameters come into play, such as farmers' perception of climate change and its expected impacts, and this is what the fourth chapter proposes to investigate.

### **0.2.1 First chapter - Crop insurance in France: specific features of the scheme and potential determinants**

This first chapter establishes the analytical framework for the whole thesis. Its aim is to establish directions for research into the factors that explain the low take-up of crop insurance by French farmers. Starting with the introduction of the agricultural disaster scheme in 1964, we retrace the development of the French scheme, looking back at the successive reforms and the evolution of the contracts offered to farmers, and finally explaining precisely the state of supply today (the pre-reform scheme of 2023) and the problem of the low adoption of insurance. Then, we compare this insurance offer and the way in which the scheme is governed with the schemes in place in Spain and Italy. This first comparison allows us to look at a country where insurance is much more widespread and better established. The second offers the opportunity to identify certain similarities and differences with a country facing the same issues as France.

Secondly, we conduct a literature review on the obstacles and determinants of the adoption of crop insurance. Based on this set of articles and their theoretical or empirical results, we classify the identified impact of market, supply-side and demand-side characteristics on crop insurance. These two parts lead to a discussion of the elements that would be interesting to test with French farmers in order to understand their insurance behaviour more precisely and to identify certain gaps in the literature on the adoption of crop insurance, particularly with regard to the analysis of behavioural variables.

This chapter is the only one in this thesis written in French, since it is published in French in the journal *Economie Rurale* (Koenig et al., 2022).

### **0.2.2 The need to conduct a survey**

The conclusion of the first chapter leads to the need to test a diverse set of hypotheses on the parameters explaining the use or non-use of insurance by French farmers. These hypotheses require us to look at a range of farm characteristics that could have been tested using accounting databases such as the FADN<sup>11</sup> (Farm Accountancy Data Network). However, other hypotheses required the collection of information not present in the FADN or any other database to our knowledge.

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<sup>11</sup>Known as RICA in France (Réseau d'information comptable agricole).

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The aim was to look at a range of behavioural parameters affecting farmers. In addition to the classic indicators of decision-making found in the behavioural economics literature, such as risk aversion or present preference (Outreville, 2014), we wanted to obtain information on farmers' perceptions of the insurance contracts offered to them. In particular, we wanted to test the impact of different contract characteristics such as the level of the deductible, the trigger threshold, the methods used to calculate the insured production, etc. So the only option was to conduct a survey to gather our own data.

Reflection on the construction of this survey began during 2020. The first consideration was the format of the survey. From a purely scientific point of view, the online format seemed the most appropriate. It would make it possible to reach a larger number of farmers and therefore to have more data for our empirical analyses, while avoiding as far as possible any selection bias (concerning access channel or geographical location) and analysis bias (minimisation of oral information and open-ended responses). On a purely practical level, 2020 was a year particularly marked by professional constraints (widespread teleworking) and mobility constraints due to the Covid-19 pandemic and its two phases of lockdown in France.

The survey was built using LimeSurvey and comprises 57 questions divided into 7 groups.

The survey was launched at the beginning of 2021. The distribution of the survey was a particularly time-consuming challenge. As the aim was to question farmers about their insurance behaviour, it was necessary to have a sample that was as representative as possible and above all composed of both insured and non-insured farmers. In addition, in order to isolate any specific effects as far as possible, the survey was aimed at all farmers in mainland France, regardless of crop or location. So how could we reach as many farmers as possible? The distribution channel was therefore a key issue. The chambers of agriculture seemed to us to be the best suited to help us reach a representative population of farmers.

We first tried to distribute the survey through the Permanent Assembly of the Chambers of Agriculture (the headquarters of the Chambers of Agriculture), but without success. We had written a standard email containing the description and objective of the survey as well as the access link. The multitude of intermediaries between the headquarters and local farmers was an obstacle to spreading. We therefore contacted the 84 departmental and interdepartmental chambers in Metropolitan France directly. As a result of numerous telephone and e-mail exchanges, a number of chambers of agriculture have distributed our standard e-mail directly to their networks of farmers or by distributing the same message in their newsletters. RGPD rules required us not to have access to the list of e-mail addresses, and as we cannot be certain which chambers have or have not shared our survey, we are unable to know how many farmers have received this

survey in their mailbox. In order to encourage farmers to respond, within a framework of total anonymity of the respondents, we indicated in our email that for each fully completed survey we will make a donation of €2 to the “Petits Princes” Association, an association which makes the dreams of seriously ill children and teenagers come true. We collected 465 responses over the period February to October 2021, 288 of which were complete and usable for our analyses. The full questionnaire and a data paper presenting the survey and dataset are available in the appendix of this thesis.

### **0.2.3 Second chapter - Subjective barriers and determinants to crop insurance adoption**

The second chapter of this thesis analyses a part of the data from this survey in order to test the hypotheses set out at the end of the previous chapter.

The research question is simple: what are the main determinants and barriers to the adoption of crop insurance? However, the approach is original. Because of the nature of the data we collected, we were able to test certain determinants that are relatively standard in the literature (farm size, type of crop, age and level of education of the farmer, degree of risk aversion, etc.) but also elements that, to our knowledge, have never been studied. In particular, we look at the process of deciding whether or not to take out insurance from the point of view of the obstacles to adoption. In our analysis, these barriers are not determinants with a negative sign but elements intrinsic to the functioning of the market or to the characteristics of the contracts.

Using the different methodologies employed in the survey (questions, classification mechanisms, self-ranking, Likert scales, experimental tests) and thanks to a well-balanced sample between insured (49.31%) and non-insured (50.69%) farmers, we carried out a cross-sectional and a dynamic probit regression. As a complement to this econometric analysis, we analyse the results of the different classifications of barriers.

We highlight various effects and differences regarding barriers between adopters and nonadopters of crop insurance contract. While the uninsured point to the low probability they perceive of a claim, as well as problems of trust and administrative management of the contracts, the insured are highly critical of the intrinsic features of the contracts. However, both population agree that insurance is perceived as too expensive (even though insurers are structurally loss making in this policy). We also underline several effects such as a strong inertia dynamic for insured regarding insurance adoption; the occurrence of recent losses that strongly encourages the use of insurance and a misperception of the role of the subsidy as an increase of its level does not appear to be

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a substitute for a reduction in the level of the premium.

We group our results together by summarising the process of a farmer’s consideration of whether or not to adopt a crop insurance contract as a three-stage process. It starts with an initial phase of self-assessment of their risk and the likelihood of receiving compensation; followed by a second phase of evaluation of the quality of the coverage offered and a final phase concerning their perception of the cost of the insurance and their ability to pay for it.

#### **0.2.4 Third chapter - Reform trajectories of European crop insurance schemes: reflections from the French case**

This third chapter consists of a policy paper on the influence of the CAP guidelines on the reforms implemented at national level. In the context of this thesis, this chapter outlines my collaboration with Professor Fabio Gaetano SANTERAMO from the University of Foggia, who has published extensively in recent years on crop insurance in Italy. As mentioned in the first chapter, Italy also faces the problem of a very low take-up of crop insurance, with significant geographical disparities. Faced with a common problem, we agreed to work together and I spent 3 months visiting the Department of Agricultural Sciences at the University of Foggia from September to November 2021. In *EuroChoices* journal, [Santeramo and Ramsey \(2017\)](#) discuss some of the specific features of the American crop insurance model and concludes by opening up the idea of a European-scale insurance scheme. While this could potentially help to resolve the problem of the scale of pooling, the authors highlight the extent of the difficulties and barriers to such a move, stressing the importance of developing national markets beforehand. A few years later, we propose to revisit this question by asking whether the systems in place at national level might gradually be harmonised under the influence of a unified common agricultural policy. Focusing on the French case, we draw a parallel between national reforms and the emergence of a “risk management” component in the CAP. We then draw a parallel with the potential impact of the CAP in the same two case studies as in the first chapter: Spain and Italy. We show that, under the influence of the same supranational policy, trajectories between countries tend to diverge. Our case studies have progressively moved from public support for single-risk contracts to multi-risk contracts. However, current trends differ. In particular, there are two opposing strategies for developing the insurance market: a single, simple subsidised offer for all (France) versus a diversified, complex subsidised offer that can be better adapted to the various needs of farmers (Spain, Italy). We discuss these differences in respect of the significant changes made to the French system by the 2023 reform.

### **0.2.5 Fourth chapter - Climate change perception, impact and adaptation: implications for crop insurance**

This fourth chapter looks at whether or not crop insurance is considered by farmers as an adaptation tool. Generally speaking, in this chapter we study farmers' perceptions of climate change, the effects in terms of variations in the meteorological hazards they expect and the strategies they are implementing or intend to implement to cope with them. This chapter is also based on data from the survey. Using in particular a group of questions not exploited in the second chapter, we study farmers' perceptions of climate change in three stages.

Having shown the importance of weather risks in the overall risk to which farmers are exposed, we first look at farmers' perception or awareness of climate change. This first stage enables us to exclude from the rest of the analysis 8 farmers out of the 288 who do not believe in climate change and for whom the questions relating to expected effects and adaptation are not applicable. We constructed an initial index indicating the farmers' climate change perception. Secondly, we asked farmers about expected weather variations (increase, decrease, no change) in terms of both frequency and intensity for 6 hazards (drought, storms, floods, hail, frost and pests and diseases). These questions are used to construct a synthetic indicator of expected effects. We show, by means of correlation matrices, that certain risks are considered to be significantly correlated with the others (drought or pests and diseases) and others are not correlated (frost). Thirdly, through an econometric analysis, we study the determinants of the perception of climate change and the determinants of the adoption of 4 generic adaptation strategies (change of practices, crop diversification, increased use of insurance and income diversification). We highlight two distinct farmer profiles. On the one hand, there are farmers who feel relatively less exposed today to weather hazards, with a high degree of inertia on their farms (whether they have a label or are salaried), and who are more inclined to adapt their farming practices. On the other hand, there are farmers who feel relatively more exposed today who intend to decouple their income from the weather by adopting a strategy of diversifying their sources of income. In this context, insurance is struggling to find its place. We discuss the results in the light of possible future developments in crop insurance.

Figure 1 below summarises each of these chapters according to their respective research question, their method and some of the main results.

The appendix of this thesis consists of three documents:

- The survey questionnaire (in English) with the presentation cover page in its original

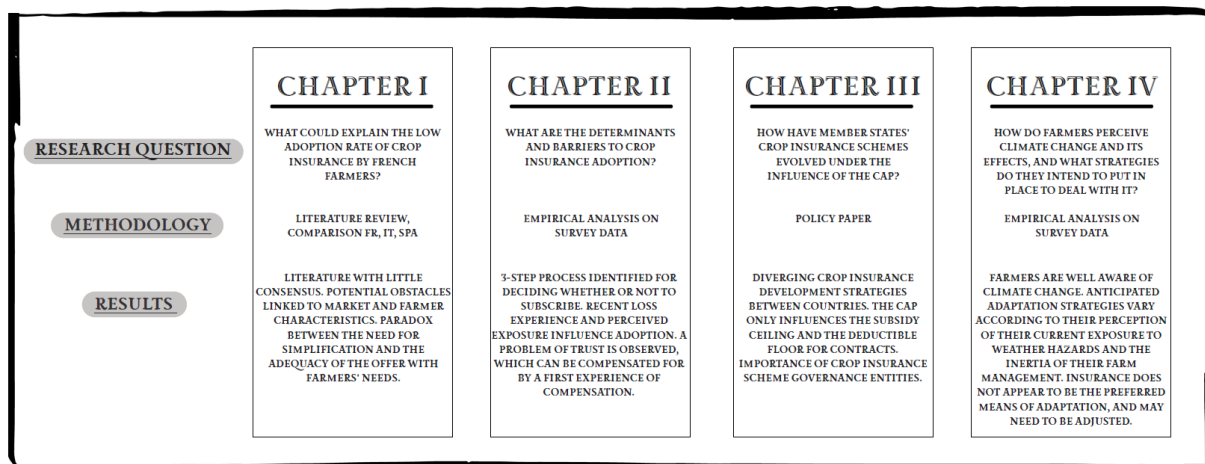


Figure 1: Summary plan of chapters

version (in French and its translation).

- A data paper presenting the data, which are now in open access.
- A popular article (in French) entitled “*Aléas météorologiques et assurance récolte : Une histoire de partage du risque*”<sup>12</sup> which will shortly be published in the journal *Regards Croisés sur l'économie*. This article looks at how risk has been “shared” between farmers, insurers and the state over time. We show that history can be divided into three distinct periods: 1/ The State encourages recourse essentially to the private insurance market; 2/ The State re-involved in agricultural risk cover; 3/ Establishment of a public-private partnership to cover these risks.

<sup>12</sup>“*Weather hazards and crop insurance: a history of risk sharing*”.

# Bibliography - Introduction

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# CHAPTER I

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Crop insurance in France: specific features of the scheme and potential determinants

ASSURANCE RÉCOLTE EN FRANCE : SPÉCIFICITÉ DU  
RÉGIME ET DÉTERMINANTS POTENTIELS -  
CROP INSURANCE IN FRANCE: SPECIFIC FEATURES OF  
THE SCHEME AND POTENTIAL DETERMINANTS

Richard KOENIG<sup>1</sup>, Marielle BRUNETTE<sup>2</sup>, Philippe DELACOTE<sup>3</sup>, Camille TEVENART<sup>4</sup>

### Résumé - Abstract

Le secteur agricole français est exposé à de nombreux risques météorologiques qui vont s'accroître sous l'effet du changement climatique. La gestion de ces risques est un enjeu essentiel de l'activité des agriculteurs. Parmi les instruments à leur disposition, l'assurance récolte permet de transférer à un assureur une part de ces risques. Une offre est disponible en France depuis 2005 pour la couverture de pertes économiques causées par une quinzaine d'aléas météorologiques différents. Or, malgré de fortes subventions publiques, cette assurance reste faiblement souscrite avec une couverture de seulement 30% de la surface agricole française. L'objectif de cet article est de mettre en évidence, au travers d'une revue de littérature et d'une comparaison du régime français avec ceux en place en Espagne et en Italie, des facteurs pouvant expliquer ce faible taux de souscription. Les auteurs proposent ainsi une classification de ces freins entre caractéristiques liées aux contrats, profils de l'exploitation et de son exploitant et concurrence avec d'autres instruments de gestion du risque et soulignent les points de divergence du modèle français avec ceux mis en place à l'étranger.

France's agricultural sector is exposed to many weather risks, which will increase because of climate change. Managing these risks is an essential part of farmers' activities. Among the instruments at their disposal, crop insurance enables them to transfer part of these risks to an insurer. A contract is available in France since 2005 to cover economic losses caused by more than fifteen different weather hazards. However, despite important governmental subsidies, this insurance remains poorly subscribed with only 30% of the French agricultural area covered. The objective of this article is to display, through a review of the literature and a comparison of the French regime with those of Spain and Italy, factors that may explain this low rate of diffusion. We thus propose a classification of these lock-ins between contract-related characteristics, farm and operator profiles and competition with other risk management instruments and underline the points of divergence of the French model with those implemented abroad.

**Keywords:** Assurance, agriculture, prévention, risque, aléas météorologiques – Insurance, agriculture, prevention, risk, weather hazards

**JEL Classification:** D81, G22, Q10, Q54

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<sup>1</sup>Université de Lorraine, Université de Strasbourg, AgroParisTech, CNRS, INRAE, BETA, France. Climate Economics Chair (CEC), Paris. richard.koenig@chaireeconomieclimat.org - Corresponding author

<sup>2</sup>Université de Lorraine, Université de Strasbourg, AgroParisTech, CNRS, INRAE, BETA, France. marielle.brunette@inrae.fr; Associate researcher at the Climate Economics Chair (CEC), Paris.

<sup>3</sup>Université de Lorraine, Université de Strasbourg, AgroParisTech, CNRS, INRAE, BETA, France. philippe.delacote@inrae.fr; Head of the Research Program Agriculture and Forestry at the Climate Economics Chair (CEC), Paris.

<sup>4</sup>Université de Lorraine, Université de Strasbourg, AgroParisTech, CNRS, INRAE, BETA, France. Climate Economics Chair (CEC), Paris. camille.tevenart@gmail.com

## 1.1 Introduction

L'agriculture est une activité exposée à de multiples risques de production et de marché. Ces risques sont aujourd'hui exacerbés par le changement climatique qui modifie les conditions de cultures et accroît la fréquence et l'intensité des aléas météorologiques. Dans ce contexte, la protection des exploitations agricoles devient un enjeu majeur ([Groupe d'Experts Intergouvernemental sur l'Évolution du Climat, 2021](#)). Cette gestion des risques mêle un ensemble de réglementations, dispositifs et acteurs formant un système complexe à appréhender et dans lequel l'agriculteur doit procéder à des arbitrages pour constituer la couverture la plus efficiente pour son exploitation. L'exploitant doit ainsi, en fonction de sa contrainte budgétaire, décider quels risques couvrir en particulier et avec quels instruments.

Certains de ces risques peuvent être couverts par le marché de l'assurance privée. Les contrats d'assurance couvrent les pertes de rendements dues à des aléas météorologiques, la mortalité des animaux ou le chiffre d'affaires en assurant le risque de production et le risque de marché. En France, depuis 2005, un contrat d'assurance multirisque climatique couvre les pertes de récoltes causées par de nombreux aléas météorologiques. Cependant, malgré des subventions publiques importantes, ce type de contrat ne couvre qu'environ 30% des surfaces agricoles françaises. Ce taux de diffusion, qui mesure la proportion des surfaces assurées, est très inférieur à l'objectif de 70% que la Fédération française de l'assurance (FFA) estime nécessaire pour l'efficacité et la pérennité du régime assurantiel ([Descrozaile, 2021](#)) et même inférieur aux moyennes mondiales de 2008 des pays développés : 47,6% (des pays avec subventions) et de 39,1% (des pays sans subvention) ([Mahul and Stutley, 2010](#)).

L'enjeu du développement de l'assurance récolte est en lien étroit avec celui du changement climatique. Les rapports du GIEC annoncent un accroissement de la fréquence et de l'intensité des aléas météorologiques. Bien que les effets identifiés du changement climatique sur l'agriculture soient encore soumis à débat dans la littérature ([Huang and Sim, 2018](#)), l'agriculture est amenée à être l'un des secteurs d'activités les plus impactés dans la mesure où les conditions météorologiques et climatiques sont parties intégrantes des facteurs de production ([Vaitkeviciute et al., 2019](#)). La COP23 a souligné l'importance de l'agriculture dans la lutte contre le changement climatique et a mis en place des groupes de travail sur les stratégies d'adaptation du secteur. Parmi les instruments préconisés, les mécanismes assurantiers sont particulièrement évoqués ([Drieux et al., 2019](#)).

Il semble donc primordial de comprendre les raisons du faible taux de souscription de

l'assurance récolte en France et d'identifier les points de blocage et leviers d'amélioration du régime. Dans cette optique, nous présentons le développement historique de l'offre assurantielle française. Nous comparons ensuite le cas français avec les régimes en place en Espagne et en Italie. Enfin, nous identifions, au sein de la littérature, les déterminants et freins à l'adoption de l'assurance récolte. Nous catégorisons ces freins entre les spécificités des contrats et de leur mise en place, les caractéristiques de l'exploitation et de son exploitant et le lien entretenu avec les autres instruments de gestion du risque.

## 1.2 L'assurance récolte en France

### 1.2.1 Evolution historique de l'offre assurantielle française

La loi du 10 juillet 1964 instaure le Fonds national de garantie des calamités agricoles (FNGCA) dont la mission consiste à indemniser les pertes causées par des événements météorologiques exceptionnels et non assurables et à soutenir financièrement le développement du marché de l'assurance récolte au travers de subventions à la prime. Afin d'être éligibles à l'indemnisation par le fonds, les pertes subies doivent être causées par des aléas qualifiés de « calamités agricoles » par arrêté ministériel et sur des cultures ne figurant pas dans la liste fixée par arrêté des cultures et événements assurables (arrêté du 29 décembre 2010 actuellement en vigueur). Le champ d'intervention du fonds se restreint à mesure que l'offre assurantielle se développe. Ainsi, reconnues comme assurables par le marché, les grandes cultures puis les vignes en sont exclues respectivement en 2009 et en 2011.

Sur la période 1980-2004, le fonds a versé en moyenne 160 millions d'euros par an correspondant à une indemnisation moyenne de 25% des pertes de l'exploitant (Boyer, 2008). La loi du 10 juillet 1964 instituant le FNGCA prévoit un soutien au développement de l'assurance récolte matérialisé par la subvention d'une partie des primes d'assurance des agriculteurs. L'article 5 de cette loi stipule un accompagnement pendant sept ans de l'agriculteur qui s'assure au travers d'une subvention dégressive avec un plafond de 50% du niveau de la prime la première année jusqu'à 10% pour la dernière.

Le fonds est approvisionné par une contribution des agriculteurs au travers d'un prélèvement de 5,5% (11% avant un abaissement en 2016) sur les primes d'assurance payées pour les bâtiments, cheptel ou responsabilité civile. Une subvention de l'État vient compléter les besoins du fonds (respectivement des contributions de 60 et 75 millions d'euros en 2018 [senat.fr]).

Différents rapports d'évaluation ([Babusiaux, 2000](#); [Ménard, 2004](#); [Mortemousque, 2007](#)) ont mené à la réforme de ce fonds, via la loi de modernisation de l'agriculture et de la pêche de 2010. Rebaptisé Fonds national de gestion des risques agricoles (FNGRA), il vise toujours à indemniser les calamités agricoles, subventionner les primes d'assurance récolte mais, dorénavant, aussi à indemniser les pertes économiques liées à un incident environnemental ou sanitaire (au travers d'une prise en charge partielle des indemnisations réalisées par le Fonds de mutualisation sanitaire et environnemental [FMSE]).

Disponible depuis le XVIIIe siècle et complétée d'une garantie optionnelle tempête à partir de 1985, l'assurance grêle était la seule assurance récolte disponible sur le marché français. Elle était par ailleurs soutenue au travers d'aides incitatives à la souscription ([Mortemousque, 2007](#)). La couverture contre le gel s'est progressivement développée pour devenir également une garantie additionnelle aux contrats grêle ([Babusiaux, 2000](#)). À l'approche de l'an 2000, les pouvoirs publics français ont entamé une phase de réflexion sur le système d'assurance récolte en place ([Babusiaux, 2000](#); [Ménard, 2004](#)), conduisant à une nouvelle offre d'assurance récolte à partir de 2005. Appelée assurance « multirisque climatique sur récoltes », cette offre est soutenue publiquement par une subvention couvrant 35% du coût de l'assurance pour les grandes cultures ; rehaussée en 2010 à 65%, grâce à une réforme permettant aux États membres de l'UE de prélever jusqu'à 10% de leur enveloppe du premier pilier de la PAC pour soutenir davantage les agriculteurs dans leur couverture assurantielle ([Chatellier and Guyomard, 2011](#)).

Le système d'assurance récolte français est aujourd'hui régi par la mesure 17 du Programme national de gestion des risques et d'assistance technique (PNGRAT). Sur un budget de fonctionnement de 600,75 millions d'euros pour la période 2015-2020, auquel s'est ajouté un complément de 74,5 millions en 2018 pour compléter les besoins de financement (prélevé sur les aides du 1er pilier), 96% sont alloués à l'aide à l'assurance récolte (subventions prenant en charge sous conditions jusqu'à 65% de la prime) et 4% sont consacrés au FMSE. À ce jour, deux formes de contrats se distinguent pour la couverture des risques météorologiques : les contrats d'assurance récolte, indemnisant des pertes de cultures, et les contrats d'assurance chiffre d'affaires, encore peu développés en France, qui proposent de couvrir à la fois le risque de production et de marché.

Le terme « assurance récolte » recouvre en réalité une multitude d'assurances différentes. Leur point commun est de couvrir les pertes économiques causées par des dommages sur récoltes. Un contrat d'assurance récolte stipule tout d'abord les aléas météorologiques qu'il couvre. Il précise ensuite la culture et le rendement de l'agriculteur assuré en se basant, par exemple, sur l'historique d'exploitation. De nombreux contrats requièrent ainsi le calcul de la moyenne «

olympique » des rendements, c'est-à-dire la moyenne des cinq dernières années en excluant la valeur la plus haute et la plus basse. Deux paramètres clés sont également définis : le seuil de déclenchement et la franchise. Le seuil de déclenchement est le niveau de pertes qui déclenche un droit à l'indemnisation. C'est un pourcentage de pertes estimées du rendement assuré. Le niveau de franchise définit la part des pertes non indemnisées par l'assureur et restant donc à la charge de l'assuré. Cette franchise est généralement égale au seuil de déclenchement, elle peut en être inférieure mais pas supérieure. Enfin, le prix garanti pour chaque culture doit être établi. Pour le fixer, différentes modalités existent : prendre le prix de la campagne précédente, la moyenne des deux dernières années ou encore la moyenne olympique sur les cinq dernières campagnes ([Ministère de l'Agriculture et de l'Alimentation \(MAA\), 2020](#)). Une fois ces paramètres identifiés, l'assureur propose généralement des options et des garanties complémentaires à l'assuré telles qu'une réduction du niveau de franchise ou du seuil de déclenchement, une hausse du prix garanti ou un rendement assuré supérieur à la moyenne olympique.

Le « cahier des charges applicable aux entreprises d'assurance pour la prise en charge partielle de prime et cotisations d'assurance récolte » est un document publié chaque année par le ministère de l'Agriculture et de l'Alimentation et celui de l'Économie et des Finances. Il indique les conditions d'éligibilité des contrats à l'aide publique et une liste des entreprises s'étant engagées à respecter le cahier des charges au moins une fois sur les années précédentes. Ainsi, pour la campagne 2021, 20 entreprises sont répertoriées. Près de la moitié d'entre elles fait partie du groupe Groupama faisant de ce dernier le leader avec 65% des parts de marché.

### 1.2.2 L'assurance multirisque climatique

L'offre d'assurance multirisque climatique (MRC), disponible et en développement depuis 2005, est un ensemble de contrats de couverture des pertes de récoltes du fait d'aléas météorologiques proposé par les assureurs privés et soumis à un cahier des charges régissant les conditions d'accès aux subventions. Cette offre, disponible à la souscription pour la grande majorité des cultures, couvre les pertes causées par une quinzaine d'aléas : gel, sécheresse, grêle, inondation... L'ensemble des aléas assurables est fixé et redéfini par arrêté interministériel. Le cahier des charges, dressé et actualisé chaque année par le ministère de l'Agriculture et de l'Alimentation, encadre les risques couverts, le design des contrats et les conditions d'accès aux subventions. Cette offre MRC se décline depuis 2014 sous deux types de contrats (Fig. 1.1) : les contrats « par groupe de culture » et « à l'exploitation », et sous trois niveaux de garanties.

Les contrats par groupe de culture, très majoritairement souscrits, requièrent, pour prétendre

à une subvention, d'assurer 100% des surfaces d'une même culture avec au minimum 70% des surfaces en grandes cultures et 100% de celles en arboriculture et viticulture. Les contrats à l'exploitation requièrent qu'au minimum 80% des surfaces de l'ensemble des cultures de vente de l'exploitation soient assurées. Ce type de contrats est très peu souscrit. En 2019, seuls 3% des contrats MRC étaient de ce type (Descrozaille, 2021). Les trois niveaux de garanties se déclinent en un contrat socle subventionné et deux niveaux de garanties optionnelles.

	1 <sup>er</sup> niveau de subvention à 65%	2 <sup>d</sup> niveau de subvention à 45%	Sans subvention
	Contrat socle	Garanties complémentaires (optionnelles)	Garanties supplémentaires (optionnelles)
Contrat par groupe de cultures	Franchise à 30 %	Franchise à 25 %	- Rachat de franchise et de seuil
Contrat à l'exploitation	Franchise 20 %		- Complément de rendement
	- Seuil 30 % - Rendement historique - Prix maximum de niveau 1	- Complément de prix - Pertes de qualité	- Frais de resemis et frais supplémentaires

Source : Les auteurs

Figure 1.1: Niveaux de garanties du contrat d'assurance MRC.

L'agriculteur part toujours d'un contrat socle subventionné à 65% tandis que le supplément de prime relatif aux garanties complémentaires est subventionné à 45% (si elles sont éligibles).

Les assureurs ont présenté dès 2005 aux agriculteurs ce type de contrat comme une extension de leur contrat grêle historique. Ainsi, dès la première année, plus de 57 000 polices ont été souscrites. Cependant, l'offre MRC s'est peu diffusée depuis, passant de 22,37% des surfaces agricoles assurées en 2005 à 29,8% en 2018 (hors prairies) (Mortemousque, 2007; Boucher et al., 2019). Ce taux de diffusion cache d'importantes disparités. Alors qu'en grandes cultures le taux fluctue autour de 30%, il stagne autour de 2,5% pour l'arboriculture. Seul le taux de souscription en viticulture marque un véritable décollage, passant de 10% à près de 30% de surfaces assurées en MRC aujourd'hui.

Conjointement à ce faible taux d'adoption se pose le problème de la pérennité de l'offre MRC. Une offre d'assurance pérenne implique un équilibre dans le rapport entre les indemnités versées et les cotisations perçues par les assureurs. Ce ratio est appelé rapport sinistres à primes (S/P). L'équilibre-technique de ce rapport est généralement fixé entre 63% et 75%, impliquant qu'environ un quart des cotisations sont destinées à financer les frais de gestion et de réassurance (Mahul, 1998; Boucher et al., 2019). Sur le marché de l'assurance MRC, cet équilibre n'a été atteint que pour les années 2008 et 2014 (Fédération Française des Sociétés d'Assurances (FFSA), 2015) et affiche une valeur moyenne de 105% entre 2008 et 2018 (Boucher et al., 2019), traduisant

une situation structurellement déficitaire de cette branche sur le marché de l'assurance.

Pour soutenir davantage l'offre MRC, la Commission, le Conseil et le Parlement européen ont adopté, le 12 octobre 2017, de nouvelles orientations dans le cadre de la PAC. Appelées « règlement Omnibus », elles ont notamment pour objectif de renforcer et simplifier les outils de gestion des risques en agriculture. Ainsi, les instances européennes se sont accordées sur l'abaissement du seuil de déclenchement du contrat socle de l'assurance MRC à 20% et une hausse du plafond des subventions à 70%. Ce nouveau règlement aurait dû entrer en vigueur dès janvier 2018. Bien qu'allant dans le sens des réclamations du principal syndicat agricole français et ayant même fait l'objet d'une résolution du Sénat adoptée le 24 juin 2020 « visant à encourager le développement de l'assurance récolte », l'application de ce règlement semble être repoussée d'année en année. Le Gouvernement a en effet décidé de maintenir le taux de subvention à 65% et le seuil de déclenchement à 30% pour, au moins, les campagnes 2020 et 2021<sup>5</sup>.

L'application de ce règlement entraînera un surplus de participation publique et sera accompagnée d'une importante réforme au travers d'une loi qui devrait être discutée au Parlement au premier trimestre de l'année 2022 pour une application en 2023<sup>6</sup>.

### 1.3 Les systèmes en place en Espagne et en Italie

L'assurance récolte varie fortement d'un pays à l'autre. Nous présentons les régimes en place en Espagne et en Italie<sup>7</sup>. Notre intérêt s'est porté sur l'étude de ces deux pays car bien que parties prenantes de la même PAC, nos trois pays sont dans des situations différentes. L'Espagne semble avoir instauré l'un des régimes les plus efficaces en Europe et l'Italie connaît une situation analogue à la France tout en proposant une offre de contrats différente.

#### 1.3.1 Un régime efficace en Espagne

En place depuis 1978, le système d'assurance récolte espagnol est fondé sur un partenariat public-privé. L'État encourage le regroupement d'agriculteurs dans des « entités mutuelles »

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<sup>5</sup>Pas d'augmentation du taux de subvention ». Article sur *lafranceagricole.fr* du 26 juin 2020.

<sup>6</sup>Annonces du président Emmanuel Macron devant les principaux syndicats à la 7e édition des rencontres « Terres de Jim » le 10 septembre 2021 : [https://www.francetvinfo.fr/economie/emploi/metiers/agriculture/agriculture-emmanuel-macron-annonce-un-nouveau-systeme-d-assurance-recolte-dote-de-600-millions-d-eurospar-an\\_4767099.html](https://www.francetvinfo.fr/economie/emploi/metiers/agriculture/agriculture-emmanuel-macron-annonce-un-nouveau-systeme-d-assurance-recolte-dote-de-600-millions-d-eurospar-an_4767099.html).

<sup>7</sup>Pour une comparaison internationale, lire Mahul and Stutley (2010). Pour un aperçu des régimes en place dans le reste de l'Europe, lire Bielza Diaz-Caneja et al. (2009).



([Direction de l'Initiative Parlementaire et des Législations \(DIPL\), 2016](#)). Ces regroupements permettent la souscription de contrats collectifs, donnant droit à une subvention majorée de 5% et à des services d'aide aux démarches administratives.

Deux entités sont au coeur du système : l'*Entidad Estatal de Seguros Agrarios* (ENESA) et Agroseguro. Alors que le premier a une forme d'équivalent en France avec le PNGRAT, le second est spécifique à l'Espagne. *Agroseguro* est une société privée regroupant toutes les entreprises espagnoles proposant des contrats d'assurance récolte afin de former un groupe de coassurance. L'objectif est de mettre en commun le pool d'assurés, d'administrer les contrats et de gérer une grande base de données nationale. La constitution de ce groupe permet une meilleure mutualisation, offre une connaissance approfondie de la distribution et de l'historique des aléas sur les exploitations agricoles espagnoles permettant d'optimiser les contrats et de lutter contre les asymétries d'information et permet d'atteindre des frais administratifs très bas (environ 3,5% de la prime totale). De plus, le groupe est réassuré par un consortium public. *Agroseguro* administre les contrats du paiement de la prime au traitement et versement des indemnisations. Les prix sont fixés pour chaque police d'assurance, les entreprises se font donc uniquement concurrence sur les modalités de commercialisation et de service client. Les agriculteurs payent directement au groupe leurs cotisations assurantielles minorées du taux de subvention. *Agroseguro* assume le décalage entre le paiement de la prime et la réception de la subvention. Ainsi, au moment de la souscription, les agriculteurs payent en moyenne seulement 41% du montant total de la prime. Bien que certaines compagnies d'assurances françaises proposent ce service, le système français fait, qu'en général, l'agriculteur doit s'acquitter de l'ensemble de la prime, faire une demande de subvention avant fin novembre pour ne percevoir la subvention qu'au printemps suivant. Par ailleurs, la législation espagnole contraint les assureurs à verser les indemnisations dans les 60 jours suivant la date prévue de récolte. Dans les faits, le délai appliqué est même en moyenne plus court ([Antón and Kimura, 2011](#)).

Le système assurantiel espagnol affiche des taux de souscription supérieurs aux taux français : 78% des surfaces en cultures fruitières sont assurées, 46% pour les surfaces légumières, 39% en viticulture et plus de 75% des surfaces de céréales d'hiver contre respectivement des taux de 3%, 14%, 26,% et 29,8% en France en 2019 ([Descrozaillie, 2021](#)). Le marché semble sur une bonne dynamique : le capital assuré est en croissance constante passant d'environ 2 milliards d'euros en 1991 à plus de 15 milliards en 2020 pour une surface agricole assurée de près de 7,8 millions d'hectares et 416 000 polices d'assurance souscrites ([Ministerio de Agricultura, Pesca y Alimentacion \(MAPA\), 2021](#)). De plus, le rapport S/P s'améliore, alors qu'il était supérieur à 100% entre 1980 et 1990, il est régulièrement autour de 80% depuis les années 2000.

Enfin, à l’instar du régime de calamités agricoles français, l’ENESA procède à des paiements *ad hoc* en cas d’aléas extraordinaires. Ces aides sont cependant conditionnées à une souscription, au préalable, d’une police d’assurance.

Dans la littérature, peu de travaux s’intéressent spécifiquement à l’assurance récolte espagnole. Cependant, [Pálinkás and Székely \(2008\)](#) ont mené une étude comparative dans cinq pays européens, dont l’Espagne. Leur enquête, effectuée auprès d’environ 200 agriculteurs dans chaque pays, montre que l’assurance récolte est le premier instrument de couverture mis en place en Espagne avec 59,2% de souscription. Les dynamiques de souscription d’assurance en Espagne ont été étudiées par [Garrido and Zilberman \(2008\)](#). En traitant les données de 41 660 exploitations agricoles sur 12 années, ils montrent que la subvention est le facteur ayant la plus forte influence sur la probabilité de souscrire.

L’Espagne a instauré en Europe ce qui semble être l’un des régimes d’assurance récolte les mieux organisés. L’organisation du marché autour d’un pool de coassurance est d’ailleurs un élément revenant régulièrement dans les débats en France autour de la réforme du régime ([Descrozaille, 2021](#)).

### 1.3.2 Des similitudes avec le cas italien

L’Italie est dans une situation comparable à la France puisque le régime d’assurance en place est particulièrement subventionné et les taux de diffusion sont faibles et dispersés. En 2018, seulement 8,7% de la surface agricole assurable italienne était assurée, dont 15,4% de surface viticole et 14,9% de riziculture, représentant environ 63 000 exploitations. De fortes disparités régionales existent puisqu’en 2019, 83% de la valeur assurée nationale se situaient dans la région Nord contre respectivement 9% et 7% pour les régions Sud et Centre ([ISMEA, 2020](#)).

[Santeramo et al. \(2016\)](#) ont étudié spécifiquement les dynamiques d’entrées et de sorties des agriculteurs italiens sur le marché de l’assurance récolte. Selon eux, les taux de souscription sont nettement plus importants dans le Nord du pays car le rapport S/P y est proche de 1, contre 0,5 dans le Sud, rendant l’assurance particulièrement attractive. Ils montrent également que peu d’exploitants agricoles conservent un contrat d’assurance plus de deux ans, marquant alors un véritable *turnover* sur le marché. Enfin, les auteurs mettent en avant des retards répétés d’indemnisation et une gestion administrative complexe.

Le régime de couverture du risque italien date des années 1970 et de la création du *Fondo di Solidarietà Nazionale* (FSN) dont la mission est de soutenir le marché assurantiel et de

verser des aides *ex post* en cas d'événements exceptionnels. À partir de 2004, des contrats de couverture multirisque sont introduits. Pour encourager à la souscription, l'État met fin aux subventions en place depuis les débuts du FSN sur les contrats mono-risque pour soutenir les offres pluri<sup>8</sup> et multirisque. Les aides mises en place ont fait de l'Italie le pays soutenant le plus au monde son assurance récolte en proportion de subventions par rapport aux primes. En effet, ces aides représentaient en moyenne 74% des primes d'assurance en 2007. En 2010, à la suite d'une régulation européenne, l'État italien a plafonné ses subventions à hauteur de 65%. La réorientation des subventions des contrats mono-risque aux multirisque a modifié la structure des contrats souscrits. Alors qu'en 2004, 92% des contrats étaient de type mono-risque, ce taux est tombé à 0% en 2014. Les contrats pluri-risque et multirisque passent respectivement de 7,7% et 0,3% à 73,2% et 26,8%. L'année 2015 marque une refonte des contrats proposés. Un nouvel ensemble de contrats catégorisés A, B, C vise à proposer une diversité de couverture aux agriculteurs qui diverge selon la fréquence et les aléas couverts. Venant se substituer aux contrats pluri- et multirisque, ces nouveaux contrats n'ont pas encore entraîné un véritable décollage des taux de souscription (Santeramo, 2019).

France et Italie font face aux mêmes problématiques sur le marché de l'assurance récolte. Cependant, les raisons des faibles taux de diffusion peuvent être différentes dans chaque pays. La France observe de fortes disparités entre cultures alors que l'Italie témoigne de fortes inégalités de couverture régionale. L'Italie a fait le choix de diversifier davantage ses offres proposant possiblement une meilleure adéquation avec les situations de chacun mais entraînant un manque de transparence dans la compréhension des contrats disponibles.

La Figure 1.2 ci-dessous propose un récapitulatif des trois régimes.

## 1.4 Freins et déterminants de l'adoption de l'assurance récolte

Dans cette partie, nous catégorisons les différents freins et déterminants de l'adoption de l'assurance récolte identifiés dans la littérature, soit les caractéristiques du marché et des contrats, les caractéristiques de la ferme et de son exploitant, et nous soulignons l'importance de la complémentarité ou de la substituabilité avec l'assurance des autres outils de gestion du risque à disposition de l'agriculteur.

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<sup>8</sup>Les contrats pluririsque couvrent le risque grêle et au minimum un autre risque (gel, vent...) sauf les risques inondation et sécheresse contrairement aux multirisques qui les couvrent aussi.

Pays	France	Espagne	Italie
Sources	<i>Descrozaile, 2021</i> (données 2019)	<i>MAPA</i> (données 2020)	<i>ISMEA</i> (données 2018)
Surface (en millions d'hectares)	4,74 (≈29,7 % SAU)	6,14 (≈49,51 % SAU)	1,1 (≈8,7 % SAU)
Valeur assurée (en milliards)	7,985	15,2	5,68
Nombre de contrats souscrits	64 782 (57 236 exploitations assurées).	416 000	150 008 (62 909 exploitations assurées).
Équilibre (S/P)	91 %	±80 %	83,3 %
Subventions totales (en millions €/an)	136	237	1 341 (sur la période 2014-2020, soit 191,6/an).
Nombre d'offreurs	20 (dont 9 filiales Groupama)	18	25
Structure du marché	- Contrat régit par un cahier des charges conditionnant l'accès à la subvention. - Importantes différences de couverture selon les cultures.	Pool de coassurance Agroseguro (subvention directe et indemnisation rapide). - Subvention de base et pourcentage supplémentaire de subvention en fonction des situations (jeunes agriculteurs, groupement, pratiques...).	- Très fortes inégalités de souscription Nord/Sud. - Les vignes et les pommes représentent respectivement 31,3 % et 12,6 % du total de valeur assurée.
Orientation des politiques et contrats proposés	→ Soutien orienté vers l'offre MRC pour un même contrat sans distinction de culture ou de localisation.	→ 4 modèles d'assurance proposés qui diffèrent selon le niveau de couverture.	→ Deux réformes successives allant vers une diversification des contrats proposés.

Source : *Les auteurs*

Figure 1.2: Comparatif des différents régimes d'assurance récolte.

### 1.4.1 Caractéristiques du marché et des contrats

#### *Asymétries d'information*

L'une des principales explications possibles aux difficultés que rencontre l'offre d'assurance récolte française pourrait se trouver dans les problèmes d'asymétries d'information que sont la sélection adverse et l'aléa moral.

La sélection adverse qualifie un dysfonctionnement de marché qui pousse les agents les moins à risque à sortir du marché. L'aléa moral désigne la situation dans laquelle un assuré prend plus de risque du fait qu'il soit couvert.

Aléa moral et sélection adverse ont fait l'objet de nombreux travaux. [Just and Calvin \(1994\)](#) prouvent la présence de ces deux asymétries sur le marché de l'assurance récolte américain. [Goodwin \(1993\)](#), en s'intéressant aux producteurs de maïs de l'Iowa, réalise que les régions où les risques sont les plus faibles ont une élasticité de la demande d'assurance plus importante.

Augmenter le prix de la police d'assurance exclurait donc mécaniquement les agriculteurs de la région la moins exposée et augmenterait le niveau de risque moyen du pool de mutualisation. L'auteur critique aussi les modalités de calcul du rendement assuré. En se basant sur un rendement moyen, l'assureur n'appréhende pas le véritable risque de l'assuré. Selon lui, il faut s'intéresser à la distribution des rendements et à son coefficient de variation car le risque se situe dans la variabilité autour, et surtout sous, ce rendement moyen. De plus, selon [Goodwin \(1994\)](#), plus le rendement moyen est important, plus il est associé à de fortes variations. Cette modalité de calcul encourage donc davantage les agriculteurs avec un rendement dispersé à souscrire. Sur son échantillon d'étude de 2 247 fermes du Kansas (de 1981 à 1990), il trouve ainsi un coefficient de variation supérieur en moyenne de 3% chez les agriculteurs assurés par rapport aux non assurés. Cette différence peut s'expliquer par cet effet de sélection adverse mais peut aussi être expliquée par un effet d'aléa moral qui encouragerait l'agriculteur à prendre plus de risque du fait d'être assuré.

Dans leur revue de littérature, [Knight and Coble \(1997\)](#) pointent ainsi le fait qu'aux États-Unis, les exploitations avec les plus fortes indemnités espérées par rapport à la prime sont les plus susceptibles de souscrire à l'assurance récolte. De la même manière, [Santeramo \(2019\)](#) observe une variance moyenne de la production des agriculteurs italiens assurés supérieure à celle des non assurés. Il en conclut la présence d'asymétries d'information. [Zhao et al. \(2017\)](#) ont montré l'existence de sélection adverse en Chine et soulignent l'importance des subventions pour tenter de contrer cet effet.

Le déséquilibre structurel actuellement observé dans le rapport S/P en France témoigne d'un problème de mutualisation du pool d'assurés. En effet, les plus « mauvais risques » se concentrent et entraînent un phénomène de sélection adverse : le pool d'assurés est alors composé d'agriculteurs particulièrement exposés aux risques ce qui conduit les assureurs à verser proportionnellement plus d'indemnités dégradant ainsi le rapport S/P. L'équilibre technique n'étant pas atteint, le niveau des primes est rehaussé l'année suivante encourageant les agents les moins exposés aux risques à sortir du marché. Ainsi, mécaniquement, une boucle de sélection adverse s'installe dégradant le pool de mutualisation des assurés et le rapport S/P des assureurs. Ce phénomène a notamment été observé sur l'offre d'assurance « grêle » française au début des années 1990 par [Babusiaux \(2000\)](#).

L'absence de risque systémique est l'un des critères d'assurabilité ([Berliner, 1985](#)). En sa présence, la mutualisation du pool n'est pas garantie. La nature même durisque couvert pourrait expliquer les difficultés rencontrées par les marchés d'assurances récolte. [Miranda and Glauber](#)

(1997) estiment ainsi que l'intervention de l'État, notamment via une réassurance publique, est une condition primordiale au maintien du marché. Ils estiment que le portefeuille des contrats des assureurs américains est entre 20 et 50 fois plus risqué qu'il ne le serait si les rendements des assurés étaient réellement indépendants entre eux. C'est pour cette raison, ainsi que pour les problématiques d'asymétries d'information, que [Wright and Hewitt \(1994\)](#) soulignent l'importance des aides publiques pour le maintien de l'offre.

### *Coûts et subventions publiques*

Le coût de l'assurance est naturellement un paramètre déterminant pour un agriculteur dans sa décision de souscription. [Yi et al. \(2020\)](#) montrent que les écarts d'élasticité de la demande des différents contrats d'assurance récolte américains peuvent être d'un rapport de 1 à 14 en fonction du type de contrat, de la zone géographique et du niveau de couverture. Comme [Cabas et al. \(2008\)](#), [Ginder and Spaulding \(2009\)](#) ont identifié le prix comme étant le facteur le plus déterminant pour les agriculteurs dans leur décision de souscription. Leur enquête montre aussi l'importance, pour une partie de leur échantillon, de la disponibilité de subventions dans la décision de souscription. Ce résultat est partagé par [Garrido and Zilberman \(2008\)](#) qui ont identifié la subvention comme le principal élément encourageant à la souscription de l'assurance récolte en Espagne. La subvention est d'autant plus déterminante s'il s'agit d'une première souscription pour l'agriculteur. Pour cette raison, les auteurs soulèvent l'idée de la mise en place d'une importante subvention pour encourager à une première souscription.

### *Caractéristiques des contrats et attentes en matière d'indemnisation*

Le niveau du seuil de déclenchement est une caractéristique clé. Ce seuil de 30% sur les contrats socles MRC français est considéré comme trop élevé par les agriculteurs qui souscrivent très majoritairement à une option de réduction de son niveau ([Boucher et al., 2019](#)).

Les attentes en matière d'indemnisation influencent les comportements de souscription et de re-souscription. En effet, les agriculteurs ayant perçu une indemnisation par le passé ont moins besoin de l'incitation par la subvention pour souscrire à nouveau ([Garrido and Zilberman, 2008](#)). Ce résultat est également obtenu par [Enjolras and Sentis \(2011\)](#) pour les agriculteurs français. [Coble et al. \(1996\)](#) ont montré que les agriculteurs qui s'attendent à des petites indemnisations régulières ont plus tendance à s'assurer que les agriculteurs qui s'attendent à des indemnisations plus rares mais importantes.

Cabas et al. (2008) ont analysé la dynamique d'entrées et de sorties des agriculteurs du marché de l'assurance récolte canadien. En travaillant sur les données de l'état de l'Ontario sur la période 1988-2004, ils montrent que le coût de l'assurance est particulièrement déterminant pour les entrants sur le marché tandis que le niveau des rendements est important pour les sortants. Ils mettent aussi en avant l'importance des effets de réseaux et du « bouche-à-oreille », les agriculteurs hors du marché observant les indemnisations des agriculteurs présents sur le marché. Cet effet est aussi repéré par Lyu and Barré (2017).

De leur côté, Kunreuther and Pauly (2005) dressent une suite d'« anomalies » pouvant être présentes sur les marchés de l'assurance : absence de considération des instruments de prévention, poids trop important accordé par les assureurs aux pertes récentes dans l'établissement du niveau des primes et crainte des assurés de demander les petites indemnisations auxquels ils ont droit de peur de voir leur prime s'accroître.

#### 1.4.2 Caractéristiques des exploitations agricoles et des exploitants

Les caractéristiques de l'exploitation agricole peuvent également expliquer le recours à l'assurance. La manière dont ces variables influencent l'adhésion n'est pas toujours uniforme, comme l'illustre la Figure 1.3.

La surface cultivée et le capital exercent généralement une influence positive sur la probabilité de souscription. Les pertes potentielles étant plus importantes, l'intérêt du recours à l'assurance se retrouve accru. Néanmoins, l'aversion au risque déclinant avec la richesse (Bar-Shira et al., 1997) et le consentement à s'assurer augmentant avec l'aversion au risque, les agriculteurs à la tête d'exploitations plus grandes seraient moins enclins à s'assurer car plus riches.

La propriété ou non des terres cultivées peut influencer dans un sens comme dans l'autre le recours à l'assurance. Pour certains, la location des terres cultivées traduit une plus grande exposition au risque, la propriété foncière étant une rente potentielle sécurisante, et un niveau de richesse moins important encourageant l'exploitant à s'assurer (Mishra and El-Osta, 2002). Cependant, certains auteurs montrent que les plus grandes fermes exploitent davantage de terres en location (Finger and Lehmann, 2012). D'autres paramètres peuvent être considérés comme l'endettement qui est identifié comme ayant une influence positive sur la souscription d'assurance (Calvin, 1992; Smith and Baquet, 1996).

L'étude de la couverture assurantielle des cultures biologiques est particulièrement récente et concentrée sur les États-Unis. Cette couverture peut se faire au travers de contrats propres à



la démarche biologique ou au travers des contrats standards (pour l'agriculture conventionnelle) avec un pourcentage de surplus de prime (Singerman et al., 2012; Delbridge and King, 2019).

Les caractéristiques de l'exploitant peuvent également influencer sa conduite d'exploitation et sa décision d'assurance. L'âge et le niveau d'éducation sont considérés dans la plupart des études avec des impacts différents comme le montre la Figure 1.3. Outre la décision de souscription, les caractéristiques de l'exploitant peuvent aussi influencer le type de contrat souscrit (Sherrick et al., 2004). L'influence des caractéristiques individuelles de l'exploitant sur son choix de souscription est liée à son attitude face au risque. À l'instar de Mossin (1968), l'influence de l'aversion au risque a été démontrée positive sur le recours à l'assurance récolte (Lyu and Barré, 2017; Yanuarti et al., 2019)). Lyu and Barré (2017) montrent cependant que si le montant assuré est suffisamment important, les agriculteurs, averses comme non averses au risque, s'assurent tout autant. Ils montrent également que la hausse du prix de certains intrants, comme des fertilisants, renforce l'effet de l'aversion au risque sur le choix de souscription. Moschini and Hennessy (2001) montrent que plus l'agent est averse au risque, plus il sera tolérant à un taux d'assurance non actuariel.

Variables	Influence positive	Influence négative	Absence de significativité
Surface de l'exploitation	Goodwin (1993) ; Finger, Lehman (2012) ; Santeramo et al. (2016)	Nieuwoudt et al. (1985)	
Capital	Goodwin (1993) ; Salazar et al. (2019)	Black et Dorfman (2000)	Enjolras et Sentis (2011)
Propriété des terres cultivées	Fahad et al. (2018) ; Salazar et al. (2019) ; Finger et Lehmann (2012)	Sherrick et al. (2004) ; Black et Dorfman (2000)	Vigani et Kathage (2019)
Niveau d'éducation	Santeramo et al. (2016) ; Fahad et al. (2018) ; Salazar et al. (2019)	Black et Dorfman (2000)	Gardner et Kramer (1986) ; Lefebvre et al. (2014)
Âge de l'exploitation	van Asseldonk et al. (2002) ; Sherrick et al. (2004)	Calvin (1992) ; Salazar et al. (2019)	Smith, Baquet (1996) ; Zhao et al. (2017)

Source : Les auteurs

Figure 1.3: Influence identifiée dans la littérature de certaines variables sur le recours à l'assurance.



### 1.4.3 Lien avec les autres outils de gestion des risques

Selon Ehrlich and Becker (1972), la prévention regroupe les instruments d'autoprotection (réduisant la probabilité d'occurrence d'un aléa) et d'auto-assurance (atténuant les dommages)<sup>9</sup>. Ils démontrent par ailleurs la substitution entre assurance et auto-assurance. Gollier (1996) souligne que les agents couverts par une police d'assurance investissent moins dans la prévention si le taux de prime n'est pas amoindri par les efforts consentis.

Les filets anti-grêle sont probablement l'un des instruments de prévention les plus importants en arboriculture. Rogna et al. (2019) montrent que l'intérêt des filets par rapport à l'assurance est fonction croissante du risque de dommage, de la valeur de la production et de l'aversion au risque de l'exploitant.

Les exploitations impliquées dans une démarche de contractualisation ou de filière intégrée peuvent avoir, dans les clauses de leur contrat, une obligation de recours à l'assurance avec participation ou non du partenaire car la signature de tel contrat peut désinciter l'agriculteur à protéger ses cultures (du fait de la sécurisation qu'il propose).

L'influence de l'irrigation sur le recours à l'assurance a été analysée à diverses reprises. Alors que Enjolras and Sentis (2011) et Santeramo (2019) trouvent une influence positive, Serra et al. (2003) n'obtiennent pas de significativité et Salazar et al. (2019) démontrent une influence négative. Foudi and Erdlenbruch (2011) montrent qu'irrigation et assurance sont perçues comme substituables par les agriculteurs. Ils en concluent que l'irrigation est une forme d'auto-assurance. En étudiant conjointement les déterminants de l'adoption de l'irrigation et de l'assurance, ils trouvent que la disponibilité en eau de l'année précédente a un rôle déterminant puisqu'elle décroît significativement le recours aux deux dispositifs sur l'année étudiée.

La diversification des cultures (Santeramo et al., 2016) et des activités, notamment par un couplage culture-élevage (Serra et al., 2003) ou par un complément de revenu hors exploitation agricole (Calvin, 1992) est un instrument de prévention car elle réduit l'exposition aux risques et la probabilité de recours à l'assurance. Dans le même temps, O'Donoghue et al. (2009) ont montré que les réformes américaines augmentant la couverture assurantielle ont accru la spécialisation des agriculteurs et donc réduit le degré de diversification.

La situation étant relativement analogue entre la France et l'Italie, Enjolras et al. (2012) ont étudié conjointement les déterminants de souscription à l'assurance récolte dans les deux pays

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<sup>9</sup>Le lien entre recours aux pesticides et à l'assurance récolte n'est pas abordé ici. Le lecteur intéressé pourra se référer, par exemple, à Smith and Goodwin (1996) et Möhring et al. (2020).

à partir des données européennes du *Farm Accountancy Data Network* (FADN). Alors qu'en France la diversification et l'irrigation influencent positivement le recours à l'assurance, ils ont une influence négative en Italie.

À l'instar de la France, de nombreux pays ont depuis longtemps mis en place un régime d'aides exceptionnelles en cas de catastrophes naturelles. [Van Asseldonk et al. \(2002\)](#) ont ainsi montré que de nombreux agriculteurs aux Pays-Bas pensent que face à une situation dramatique et la pression qui s'en suit, l'État n'a d'autre choix que de débloquer ces aides *ad hoc*. Cette « croyance » affecte négativement la disposition des agriculteurs à payer une police d'assurance. [Boyer \(2008\)](#) parle d'une « concurrence déloyale » de ce type de régimes sur les assurances car le coût de ces mesures est quasi nul pour l'agriculteur ou du moins ne reflète pas sa réelle exposition aux risques. [Deryugina and Kirwan \(2018\)](#) ont mesuré empiriquement que cette aide gratuite a des effets désincitatifs sur les efforts de protection de l'agriculteur et sa gestion de production. À l'inverse, [Just and Calvin \(1994\)](#) trouvent un effet positif de ce genre de programme d'assistance *ad hoc* sur la souscription.

Ce résultat pourrait s'expliquer par le fait que les agriculteurs qui perçoivent ce type d'aides sont à la fois les plus informés sur les outils de gestion du risque à leur disposition et des agriculteurs qui ont donc connu une situation de pertes importantes qui pourrait les conduire à s'intéresser davantage aux outils assurantiels pour les campagnes suivantes.

Enfin, [King and Oamek \(1983\)](#) ont cherché à identifier l'effet de la suppression du régime américain d'assistance *ad hoc* sur la situation des agriculteurs et leur couverture assurantielle. Il en résulte que dans tous les scénarii, la perte de bien-être des agriculteurs n'est pas compensée même si les subventions pour l'assurance augmentent. L'assurance devient certes plus attractive mais la hausse des souscriptions reste très incertaine.

## 1.5 Discussion et conclusion

Le faible taux de diffusion de l'assurance MRC en France depuis son instauration est préoccupant dans un contexte de promotion importante de l'outil par les pouvoirs publics. Ce constat a conduit le gouvernement à constituer un groupe de travail sur la question et à commander divers rapports parlementaires ([Mortemousque, 2007](#); [Descrozaille, 2021](#)). Nous proposons dans cet article une revue de littérature sur l'assurance récolte soulignant les spécificités du régime français et identifiant les freins et déterminants de sa souscription par les agriculteurs.

La littérature suggère que le faible taux de diffusion de l'assurance récolte s'explique par une conjonction de facteurs liés à la structure et au fonctionnement du marché, aux caractéristiques des contrats mais aussi par un certain nombre de déterminants relatifs aux exploitations agricoles et à leurs exploitants. L'étude des régimes d'assurance récolte à l'étranger nous permet d'identifier des leviers potentiels pour l'intervention étatique et donne des pistes de recherches particulièrement intéressantes à étudier. Les spécificités espagnoles pourraient notamment être source d'inspiration pour des réformes à venir.

Cette étude fait alors apparaître un paradoxe : un besoin de simplification tout en prenant en compte l'hétérogénéité des exploitants, ce qui semble difficile à concilier. D'un côté, l'intérêt pour l'assurance ne peut être qu'accru à mesure que l'offre devient plus claire, transparente et simple à comprendre. Les différentes réformes en France vont dans le sens d'une telle simplification. D'un autre côté, cependant, il semble évident que les difficultés rencontrées par les agriculteurs varient énormément en fonction de la culture ou de la localisation. Un même contrat pour tous semble donc voué à être souscrit que par un certain type d'agriculteurs si une identification précise des problématiques de chacun n'est pas établie et si les contrats proposés ne laissent place à aucune souplesse. À l'inverse, l'Espagne et l'Italie ont fait le choix de proposer un ensemble diversifié de contrats subventionnés aux agriculteurs. Les récentes réformes italiennes allant dans ce sens n'ont pas fait décoller le taux d'adoption de l'assurance et ont entraîné davantage de complexité dans les démarches de souscription. L'Espagne, en revanche, a su instaurer une offre d'assurance récolte atteignant un taux de diffusion record.

Bien que le prix de l'assurance semble être l'un des freins à la souscription les plus évidents, il convient de le mettre en perspective avec les caractéristiques proposées dans les contrats et les éléments sur lesquels il est possible d'influer. Particulièrement souhaitée par différents assureurs et groupes de travail sur la question, la mise en place d'un pool de coassurance en France à la manière d'*Agroseguro* en Espagne pourrait dynamiser l'offre MRC. Ce pool permettrait une meilleure mutualisation du risque mais aussi de faire entrer de nouveaux assureurs sur le marché, de réduire la part de frais de gestion de la prime et de faciliter l'obtention de la subvention et le versement des indemnités.

La subvention est le principal mécanisme d'incitation à la souscription. En plus de son niveau, il est nécessaire de s'intéresser à la manière dont elle est distribuée. Le décalage temporel entre paiement de la prime et réception de cette subvention semble être un frein, particulièrement pour les petites exploitations qui ne peuvent assumer le décalage dans la gestion de leur trésorerie. L'instauration d'une entité prenant en charge ce décalage constituerait un moyen de simplifier

l'accès à l'assurance. De plus, il pourrait être envisagé une subvention plus importante pour la première souscription afin d'attirer les agriculteurs vers le régime d'assurance, rendant ainsi plus probable leur souscription les années suivantes du fait des connaissances et de l'expérience acquises. Une telle mesure pourrait cependant être contraire aux engagements pris auprès de l'OMC.

La pertinence du recours à l'assurance dans l'ensemble de la stratégie de gestion du risque de l'agriculteur est par ailleurs un élément décisif. Il semble ainsi nécessaire de créer une meilleure synergie entre l'ensemble de ces outils. Auto-assurance, assurance et intervention publique doivent agir de façon complémentaire et non concurrentielle avec une meilleure considération des efforts de prévention consentis dans la fixation du niveau de la prime. À l'avenir, il pourrait aussi être intéressant de s'inspirer des régimes proposés en dehors de l'UE. Le développement d'une offre « chiffre d'affaires », telle qu'utilisée aux États-Unis pourrait répondre aux besoins des agriculteurs en proposant un même outil pour la gestion des risques prix et de production. De la même manière, le développement de contrats multirisques couvrant le risque ravageurs et maladies, comme c'est le cas outre-Atlantique, répondrait à la fois aux besoins de gestion de ces risques sanitaires et de protection contre les aléas météorologiques.

L'ensemble des déterminants et freins à la souscription de l'assurance récolte répertoriés et étudiés dans la littérature sont autant d'éléments à considérer pour de futurs travaux sur ce sujet. À notre connaissance, les bases de données disponibles ne permettraient pas d'étudier ces différentes variables et entraîneraient donc la nécessité de réaliser une enquête pour directement étudier la décision de souscription ou non des agriculteurs à l'assurance récolte.

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## CHAPTER II

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### Subjective barriers and determinants to crop insurance adoption

# SUBJECTIVE BARRIERS AND DETERMINANTS TO CROP INSURANCE ADOPTION

Richard KOENIG<sup>1</sup>, Marielle BRUNETTE<sup>2</sup>

## Abstract

Crop insurance has a low rate of diffusion among French farmers. In this context, the objective of the article is to identify determinants and barriers to crop insurance from the point of view of the farmers. We designed an original survey using different methodologies (questions, experimental tests, self-ranking, Likert scales, etc.). We carried out cross-sectional and dynamic probit regressions on crop insurance adoption. We show that the characteristics of the farm (e.g., surface area, certification, diversification) and the farmers (e.g., marital and tenure status) as well as behavioral variables (e.g., time preferences) have an impact on the adoption of crop insurance. In addition, we show that the characteristics of the contract play an important role in the decision to subscribe or not since the farmers who are not insured consider the premium and deductible level to be the main barriers, whereas the farmers who adopt crop insurance report recent loss and expect poor weather conditions for the incoming season. We discuss the results with regard to the current crop insurance reform in France.

**Keywords:** Crop insurance, Farmers, Determinants, Barriers, Survey, France

**JEL Classification:** Q12: Micro Analysis of Farm Firms, Farm Households, and Farm Input Markets; G22: Insurance, Insurance Companies, Actuarial Studies

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<sup>1</sup>Université de Lorraine, Université de Strasbourg, AgroParisTech, CNRS, INRAE, BETA, France. Climate Economics Chair (CEC), Paris. richard.koenig@chaireeconomieduclimat.org - Corresponding author

<sup>2</sup>Université de Lorraine, Université de Strasbourg, AgroParisTech, CNRS, INRAE, BETA, France. marielle.brunette@inrae.fr; Associate researcher at the Climate Economics Chair (CEC), Paris.

## 2.1 Introduction

Agriculture is currently facing multiple major challenges: the doubling of the global food production for 2050, the search for more environmental-friendly products, and the repercussions of climate change effects. The impact of climate change on European agriculture and its ability to increase its resilience is an increasing popular research topic (Meuwissen et al., 2019). Agriculture is vulnerable to climate change: higher temperatures impact yields and favor pest invasion, whereas changes in precipitation regimes increase the likelihood of short-term crop failures and long-term production decline (Nelson et al., 2009). In particular, climate change increases the frequency and severity of weather-related events. A recent study on the subject indicates that crop losses tripled between 1961 and 2015 in Europe due to the severity of drought and heat waves (Brás et al., 2021). However, Beillouin et al. (2020), showed that extreme events have varying impacts in different parts of Europe and losses in some areas could be compensated for by favorable conditions in other ones, which is in line with the results of Vaitkeviciute et al. (2019).

To deal with these-weather related events, farmers may take out crop insurance contracts. In fact, crop insurance was identified by the COP23 as a major tool to adapt to climate change (Drieux et al., 2019). These types of contracts are available in most European countries. It consists of an agreement between a farmer and an insurance company that stipulates that in return for an insurance premium, the insurer compensates the farmer for crop losses according to a set of pre-established parameters. Each contract specifies the insured crops and area, the events covered (drought, hail, flooding, etc.), the level of both the trigger threshold (i.e., the minimum amount of loss that triggers the indemnities) and the deductible (i.e., the share of loss that will not be indemnified). Each contract must also state the guaranteed yield. Several computation methods exist but they are usually based on the farmer's historical yield (e.g., the "olympic" average, which is the mean of the last 5 years after removing the highest and lowest yield values). The guaranteed price must also be fixed. For example, the mean of the historical price or a price fixed by a public authority could be used as the reference. After having determined all these parameters, the farmer can adopt different options to lower the deductible, for example, or increase the guaranteed yield.

Crop insurance schemes are usually supervised and promoted by public authorities through specificities and subsidies. The adoption rate of insurance is very heterogeneous between countries. In France, in addition to a 65% subsidy rate on the multi-peril offer, the crop insurance adoption rate remains low since only 30% of the French agricultural area is insured and large coverage disparities exist between crops. This excessively low diffusion rate threatens the sustainability of the offer. Other European countries are in a similar situation, like Italy, for example, whereas in other European countries, the adoption rate is quite high, like in Spain (see Koenig et al. (2022) for a comparison). Crop insurance is increasingly promoted by public authorities that aim to reach high levels of insurance coverage and reduce intervention through disaster payments. The scope of intervention of the disaster scheme is shrinking with the development of crop insurance in France. Since crop insurance is now the main climate risk

management tool promoted by the government, with the ambition to make it a tool for adaptation to climate change, it appears essential to address issues in the current market and identify the main obstacles to crop insurance adoption and development. As [Trieschmann et al. \(2001\)](#) stated: “*as the size of the (insured) pool increases, the degree of risk faced by the pool as a whole decreases*”. The future diffusion rate of crop insurance will be a key factor to the durability and sustainability of this instrument. This question is of utmost importance in France in the context of the reform of the crop insurance scheme ([Descrozaille, 2021](#)), as well as in other countries where the scheme is being reformed.

The aim of this article is to provide answers as to why crop insurance is not widely used in France. The potential variables that can impact the farmer’s decisions to insure are diverse. The level of the insurance premium may be an important barrier. However, the quality of the services and coverage associated with this premium seem to be important as well. In addition, some behavioral variables may also contribute to the decision to insure or not. We propose to categorize them as follows: farm characteristics (area, crop, etc.), farmers’ characteristics (age, income, etc.), crop insurance (premium, subsidy, etc.) and behavioral variables (risk aversion, risk perception, etc.). In addition, these variables are very heterogeneous; some are qualitative and others quantitative. We could not find any dataset that encompassed all of this information, so we designed an original online survey using different methods to collect information that allowed us to study the main factors affecting crop insurance adoption and, in particular, to identify the most important barriers to its adoption. This design has a certain level of genericity and may serve as a basis to address similar research questions in other countries.

In the following section, we propose to briefly describe the development of the French insurance scheme before presenting a brief review of the economic literature on crop insurance. We then lay out our survey and methodology. Finally, we present our results and conclude with a discussion.

## 2.2 Context and literature review

To fully comprehend the issue problematic linked to crop insurance in France, we first describe the development of the French crop insurance scheme. In the second part, we present the literature of which our research question is part.

### 2.2.1 The French crop insurance scheme

In France, the management of catastrophic risks is coordinated by the FNGRA (*Fonds National de Gestion des Risques en Agriculture*), a national fund dedicated to the management of the agricultural disaster scheme. This fund intervenes to indemnify farmers in the event case of non-insurable losses<sup>3</sup> caused by extreme weather events qualified as “agricultural disasters” by the public authorities. The scope of this fund tends to decrease as crop insurance develops but will remain necessary to cope with

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<sup>3</sup>The overall combination of insurable risks and losses is set by the Ministerial Order of December 29, 2010.

the extreme events that no insurance could cover. Farmers adopt different insurance contracts for their activity; some are mandatory (buildings, vehicles, personnel, etc.) and others are voluntary, among them, crop insurance, the one we focus on in this paper.

Historically, hail insurance was the only type of crop insurance available. Around the mid 1980s, storm and frost risks were integrated as options in hail insurance contracts. After several parliamentary reports (Babusiaux, 2000; Ménard, 2004), the government promoted the implementation of a new contract in 2005, known as MRC (*Assurance Multirisque Climatique*) insurance. This type of contract, which covers more than 15 different weather hazards (hail, drought, freezing, excessive rain or heat, gale force winds, etc.), is available for all farmers, regardless of the crop or location. Two types of MRC contracts are proposed: one provides coverage by “crop group” and the other one provides coverage at the “farm level”. This distinction entails specifications on the characteristics of the contracts and how and when the compensation is triggered. In fact, 97% of the current MRC contracts adopted are of the “crop group” type (Descrozaille, 2021). The small subsidies existing for hail and frost policies were dropped in order to implement a 35% rate of subsidy for the MRC premium (funded by the European Agricultural Fund for Rural Development). To justify access to the subsidy, the design of the MRC policy is framed by a set of specifications updated by the Ministry of Agriculture each year: the crops and risks that can be covered, the deductible level, the trigger threshold, how both insured yield and price are computed, all the options available associated with a certain subsidy rate, and all the other obligations to which insurance companies and policyholders are subject.

The launch year of the MRC was quite a success. Given that the insurer proposed this contract as an extension of the former but remaining hail contracts, the adoption rate was considerable in 2005: 57,900 contracts subscribed, 3 billion euros of insured capital on 3.4 million hectares (22.37% of the French Utilized Agricultural Area (UAA)), 8.5 times more than in 2004 (Mortemousque, 2007). Despite this good start, the growth of the insured area in France has remained low ever since the initiative was launched. Having undergone a very slow development, the MRC scheme has experienced two major changes since its implementation in 2005. The first one, in 2010, thanks to a CAP (Common Agricultural Policy) reform that allowed fund transfers from the first pillar to the second one, the subsidy rate rose to 65% of the premium. The second one, in 2016, was a structural reform of the MRC that redesigned the architecture of the proposed contracts. From that time on, MRC insurance took the form of a three-layer coverage policy, as presented in Figure 2.1. First, the farmer adopts a “basic contract”, subsidized at 65% and respecting basic characteristics (dark gray). The farmer can then ascribe to take a first level of supplementary guarantees, resulting in a premium surcharge that is eligible at a 45% subsidy rate (gray). Finally, the farmer can opt for a second level of supplementary guarantees for which there is no subsidy to support the premium surplus (light gray).

Despite the 2016 reforms that gave some impetus to the adoption rate, the share of insured land only increased by 10.4 percentage points over the 15 years of development of the MRC policy. The MRC adoption rate remains low and, more importantly, has large disparities in coverage between crops (see Appendix 2.7.1). The diffusion rate of field crops is currently around 33% but with a low growth rate

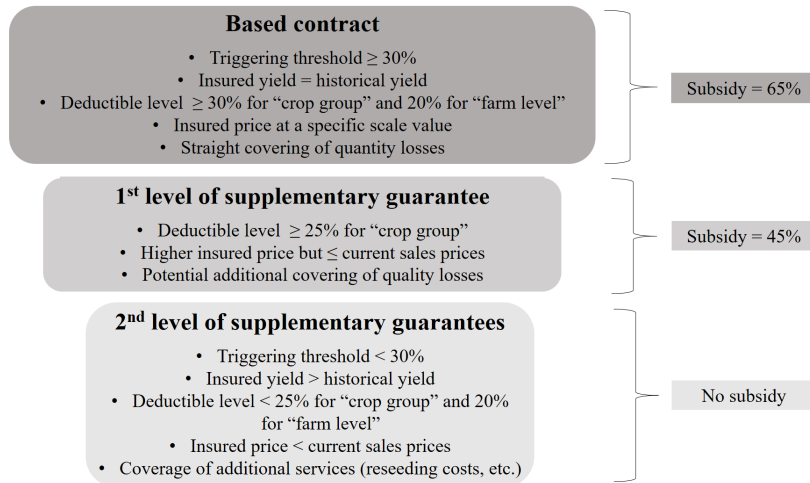


Figure 2.1: Characteristics of MRC contracts.

since 2005. For vegetables, the leap from 1.4% to 28% of the area covered is primarily explained by a reclassification of certain crops. The coverage of fruit crops is extremely low, which is particularly worrisome since they are the most weather-sensitive crops. Only viticulture is experiencing a steady growth in its diffusion rate, and has now reached now the same level as field crops.

In addition, the current insurance offer is not sustainable from the point of view of the insurers due to adverse selection issues. Indeed, insurers are compelled to pay out more claims on average than they collected in premiums at the beginning of the campaign. That measurement, referred to as the loss ratio, is the main indicator of the sustainability of the offer. By decreasing the loss ratio, adverse selection turns the policy into a loss for the insurer, leading to a permanent increase in premium to compensate for losses, gradually excluding the farmers from the market. In fact, to have a sustainable offer, this loss ratio has to be around the technical equilibrium of 75%.<sup>4</sup> Since the launch of the MRC offer in 2005, this equilibrium has only been achieved for the years 2008, 2014 and 2015. During the 2005-2018 period, the loss ratio was, on average 101%, reflecting a structural loss for the insurers (see Appendix 2.7.1).

The low diffusion rate among French farmers and the structural deficit for the insurers are particularly problematic in a context of increasing risks due to climate change. Firstly, they reflect the lack of protection for a large part of French farmers, meaning that they may exclusively rely on disaster payments, whereas the scope of intervention of this public aid is gradually being reduced. Secondly, they imply a poor quality of pooling that threatens the sustainability of the offer.

On March 2, 2022, the new guideline law for a better distribution of crop insurance was enacted. Based on the report Descrozaille (2021), this law marks a new structural reform of the crop insurance scheme and its adequacy with the other risk management tools.<sup>5</sup> Since January 1, 2023, the subsidy rate

<sup>4</sup>100% would mean that all the premiums are redistributed as compensations but the insurer requires a share of this premium to finance its management and reinsurance costs (Mahul, 1998).

<sup>5</sup>Agricultural orientation law no. 2022-298 of March 2, 2022, concerning the improved distribution agricultural harvest insurance with the intent to reform agricultural climate risk management tools. JORF n°0052 of March 3, 2022.

has increased from 65% to 70% and the basic level of the deductible has decreased to 20% (applied from the next campaign, 2023-2024). This law also implements a “one-stop service desk” for farmers, which will pay out the compensation from both insurance contracts and disaster schemes.

### 2.2.2 Literature review

The insurance literature related to crop insurances and agriculture is quite old and heterogeneous. Its theory is based on the general literature on insurance (Rothschild and Stiglitz, 1978) and its problems of asymmetry of information (Pauly, 1978). It was adapted to the agricultural insurance framework in the 1980s by Ashan et al. (1982), Nelson and Loehman (1987) and Chambers (1989), among others. This theoretical framework highlighted the imperfections on this market and its non-optimal character. Public intervention is thus necessary in order to correct this asymmetry, support the development of the market through subsidies or even provide a public offer when there is a lack of private one. The empirical and analytical literature on this topic has been historically mainly focused on the American market.

More particularly, a literature also developed on the determinants of crop insurance. Nieuwoudt et al. (1985) empirically analyzed the determinants of the crop insurance demand in the US using state data over the 1960-81 period from the Federal Crop Insurance Office. They found positive and significant effects on the adoption of crop specialization, expected rate of return and expected risk, farm size, disaster payments and part ownership. Crop insurance purchase was analyzed on the basis of this paper and tested at different states of market development in the US (Goodwin, 1993; Connor and Katchova, 2020), in different countries in Europe such as Spain (Garrido and Zilberman, 2008), the Netherlands (Van Asseldonk et al., 2002) and Italy (Santeramo et al., 2016; Coletta et al., 2018), and even more recently, in developing countries<sup>6</sup> like Indonesia (Yanuarti et al., 2019), Pakistan (Fahad et al., 2018) and China (Wang et al., 2016; Lyu and Barré, 2017).

A more recent part of the economic literature pertaining to crop insurance focuses focusing on the effect of farmers’ risk attitudes on the crop insurance purchase decision. Zhao et al. (2016, 2017) showed, with survey data, that farmers’ risk-aversion positively and significantly affects the probability to purchase crop insurance. Meanwhile, they found an adverse selection effect since high-risk farmers are more likely to adopt crop insurance. However, they suggest that “substantial” crop insurance subsidies will even attract risk-neutral farmers to the market and also make it profitable for less risky-farmers. Yanuarti et al. (2019) also found that farmers have a relatively high-level of risk-aversion, which has a positive and significant effect on crop insurance participation. In the same way, Lyu and Barré (2017) showed that decision to purchase or not crop insurance is related to risk attitude, but they also find that insured amount affects this effect. According to their results, if the insured amount is high enough, risk aversion no longer affects the insurance purchase decision.

According to Sitkin and Pablo (1992) and Cho and Lee (2006), the two main components of behavior

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<sup>6</sup>The application in developing countries is led by the emergence of a parametric insurance offer (Leblois and Quirion, 2013; Ye et al., 2020; Ghosh et al., 2021).

are risk attitude and risk perception (the personal assessment of probability to be subject to a specific hazard and its associated losses). [Menapace et al. \(2013\)](#) claim that a positive relationship between risk-aversion and risk-perception exists in that “*farmers who are more (less) risk averse tend to perceive greater (smaller) probabilities of farm losses occurring*”. Looking specifically at risk perception, [Vigani and Kathage \(2019\)](#) found that a higher perception of risks has a positive and strongly significant impact on the adoption of insurance (and insurance combined with other risk management tools). In order to have a combined approach, [van Winsen et al. \(2016\)](#) used a survey to assess the effect of both risk attitude and risk perception on crop insurance adoption. Their results suggest that only risk attitude, and not risk perception affects farmers in their decision process. They also identify two types of farmers’ profiles: farmers “willing to take risks” and “risk-averse” farmers. The first ones are more likely to apply *ex-ante* risk management tools such as insurance or diversification, whereas the others are more into an *ex-post* strategy in which they will face the impacts of losses by looking for off-farm income, delving into their savings or working harder to compensate.

Another behavioral variable that seems to affect crop insurance adoption is time preference. Indeed, the economic literature has identified the effect of time preference on insurance consumption, especially social insurance ([Kifmann et al., 2010](#)), whereas [Coletta et al. \(2018\)](#) also showed that time preferences have a significant impact on some risky decisions. They deduced that since crop insurance adoption also implies risk, time preferences should play a role, either positively or negatively.

The French case was studied by [Enjolras and Sentis \(2011\)](#) who used FADN (Farm Accountancy Data Network) data for the 2002-2006 period, corresponding to the period preceding MRC implementation. They found that the largest farms tend to insure more than smaller farms. Moreover, the farms considered as “high risk” are more prone to subscribe to a crop insurance contract. Finally, the authors underline a “fidelity to insurance”, meaning that farmers who have already subscribed to a policy and who have previously received indemnities are more likely to subscribe again. [Enjolras et al. \(2012\)](#) took a common approach for France and Italy regarding the main determinants of crop insurance adoption and its elasticities of demand for the 2002 to 2007 period. They confirmed the existence of a “fidelity” or “inertia” effect regarding crop insurance participation for both countries. A key difference between both countries is the effect of diversification. While in Italy it has a negative effect on crop insurance, reflecting a substitute risk management tool, it has a positive effect in France, which means that diversification and insurance are considered as complementary in the risk management strategy of French farmers.

Recently, the literature concerning crop insurance in France was focused on its effect on farm management and especially on pesticide use. [Möhring et al. \(2020\)](#) found that crop insurance adoption is significantly associated with an increase in pesticide expenditures. Both tools are linked by an intensive and extensive margin effect, which implies both an increase in pesticide use per hectare and a cropland extension. Over the 2008 to 2012 period, [Enjolras and Aubert \(2020\)](#) found no specific impact of crop insurance on pesticide use for field crops and quality wine-growing. However, they found that crop insurance leads to a reallocation of land within the farm.



Crop insurance is an old topic in the agricultural economic literature. Nevertheless, the context of the country and the time of the study are important considerations with regard to the results. The different crop insurance schemes mentioned in the literature have and will experience structural reforms. Regarding the French situation, as we know, no recent academic study has focused on the actual state of the scheme. In addition, the empirical literature has focused on determinants to crop insurance, generally using European or American scale data. We consider that it could be relevant to look at barriers to crop insurance adoption. Barriers are not necessarily negative determinants. They may also be elements that block the functioning of the scheme or that are intrinsic characteristics of its design. To address this issue, we proposed to collect farmers' data through a survey.

We can categorize the variables studied by this literature into four groups: farm characteristics, farmers' characteristics, crop insurance and behavioral variables. Using this categorization, Appendix 2.7.2 proposes a summary table of the literature results. We also use this categorization and the literature results to formulate the research hypotheses presented in Table 2.1.

Table 2.1: Research hypotheses from the literature.

<b>H1</b>	<b>Farm characteristics significantly impact insurance adoption.</b>
H1a	Farm size (in area) is associated with a higher propensity to insure.
H1b	Using irrigation and other prevention tools reduces the willingness to adopt crop insurance.
H1c	Diversification (of crop or income) is negatively linked to crop insurance purchase.
H1d	Recent losses encourage farmers to adopt crop insurance.
<b>H2</b>	<b>Farmers' characteristics significantly impact crop insurance adoption.</b>
H2a	Farmers with lower income levels are less insured than the others.
H2b	Household size (i.e., having children in their care) reduces the likelihood of purchasing insurance.
<b>H3</b>	<b>Farmers past crop insurance choices significantly impact current insurance adoption.</b>
H3a	There is a "fidelity" effect: farmers who were previously insured tend to insure again.
H3b	Having already received compensation from an insurer will encourage the farmer to insure again.
<b>H4</b>	<b>Behavioral variables significantly impact crop insurance adoption.</b>
H4a	The higher the risk aversion is, the higher the probability to adopt crop insurance will be.
H4b	Risk perception and the feeling of vulnerability affect the likelihood of crop insurance adoption.
H4c	The more the farmer has a preference for the present, the less likely he or she will insure.

The objective is then to propose a relevant methodology to test these research hypotheses.

## 2.3 Methodology approach

In order to test these different hypotheses we needed information we could not find in any previously existing dataset. We therefore designed an online survey using different methods to question farmers about their crop insurance perception and adoption. In this section, we first describe our design and the sample. We then explain our econometric approach.

### 2.3.1 The design of our approach

The survey was distributed through the French Chambers of Agriculture network, a group of public organizations run by elected professionals from agricultural syndicates that represent French farmers and rural areas. We aimed to spread the survey among farmers in Metropolitan France, regardless of crop or location. The network we went through was the main channel to reach farmers without intentionally over-representing a category of farmers. We first contacted the national headquarters and then the 89 metropolitan departmental and interdepartmental offices with emails and phone calls. In order to respect anonymity rules, we asked them to diffuse the survey and the link necessary to complete the survey in their respective mailing lists or newsletters. Therefore, as we did not specifically know which offices diffused it or not, nor the number of people who received it, we were not able to determine how many farmers received this survey in their mailbox. However, we received responses from 25 different departments among which four are particularly represented (Aude, Jura, Nord, Vienne). The questionnaire was available between February 2021 to October 2021. We collected a total of 465 responses including 288 complete ones. The survey was completed by the farm manager. All the responses are anonymous with the two-digit department code as the most detailed information. Anonymization of our survey made it impossible to directly provide monetary incentives. To encourage farmers to complete the survey, we used an indirect incentive. We told farmers that a donation of €2 was made for each survey completed to the “Petits Princes” Association<sup>7</sup>, as [Ginder and Spaulding \(2009\)](#) did for their survey in northern Illinois.

The survey consisted of 57 questions, but none of the farmers answered the 57 questions since some of them were conditional. The survey was tested on a sample of researchers prior to its release to French farmers. Based on Cognitive Aspects of Survey Methodology studies and web-survey methods, we attempted to design our survey to avoid casual self-administered questionnaire issues ([Tourangeau, 2003](#); [Tourangeau et al., 2004](#)). The order of the groups of questions and the questions within them was not random, but the order of the proposed answers to the questions was randomized when possible in order to reduce speeding (i.e., giving answers very quickly), straightlining (i.e., choosing the same response option for all items in a grid) and framing effects (i.e., bias for central positions) ([Harrison et al., 2005](#); [Zhang and Frederick, 2014](#)). Moreover, we separated questions into several groups, each at different step of the survey, so that the respondents could not see the impact of their previous responses on the progress of the survey. Some responses could lead to other questions or, on the contrary, to not making them visible to the respondent. In order to prevent respondents from changing their minds because of the emergence of new questions, we hid these decisive questions as much as possible by putting them at a different step than the dependent questions. Finally, we did not mention the total number of possible questions and the progress bar of the survey in order not to influence or discourage the respondents.

We combined several methodologies to fully answer our research question. Using classical survey

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<sup>7</sup>Since 1987, the “Petits Princes” Association has been making dreams come true for seriously ill children and teenagers suffering from cancer, leukemia and certain genetic diseases.

questions, we collected socio-demographic variables and characteristics of the farm. Among these questions, we had information related to the farmers' crop insurance. In addition, we used experimental tests to quantify risk preferences, self-ranking to measure the subjective degree of impatience, impulsiveness and exposure to weather hazards, 5-point Likert scales to identify the barriers to the adoption of crop insurance, and ranking to display the determinants of crop insurance purchase and the main barriers to its adoption. With the combination of these different methodologies, we hoped to capture as many of the potential explanatory variables as possible.

### Classical survey questions

We asked the subjects to indicate if they had or would take out crop insurance for the 2020-2021 campaign (Insurance). We ask them if they were insured during the last growing season (InsT1), two years ago (InsT2), and the total number of years of subscription to a crop insurance contract (YearsIns). The last question asked them if they had already received compensation for crop loss from an insurer. Given that variable of interest in our study is the fact that the farmer is insured or not, we present all the descriptive statistics with this distinction: all, insured, non-insured. Table 2.2 presents the results to these questions.

Table 2.2: Crop insurance.

Variables	Detail	All	Insured	Non-Insured
YearsIns	No. of years with a crop insurance contract	7.7 (9.9)	13.27 (9.8)	2.3 (6.6)
		in %	in %	in %
Insurance	Insured (proportion)	49.31	100	0
InsT1	Having a crop insurance contract in T-1	52.43	97.89	8.22
InsT2	Having a crop insurance contract in T-2	51.04	92.25	10.96
Compensation	Having received compensation for crop losses from an insurer	55.21	85.21	26.03
N	Number of observations	288	142	146

We can observe that our sample is well-balanced since 49.31% of the farmers have an insurance contract (142/288). A total of 126 of them have a minimum of a MRC contract, 14 have a hail one, one a grassland contract and one has an revenue insurance. In addition, approximately half of the sample had an insurance contract during the last growing season and two years ago. On average, the farmers in our sample spent 7.7 years with a crop insurance contract, and 55.21% of the farmers had already received compensation for crop losses from an insurer. Some differences between the insured and the non-insured have to be highlighted. The insured in  $T$  were also mainly insured in  $T - 1$  and  $T - 2$ , whereas few non-insured farmers in  $T$  were insured in previous years. In a similar way, many of the insured farmers had already received compensation from an insurer, whereas it was the case for only 26% of the non-insured farmers. Consequently, we expect that such variables impact insurance adoption.

Among the classical survey questions, we also have those related to farmers' and farms characteristics,

whose answers are presented in Tables 2.3 and 2.4.

Table 2.3: Farmers' characteristics.

Variables	Detail	All	Insured	Non-Insured
Age	Age of the farmer	49.65 (10.3)	50.43 (10.9)	48.90 (9.5)
Gender	1 for men	0.816	0.838	0.794
		in %	in %	in %
Education	(1) = No Diploma	1.04	0.70	1.37
	(2) = General Certificate of Secondary Education	18.06	16.90	19.18
	(3) = High School Diploma	27.08	30.99	23.29
	(4) = 1 and 2 years University level	27.08	27.46	27.40
	(5) = 3 years University level	27.43	8.45	9.59
	(6) = 4 years University level	4.51	2.11	6.85
	(7) = 5 years University level	11.46	12.68	10.27
	(8) = 6 to 8 years University level	1.39	0.70	2.05
Location	(1) = North of France	10.76	11.27	10.27
	(2) = West of France	29.17	23.94	34.25
	(3) = East of France	23.26	16.90	29.45
	(4) = South of France	36.81	47.89	26.03
HouseholdSize	(1) = 1 person	12.15	8.45	15.75
	(2) = 2 persons	31.94	36.62	27.40
	(3) = 3 persons	19.44	19.72	19.18
	(4) = 4 or more persons	36.46	35.21	37.67
Income	(1) = <€1000	7.99	3.52	12.33
	(2) = [1000:2000[	31.94	30.99	32.88
	(3) = [2000:3000[	23.61	25.35	21.92
	(4) = [3000:4000[	17.36	18.31	16.44
	(5) = [4000:5000[	6.60	9.15	4.11
	(6) = >€5000	5.56	3.52	7.53
	(7) = Prefers not to answer	6.94	9.15	4.79
SpouseOccupation	(1) = Spouse works outside of farm	53.82	57.75	50
	(2) = Spouse doesn't work outside of farm	29.86	28.87	30.82
	(3) = Single	16.32	13.38	19.18
NonAgriIncome	Non-agricultural activity income	41.32	43.66	39.04

In our sample, farmers are on average of 49.65 years old and they are mainly men. Approximately 10% are located in the North of France, 29% in the West, 23% in the East and 36% in the South. The household is generally composed of two people or four or more people. We observed a large heterogeneity concerning income, with more than 70% of the sample between €1000 and €4000. For more than half of the farmers, their spouses working outside of the farm. Finally, 40% of them receive income from a non-agricultural activity.

The average area of the farms is on average 98.13 hectares.<sup>8</sup> Respondents have generally managed their farms for an average of 20.51 years. There is a variety of possible combinations among cultivated crops. However, certain profiles are more frequently represented. Among our respondents, 28.82% produce only wine, 27.43% produce only field crops producers, 17.36% produce both field crops and breed animals, 9.03% only breed. 29.17% of the farmers use irrigation, 28.47% are involved in a contractualization process or are integrated into a supply chain, 78.47% are part of a farm cooperative and 57.64% are members of an agricultural union. Most of the farmers are owners and tenants (63.54%), and for

<sup>8</sup>This is higher than the national mean of 63 ha and less than the national mean of the large farms: 111 ha. This group of large farms (in the economic sense) represents 73% of the French cultivated land, while medium-size and small farm groups represent 20% and 7% of it, respectively (INSEE).

Table 2.4: Farm characteristics.

Variables	Detail	All	Insured	Non-Insured
Surface area	Cultivated hectares	98.13 (100.7)	103.57 (99.2)	92.84 (102.2)
FarmExp	Years as farm manager	20.51 (12.7)	21.69 (13.0)	19.36 (12.3)
		in %	in %	in %
TypeAgri	Agricultural activity (1) = Field Crops	27.43	29.58	25.34
	(2) = Wine	28.82	38.03	19.86
	(3) = Field Crops and Breeding	17.36	17.61	17.12
	(4) = Breeding	9.03	1.41	16.44
	(5) = Diversification (all others)	17.36	13.38	21.23
Irrigation	Irrigation user	29.17	32.39	26.03
Contract	In a contractualization process	28.47	33.8	23.29
Coop	Member of a cooperative	78.47	89.44	67.8
Syndicate	Member of a trade union	57.64	62.68	52.74
Tenure	(1) = Owner	23.26	28.87	17.81
	(2) = Tenant	13.19	9.86	16.44
	(3) = Owner and tenant	63.54	61.27	65.75
FamilyFarm	Farm previously managed by a family member	71.88	79.58	64.38
Label	Certification	36.46	42.25	30.82
WorkForce	Working with others on the farm	51.04	57.04	45.21
Nitrogen	Nitrogen supply to crops	83.33	88.73	78.08
Disaster	Already received a disaster payment	48.61	63.38	34.25
RecentLoss	Yield losses due to weather events in the last 2 years	65.97	75.35	56.85

71.88%, the farm was previously managed by a family member. A total of 36.46% of the farms are certified (organic farming, geographical indication, environmental certification, etc.). More than half of the farmers work with others on the farm; 83.33% of the farmers supply nitrogen to their crops; 48.61% of the farmers have already received a disaster payment; and 65.97% have suffered from a yield loss due to weather events in the last 2 years.

## Experimental test for risk preferences

Risk aversion was measured by an Ordered Lottery Selection (OLS) methodology proposed by [Reynaud and Couture \(2012\)](#) and [Brunette et al. \(2017\)](#), which are adaptations of the [Eckel and Grossman \(2002, 2008\)](#) lottery tasks. We chose to implement this method because the measurement of risk preferences is based on only one lottery choice, which is clearly an advantage since this measurement procedure was part of a long questionnaire. In addition, this method was initially developed to address the risk preferences of rural farmers ([Binswanger, 1980](#)). All of the farmers face the nine gambles presented in the first three columns of [Table 2.5](#) and we ask them to choose the gamble that they accept to play for. Each gamble is a fifty-fifty gamble with a 50% chance to obtain payoff 1 and a 50% chance to obtain payoff 2. The choice is purely hypothetical; there is no incentive<sup>9</sup>. The choice of a gamble makes it possible to infer an interval for the relative risk aversion coefficient (column 4), from “extremely risk-averse” (RA5) to “highly risk-prone” (RP3), and including through risk-neutral (RN) (column 5). The higher the number is, the higher the intensity of the individual’s preference is. A coefficient equal to zero means

<sup>9</sup>Some papers show the absence of difference in terms of decisions between lottery choices using hypothetical or real payoffs ([Battalio et al., 1990](#); [Wik et al., 2004](#)).

risk neutrality, whereas a positive one indicates risk aversion and a negative one represents a risk-prone behavior.

Table 2.5: Measurement of risk preferences.

50/50 gamble	Payoff 1	Payoff 2	Coef. of RRA ranges	Coef. of RRA code	All in %	Insured in %	Non-insured in %
Gamble 1	40	40	$r > 1.37$	RA5	60.42	60.56	60.27
Gamble 2	32	51	$0.68 < r < 1.37$	RA4	12.15	16.90	7.53
Gamble 3	24	64	$0.44 < r < 0.68$	RA3	6.25	3.52	8.90
Gamble 4	16	78	$0.4 < r < 0.44$	RA2	5.21	5.63	4.79
Gamble 5	12	86	$0.15 < r < 0.4$	RA1	5.90	5.63	4.79
Gamble 6	8	91.5	$-0.13 < r < 0.15$	RN	4.86	3.52	6.16
Gamble 7	6	92.9	$-0.47 < r < -0.13$	RP1	0	0	0
Gamble 8	4	93.4	$-0.93 < r < -0.47$	RP2	0.69	0.70	0.68
Gamble 9	1	93.5	$r < -0.93$	RP3	4.51	3.52	5.48

The last three columns of Table 2.5 provide the distribution of the farmers' choices among our sample. A large majority of them selected Gamble 1, insured or not, corresponding to a high level of risk aversion. We also computed the average risk aversion coefficient of the whole sample, which is 1.32 (s.d. 1.0). Among the insured farmers, the average coefficient is 1.37 (s.d. 0.9) and among the non-insured, it is 1.26 (s.d. 1.1).

### Self-ranking for subjective patience, impulsiveness and exposure to weather hazards

Patience is used here as a proxy for time preference measurements. An ultra-short and self-measure of this parameter has been tested and validated by [Vischer et al. \(2013\)](#).

Impulsiveness is, along with patience, the control of behavioral factors that could affect a decision. Impulsiveness is not used as a proxy for time preferences but it can capture the effect of triggering elements that can explain a specific behavior (purchase or decision) ([Vischer et al., 2013](#)). Consequently, we used two self-assessment scales, one to estimate the degree of patience and the other for impulsiveness. The scales are from 0 to 10 where 0 corresponds to “very impatient” or “not at all impulsive” and 10 to “very patient” or “very impulsive”. The respondents have to select their own self-perceived degree of patience and impulsiveness with a cursor going from 0 to 10, one by one. For the self-perception of farm exposure to weather hazards, we used a self-ranking scale, going from 0 for “very little exposed” to 5 for “very strongly” exposed.

Table 2.6: Impatience, Impulsiveness and Exposure.

Variables	Detail	All	Insured	Non-Insured
Patience	0=very impatient to 10=very patient	5.98 (2.4)	5.91 (2.3)	6 (2.5)
Impulsiv	0=not impulsive to 10=very impulsive	4.28 (2.5)	4.4 (2.6)	4.1 (2.4)
FarmExposure	0=very little to 5=very strongly	3.31 (0.98)	3.47 (0.9)	3.15 (1.03)

On average, farmers are patient (5.98/10) not so very impulsive (4.28/10) and they think that their

farms are quite exposed to weather-related events (3.31/5). Few differences appear between the insured and the non-insured.

### 5-point Likert scale to identify the potential barriers to the adoption of crop insurance

For the barriers, we asked the subjects to express their level of agreement or disagreement for each of the 13 proposed reasons for not using the MRC contract, presented in Table 2.7, with five levels: Strongly disagree (1), Somewhat disagree (2), Indifferent (3), Somewhat agree (4), Strongly agree (5). The table presented the average score of each of the potential barriers on a scale from 1 to 5.

Table 2.7: Potential barriers to the adoption of crop insurance.

Variables	Detail	All	Insured	Non-Insured
BarrierPRICE	Too high price	4.16 (1.0)	3.9 (1.2)	4.37 (0.8)
BarrierDED	Too high deductible	4.2 (0.9)	4.19 (1)	4.21 (0.9)
BarrierTRIG	Too high threshold for triggering compensation	4.09 (1)	4.04 (1.1)	4.13 (0.9)
BarrierSHIFT	The time lag between the payment of the insurance and the payment of the grant generates cash flow problems	3.42 (1.1)	3.29 (1.2)	3.54 (1)
BarrierADMI	Too many administrative documents	3.3 (1.2)	2.89 (1.2)	3.7 (0.9)
BarrierINCO	Incompatibility of the proposed contracts with the growing calendar	2.76 (1.2)	2.27 (1)	3.24 (1.1)
BarrierPROB	Too low probability of receiving compensation	3.78 (1.2)	3.22 (1.3)	4.3 (0.9)
BarrierYIELD	The method used to calculate the guaranteed return (based on historical data) makes the coverage too low	4.0 (1.1)	3.96 (1.1)	4.05 (0.99)
BarrierPREV	Having adopted sufficient measures to prevent or fight against weather hazards	2.18 (1.1)	1.84 (0.9)	2.51 (1.2)
BarrierTRUST	I do not trust insurers	2.91 (1.2)	2.46 (1.1)	3.35 (1.2)
BarrierDIVE	I have diversified my activities enough to withstand a loss caused by weather hazards	2.59 (1.3)	2.03 (1.1)	3.14 (1.3)
BarrierCOMP	The time limit for receiving compensation for crop loss is too long	3.01 (1.1)	2.65 (1.2)	3.36 (0.9)
BarrierEARLY	I have to make my decision to subscribe too early in my campaign	2.95 (1.2)	2.62 (1.2)	3.27 (1.1)

We can observe that some barriers are clearly identified among the sample. In particular, those related to the characteristics of the insurance contract clearly appeared. For example, the fact that the level of the deductible is too high (*BarrierDED*), the price level is too high (*BarrierPRICE*) and the threshold for triggering compensation is too high (*BarrierTRIG*) were among the most frequently represented. Some differences between the insured and the non-insured respondents also appear concerning variables like *BarrierPROB* and *BarrierINCO* where more than a 1 point difference exists between the two sub-samples.

### Ranking to identify potential determinants of crop insurance purchase and barriers to its adoption

A ranking methodology has been previously used done in a self-administered survey on crop insurance issues by [Ginder and Spaulding \(2009\)](#). Consequently, in order to identify the determinants of insurance adoption, we asked the insured respondents (N=142) to rank the first three proposals (TOP3) that most highly encourage them to insure among the following ones: forecasted/anticipated bad weather,

external advice (cooperative members, neighbors, insurers, etc.), the level of subsidy, having previously suffered losses due to weather-related hazards, the flexibility of the contract and the options available, the obligations (due to contracting or the integrated sector, owner's request, etc.), a change of rotation or crop.

In addition, we asked the non-insured respondents (N=146) to rank the TOP3 proposals that "would" most encourage them to insure: lower insurance price, higher level of subsidy, grant applied directly at the time of payment, reduced administrative procedures, lower deductible and threshold for triggering compensation, higher insured yield, higher guaranteed price for compensation, cover for loss of quality, cover for losses due to pests, diseases and weeds.

We made the different proposals according to the results of our literature review and the hypotheses and assumptions we made.

Concerning the potential barriers, we asked the farmers to select the TOP3 that they considered to be the most important barriers among the 13 proposals presented above.

### 2.3.2 Econometric strategy

We proposed a random utility model (RUM, [McFadden and Reid \(1975\)](#)) in order to explain the choice to adopt or not to adopt a crop insurance contract.

Let  $v_i$ , be the level of utility of the farmer  $i$  for the insurance adoption  $y_i$ . Since  $y_i$  represents the adoption of a crop insurance contract, it can take on two modalities:  $y_i = 1$  for a crop insurance subscription or  $y_i = 0$  for no insurance coverage. Thus, two levels of utility can be defined,  $v_0$  and  $v_1$ , the utility level of non adoption and adoption of crop insurance, respectively. The farmer  $i$  will adopt a crop insurance contract if  $v_1 > v_0$  with:

$$v_{i0} = v_0(W_i - ELoss_i(RL_i, EXP_i, X_i, K_i), \epsilon_{0i}) \quad (2.1)$$

$$v_{i1} = v_1(W_i, p_i, X_i, \epsilon_{1i}) \quad (2.2)$$

where  $W_i$  is the total income of the  $i^{th}$  farmer and  $X_i$  is a set of explanatory variables representing farm and farmers' characteristics.  $ELoss_i(RL_i, EXP_i, X_i, K_i) = \gamma_1 RL_i + \gamma_2 EXP_i + \gamma_3 X_i - \gamma_4 K_i$  is a function representing the expected loss in the event of weather hazard, where  $RL_i$  is the recent loss incurred,  $EXP_i$  is a subjective perception measure of exposure to weather hazards, and  $K_i$  is the prevention tool in place.  $p_i$  is the insurance premium. Finally,  $\epsilon_i$  is an error term for unobserved variations.

The  $i^{th}$  farmer will insure if the difference in utility is higher than the disutility of the perceived cost of insurance  $\psi_i$ :

$$v_1 - v_0 > \psi_i(G_i, X_i, \epsilon_{2i}) \quad (2.3)$$



where  $G_i$  a set of barriers related to the contract characteristics and market design of crop insurance.

On that basis, we can define the latent variable  $y^*$ :

$$y_i^* \equiv v_1 - v_0 - \psi_i \quad (2.4)$$

With  $v_0$ ,  $v_1$  and  $\psi$  being linear functions, we can develop the indirect utility functions:

$$v_0 = \alpha_{01} + \alpha_{02}W_i - \alpha_{02}\gamma_1RL_i - \alpha_{02}\gamma_2EXP_i - \alpha_{02}\gamma_3X_i + \alpha_{02}\gamma_4K_i + \epsilon_{0i} \quad (2.5)$$

$$v_1 = \alpha_{11} + \alpha_{12}W_i + \alpha_{13}X_i - \alpha_{14}p_i + \epsilon_{1i} \quad (2.6)$$

$$\psi_i = \alpha_{21} + \alpha_{22}G_i + \alpha_{23}X_i + \epsilon_{2i} \quad (2.7)$$

From (5), (6) and (7), we can define:

$$y_i^* = \alpha_1 + \alpha_2W_i + \alpha_3X_i - \alpha_{14}p_i + \alpha_{02}\gamma_1RL_i + \alpha_{02}\gamma_2EXP_i - \alpha_{02}\gamma_4K_i - \alpha_{22}G_i + \epsilon_{012i} \quad (2.8)$$

with  $\alpha_1 = \alpha_{11} - \alpha_{01} - \alpha_{21}$  ;  $\alpha_2 = \alpha_{12} - \alpha_{02}$  ;  $\alpha_3 = \alpha_{13} - \alpha_{02}\gamma_3 - \alpha_{23}$  and  $\epsilon_{012i} = \epsilon_{1i} - \epsilon_{0i} - \epsilon_{2i}$

Thus, the decision to insure ( $y=1$ ) or not ( $y=0$ ) can be represented as follows:

$$y_i = \begin{cases} 1 & \text{if } y_i^* > 0 \\ 0 & \text{otherwise} \end{cases} \quad (2.9)$$

We split our econometric approach into a two-step analysis regarding the binary variable of crop insurance adoption (insured or not for the ongoing campaign) as our variable of interest.

In the first step, we processed the cross-sectional data from our survey through a probit model (Eq. 2.10).

$$Pr(y = 1|G_i, K_i, X_i, W_i, RL_i, EXP_i) = \Phi[\delta G_i + \gamma K_i + \beta_1 X_i + \beta_2 W_i + \beta_3 RL_i + \beta_4 EXP_i] \quad (2.10)$$

where  $y$  is the binary variable on crop insurance adoption,  $G$  and  $K$  are vectors of potential barriers to insurance adoption and prevention tools implemented, respectively (Table 2.7),  $X$  is a vector of farm and farmers' characteristics (Tables 2.3, 2.4, 2.5 and 2.6),  $W$  represents the income (Table 2.3),  $RL$  is the occurrence of recent losses (Table 2.4) and  $EXP$  is the subjective measure of risk exposure (Table 2.6).

In the second step, we adopted a dynamic approach of the adoption of crop insurance (Eq. 2.11). In the survey, the respondents were asked whether or not they were also insured in T-1 and T-2 (two separate questions). With this information, we constructed an alternative panel database of our responses, assuming a constant set of parameters (area, participation in a cooperative or trade union, family situation, measures of behavioral variables, etc.) over the three years studied. Using this database of 864 observations (288 individuals over 3 years), we performed a dynamic probit model. We estimated a dynamic random effects probit model with unobserved heterogeneity using the `xtpdyn` on Stata developed and presented by Grotti and Cutuli (2018). The regression equation is presented in Grotti and Cutuli (2018) as follows:

$$\begin{aligned} Pr(y_{it} = 1 | y_{i,t-1}, \dots, y_{i0}, G_i, K_i, X_i, W_i, RL_i, EXP_i, Z_{it}, c_i) = \\ \Phi[\rho y_{t-1} + \delta G_i + \gamma K_i + \beta_1 X_i + \beta_2 W_i + \beta_3 RL_i + \beta_4 EXP_i + \sigma Z_{it} + c_i] \end{aligned} \quad (2.11)$$

with

$$c_i = \alpha_0 + \alpha_1 y_{i0} + \alpha_2 \bar{Z}_i + \alpha_3 Z_{i0} + a_i \quad (2.12)$$

where  $y_{it}$  is once again the binary variable on crop insurance adoption for individual  $i$  at period  $t$ ,  $y_{it-1}$  captures the state dependence,  $Z$  is a vector of time-varying explanatory variables considered to be strictly exogenous, conditional on the unit-specific unobserved effect  $c_i$ .  $y_{i0}$  and  $Z_{i0}$  are the initial value of the dependent variable (crop insurance) and of the time-varying explanatory variables, respectively.  $\bar{Z}_i = \frac{1}{T} \sum_{i=0}^T Z_{it}$  is the time-average of the explanatory variables,  $a_i$  is a specific time-constant error term, normally distributed with mean 0 and variance  $\sigma_a^2$  (Grotti and Cutuli, 2018).

In order to provide instrumental data for the dynamic approach, we collected departmental climate data for the years 2017, 2018 and 2019. Thus, we completed the database with information on the departmental minimum and maximum temperature recorded during the year (*Min. Temperature* and *Max. Temperature*), the cumulative annual rainfall (*Total Precipitation*) and sunshine (*Total Sunshine*) and the maximum gust speed recorded over the year (*Max. Wind gust*). Since the decision to insure or not for the forthcoming campaign has to be made at the end of the calendar year, we matched 2019 climate data for the decision to insure or not for 2020, 2018 data for the decision for 2019, and 2017 data for 2018.

## 2.4 Results

We propose to analyze our results in two steps. In the first step, we present the results of the econometric strategy dealing with the determinants and barriers to the adoption of a crop insurance contract. In the second step, we focus on adopters (of insurance contracts), on the one hand, and non-adopters, on the other, and the variables that support them in their choice. The first step will use econometrics to test our assumptions and the second will verify our results and classify the relative importance of our different variables.

### 2.4.1 Determinants and barriers to insurance adoption

Since our approach is based on the analysis of barriers to insurance adoption, we first regressed our variable of interest with the different barriers presented in Table 2.7. We then added all the control variables<sup>10</sup> and parameters at our disposal. Table 2.8 presents the results of two cross-sectional probit regressions (Eq. 2.10) and Table 2.9 presents the results of the complete<sup>11</sup> dynamic probit regression (Eq. 2.11). We begin with the interpretation of Table 2.8.

In the first regression in Table 2.8, we test the effects of the barriers to insurance adoption. We observe that the barriers alone lead to a  $R^2$  of 0.35, which already explains one-third of the insurance adoption. Among the 13 potential barriers we propose to rate from 1 to 5, we find a significant effect on the decision to insure for seven of them. Two of them have a positive and significant impact: the excessively high level of the deductible (*BarrierDED*) and of the threshold for triggering compensation (*BarrierTRIG*). Our results suggest that the more the farmers find the deductible level too high (as well as the triggering threshold), the more likely they are to insure. These results, particularly counter-intuitive, imply that insured farmers well understand the implication of the contract characteristics and emphasize their dissatisfaction regarding these two characteristics (usually at the same level) through this ranking. Meanwhile, we could say that non-insured farmers are not particularly aware of these characteristics or that their choice to insure or not is made before they even look at the different terms of the contracts. The five other barrier proposals have a negative and significant impact on insurance adoption. Thus, the excessively high price (*BarrierPRICE*), too many administrative documents (*BarrierADMI*), the incompatibility of the proposed contracts with the growth calendar (*BarrierINCO*), the low probability of receiving compensation (*BarrierPROB*) and the sufficient diversification of the activities (*BarrierDIVE*) act as a disincentive to insurance adoption. The cost of insurance is naturally the biggest barrier for the farmers. As we will see later, 171 farmers ranked this proposal as one of their TOP3 deterrents. The purpose is to see beyond this first step and to look at the specifications of the contract proposed at this cost. Moreover, the administrative management of the crop insurance contract is a significant barrier for adoption. If insurance is too costly in terms of time and required information, the farmers are discouraged to insure. The fact that the decision to insure could be too early for the farmer's growing season seems to be a determinant. Considering themselves diversified enough is a major element explaining the non-subscription to the insurance scheme, which has notably also been highlighted by Falco et al. (2014).

<sup>10</sup>Both *Education* and *Income* variables are treated as continuous variables in the models. The "Prefer not to answer" respondents for *Income* were included in category (3) since it is the median.

<sup>11</sup>Table 2.13 of Appendix 2.7.3 presents six regressions that progressively lead to the full model presented here.

Table 2.8: Cross-sectional probit regressions.

	Crop Insurance adoption	
	(1)	(2)
BarrierPRICE	-0.201*	-0.217
BarrierDED	0.263**	0.587**
BarrierTRIG	0.322**	0.282
BarrierSHIFT	0.060	0.289
BarrierADMI	-0.177**	-0.112
BarrierINCO	-0.293***	-0.350*
BarrierPROB	-0.563***	-0.813***
BarrierYIELD	0.176	-0.040
BarrierPREV	-0.035	-0.300
BarrierTRUST	-0.111	-0.438**
BarrierDIVE	-0.265***	-0.152
BarrierCOMP	-0.129	-0.297*
BarrierEARLY	0.082	0.174
<i>TypeAgri</i>		
1.Field Crops (FC)		0
2.Wine		0.716
3.FC and Breeding		0.699
4.Breeding		-1.070
5.Diversified-other		0.214
<i>Localisation</i>		
1.North		0
2.West		-0.645
3.East		-1.341**
4.South		0.538
Surface area		0.004
Irrigation		-0.323
Contract		-0.739*
WorkForce		0.712*
Coop		1.751***
Syndicate		-0.485
FarmExp		-0.017
FamilyFarm		0.623
Label		0.877**
Nitrogen		0.096
Disaster		0.437
Compensation		2.052***
RecentLoss		1.483***
Age		-0.001
Gender		0.819*
Education		-0.001
<i>Marital</i>		
0. Single		0
1. Married or Civil-union		0.945
2. Divorced or Widowed		0.577
3. NSPP		-0.551
HouseholdSize		-0.338
<i>SpouseOccupation</i>		
1.Single		0
2.Yes		-0.584
3.No		-1.043
Income		-0.048
NonAgriIncome		-0.119
<i>Tenure</i>		
1.Landowner		0
2.Tenant		-1.679**
3.Tenant-Owner		-0.795*
FarmExposure		0.252
CoeffRA		-0.011
Patience		0.135*
Impulsiv		0.037
Constant	2.313***	-1.432
R <sup>2</sup>	0.3581	0.6894
Observations	288	288

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table 2.9: Dynamic probit regression.

	Crop Insurance adoption
	(3)
L.Insurance	3.21***
BarrierPRICE	-0.286
BarrierDED	-0.202
BarrierTRIG	0.430*
BarrierSHIFT	0.319
BarrierADMI	-0.041
BarrierINCO	-0.155
BarrierPROB	-1.06***
BarrierYIELD	0.208
BarrierPREV	-0.157
BarrierTRUST	-0.441**
BarrierDIVE	-0.114
BarrierCOMP	-0.053
BarrierEARLY	0.186
<i>TypeAgri</i>	
1.Field Crops	0
2.Wine	-1.069
3.FC and Breeding	0.248
4.Breeding	-0.952
5.Diversified-other	0.089
<i>Localisation</i>	
1.North	0
2.West	1.705
3.East	-1.514
4.South	-1.497
Surface area	0.009***
Irrigation	-0.412
Contract	-0.210
WorkForce	0.703
Coop	0.734
Syndicate	-0.506
FarmExp	1.627
FamilyFarm	0.692
Label	1.109*
Nitrogen	0.059
Disaster	0.222
Compensation	0.828*
RecentLoss	
Age	
Gender	0.384
Education	-0.097
<i>Marital</i>	
0. Single	0
1. Married or Civil-union	1.398*
2. Divorced or Widowed	-0.785
3. NSPP	-1.748
HouseholdSize	-0.129
<i>SpouseOccupation</i>	
0.Single	0
1.Yes	-1.398
2.No	-2.330**
Income	0.044
NonAgriIncome	0.259
<i>Tenure</i>	
1.Landowner	0
2.Tenants	-2.105**
3.Tenant-Owner	-1.364**
FarmExposure	0.221
CoeffRA	-0.020
Patience	0.116
Impulsiv	0.074
Min. Temperature	0.177
Max. Temperature	0.956*
Total Precipitation	0.008
Total Sunshine	-0.004
Max. Wind Gust	-0.017
Constant	72.85
Observations	576
Number of groups	288

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Introducing the other variables improves the adjustment with a  $R^2$  of 0.69. The effect of the barriers is slightly modified since the variables *BarrierPRICE*, *BarrierTRIG*, *BarrierADMI* and *BarrierDIVE* are no longer significant, whereas *BarrierTRUST* and *BarrierCOMP* become significant. The “Compensation” barrier indicates that non-insured farmers believe that the time taken for compensation in the event of a claim is too long, which seems to go along with the notion of trust. Indeed, we find a negative effect of our barrier “Trust”, which means that not trusting the insurer negatively affects the likelihood of insurance adoption. This result is intuitive. In addition, as shown in Fig. 2.2, the non-insured farmers rank this notion of trust much more often in their TOP3 barriers.

Concerning the other variables tested, we found no specific effect of the different typologies of agricultural activities that we tested. Our sample is highly composed of wine growers and field crop producers, both being the most highly insured compared to the other types of farmers. Location has a significant impact only for farmers in eastern France who are less likely to insure than those located in the north. Farmers involved in a contractualization process (either upstream or downstream of the sector) are less likely to insure. Contractualization can already be perceived as an element of risk management. In contrast, being part of an agricultural cooperative has a significant and positive effect, whereas belonging to a syndicate has no impact.

Concerning the farm’s characteristics, we observe that the surface area has no impact, nor do the use of irrigation or nitrogen. However, having a certification (*Label*), being part of a farm cooperative and working with others on the farm (*WorkForce*) have a significant and positive effect on insurance adoption. In the same way, having suffered from yield losses due to weather events in the last 2 years (*RecentLoss*) and having already received compensation for crop losses from an insurer (*Compensation*) significantly encourage insurance adoption.

Finally, we show that some farmers’ characteristics also impact insurance adoption. In particular, the tenure seems to be important. Indeed, being a tenant or tenant-owner (as compared to a landowner) significantly discourages the farmer to insure compared to the full ownership situation. The income level is treated here as a continuous variable (and not in the categorical way presented in Table 2.3) but does not appear to be significant. The last significant variable is the degree of patience. We find that the more patient farmers think they are, the more likely that they will subscribe to crop insurance, which is consistent with the economic literature concerning time preference, discount rate and insurance demand (Hill et al., 2013). We found no significant effect of risk aversion and impulsiveness measures on crop insurance adoption.

Now, if we look at Table 2.9, we observe that some of the results are similar to those presented in Table 2.8. This is the case for the variables *Tenure*, *Compensation* and *Label*. However, some

differences appear as well. Because of the way the question was asked, the variable *RecentLoss* could not be preserved in the construction of the panel dataset. The variable *Surface area* is now positively significant, meaning that the larger the farm is, the greater the incentive will be to adopt an insurance contract, which is in line with [Enjolras and Sentis \(2011\)](#). The farmer's marital situation appears to be significant as well: being married or in a civil union has a positive and significant impact compared to being single. Moreover, the fact that the spouse does not work outside of the farm reduces the chances of crop insurance adoption. The significant barriers are also different: *BarrierTRIG* has a positive effect, whereas *BarrierPROB* and *BarrierTRUST* have a negative one. Concerning the instrumental variables, only the annual maximal temperature has a significant and positive effect on farmers' insurance adoption. The main point of running this dynamic analysis was to assess the impact of the previous (T-1 and T-2) adoption of insurance on the current adoption decision (T). We found that the variable *L.Insurance* is positive and highly significant, reflecting an inertia for previously insured farmers that confirms the results of [Enjolras and Sentis \(2011\)](#) and [Enjolras et al. \(2012\)](#).

## 2.4.2 Adopters vs. non-adopters: the variables of influence

### Identification of the main barriers

In the previous section, we used the results of the 13 5-point Likert scales linked to the proposed barriers to the adoption of crop insurance. After this step, respondents had to classify their TOP3 among these proposals ([Table 2.7](#)) in the survey. Looking at the ranking, we can observe that additional information is provided their relative perception of the crop insurance scheme and its characteristics. The following figure ([Fig. 2.2](#)) represents the occurrences of answers as TOP1 (dark gray), TOP2 (gray) and TOP3 (light gray) among the proposals of main barriers to crop insurance adoption for both insured ( $i$ ) ( $N=142$ ) and non-insured ( $n$ ) ( $N=146$ ) respondents.

It appears that insured and non-insured respondents do not rank the barrier proposals in the same order. For both populations, the price of the insurance (i.e., the premium) is an important barrier, as expected, but the proposal “the probability of receiving a compensation seems too low to me” is ranked second for the non-insured population, whereas it is ranked fifth for the insured population. This difference could reflect an adverse selection effect, or at least a subjective one, in which the insured farmers feel at risk. The characteristics of the contract, such as the deductible level, triggering threshold or insured yield, appear to be important barriers, especially for the insured population. The deductible level proposal, even though it ranks first less often, has a higher recurrence in the global TOP3 classification of the insured population.

As expected, we found more recurrence of the proposals linked to the diversification and the preven-

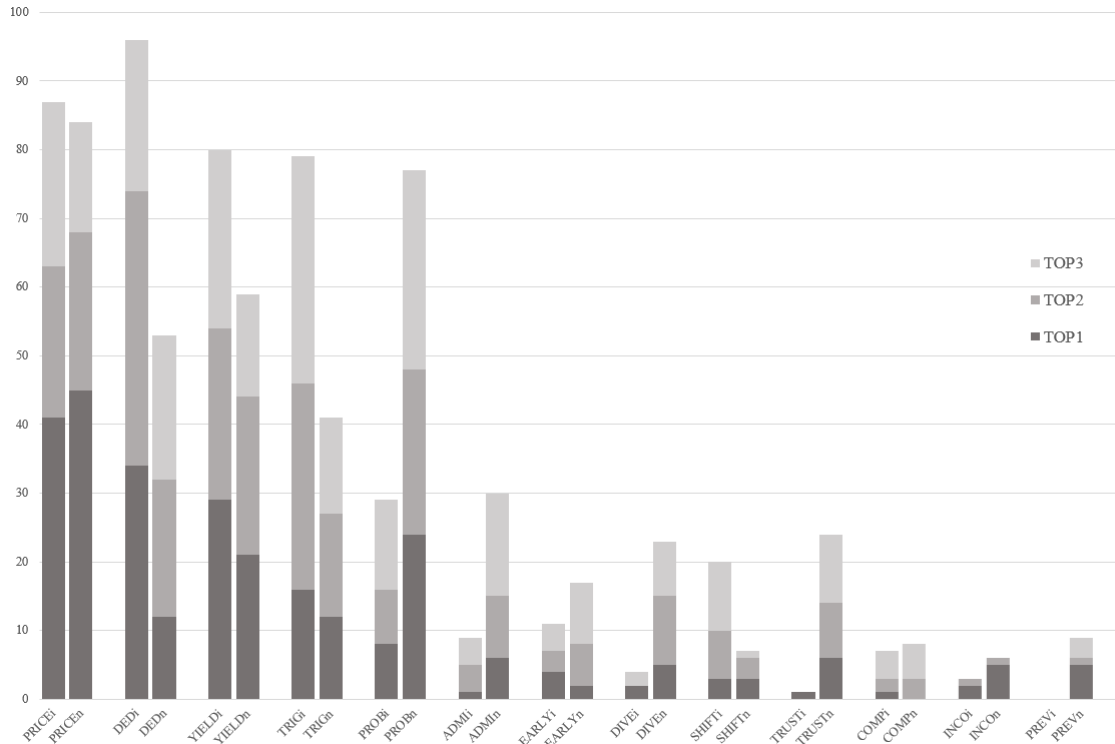


Figure 2.2: Main barriers to crop insurance adoption for insured (indexed  $i$ ) and non-insured (indexed  $n$ ) respondents.

tion tools for the non-insured population, which confirms the negative and significant effect of *Barrier-DIVE* (Table 2.8).

The administrative burden linked to the subscription and followed by the application for the subsidy is much more often classified as a top barrier for the non-insured than for the insured population (which confirms the sign and significance of *BarrierADMI* in Table 2.8).

### The determinants of adoption (or entry)

In the following section, we use the third group of questions linked to the determinants of crop insurance adoption. Figures 2.3 and 2.4 represent the classification made by crop insurance adopters regarding elements that convinced them to insure and non-adopters regarding potential changes that could convince them to adopt crop insurance, respectively. Both figures represent the occurrences of answers as TOP1 (dark gray), TOP2 (gray) and TOP3 (light gray) among the proposals.

For the crop insurance adopters (Fig. 2.3), the occurrence of previous crop *Losses* due to weather hazards is by far the most important factor among the proposals. Out of the 142 adopters, 81 ranked it as their first motivation. This confirms the positive and significant effect of the variable *RecentLoss* obtained in Table 2.8. In total, 124 of them placed this proposal in their TOP3. *Weather* forecasting is

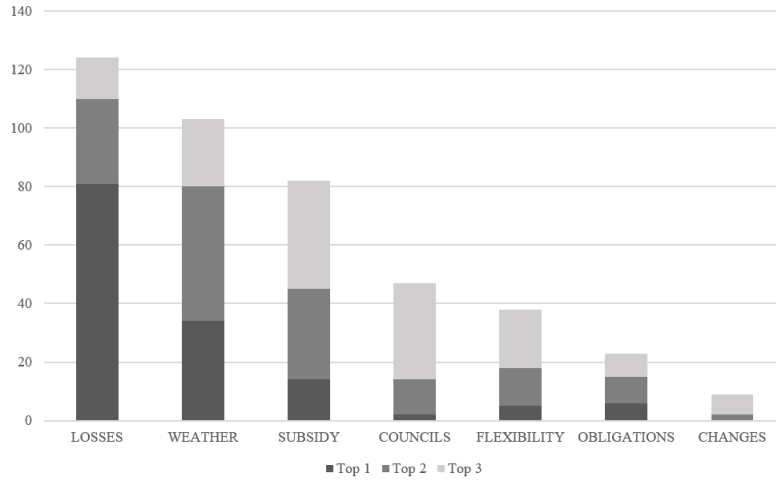


Figure 2.3: Factors encouraging crop insurance adoption.

the second most important element, followed, in third place, by *Subsidy*. This highlights the importance of the meteorological projections given in October for the respective germination and growth period of crops. Among the other proposals, *Obligations* is the fourth most frequent TOP1 ranking proposal. Crop insurance adoption could be mandatory in different contracts in which the farmer is a signatory. More data and deeper analysis regarding the quality of coverage of this kind of profile would be particularly relevant. Moreover, it appears that crop insurance is not seen as an obvious tool to support a change in practices since the proposal *Changes* is by far the least often chosen.

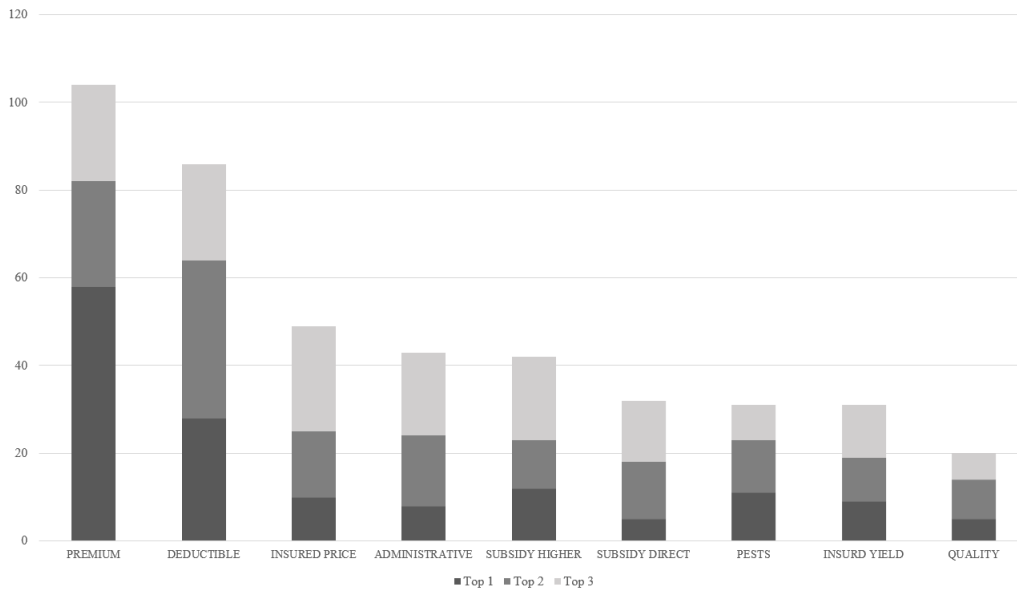


Figure 2.4: Potential entry factors in the crop insurance market.

For the non-adopters (Fig. 2.4), as expected, the reduction of the insurance *Premium* is by far the main factor that could convince farmers to join the crop insurance market. A total of 104 out of the 146 non-adopters placed this proposal in their TOP3, 58 of whom ranked it as the first factor. It appears important to link this proposal with the proposals at the level of *Direct Subsidy* and its payment



modalities. An increase in the subsidy or a decrease in the premium should be seen as substitutes, but our results suggest that it does not appear to be so for farmers. This is probably partially due to the modality of payment of the subsidy. In addition to impacting cash flow, particularly for smaller farms, the time lag between the payment of the premium and reception of the subsidy has an impact on the farmer's perception of the cost of insurance. Indeed, due to this time lag, it is likely that the farmers, in their mind, disconnect the payment of the premium and the reception of the subsidy, especially since they may receive different subsidies for their farms for different reasons (decoupled aid, coupled animal aid, compensatory allowance for natural handicaps, etc.). Once again, the deductible level<sup>12</sup> appears to be a major feature of interest. The other proposals have relatively the same rate of occurrence.

Regarding the contract characteristics, reducing the level of deductible and triggering threshold (*Deductible*)<sup>13</sup> is the main factor (after *Premium*) that could tempt non-adopters to adopt insurance. Even if these parameters are more frequently declared as an issue for the insured population (Table 2.8 and Table 2.9), reducing the level of both parameters should tempt hesitant farmers to insure. The *Insured price*, controlled by an official chart, appears to be more of an issue than the *Insured yield* modality (based on an "olympic" average). *Pests* and *Quality* coverage are among the last proposals. More data and deeper analysis would be necessary to analyze these two proposals. We assume that these parameters are more important for fruit and vegetable growers who are not numerous enough in our sample and who are the least covered by crop insurance contracts, even if they produce the most weather-sensitive products.

## 2.5 Discussion

### 2.5.1 Summary of the results

We summarize the results of the hypothesis testing in Table 2.10.

To sum up our results and review our hypotheses, we found that the occurrence of recent loss (**H1d**) and having already received compensation from an insurer (**H3b**) increase the likelihood to adopt crop insurance. Farmers already insured tend to insure again, which can be interpreted as an "inertia" or "fidelity" effect toward crop insurance (**H3a**). In terms of farm and farmers' characteristics, we found no significant effect that crop insurance is less often adopted by farmers with lower income levels (**H2a**), but we found a significant and positive effect of the farm size (in hectares) in (2) (**H1a**). We found no effect of household size (**H2b**) on the likelihood of crop insurance purchase. Regarding behavioral variables, we did not find a significant effect, either for risk aversion (**H4a**) or for risk perception (**H4b**). Time

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<sup>12</sup>This proposal also took into the triggering threshold into consideration since it was presented as "A lower deductible and threshold for triggering compensation".

<sup>13</sup>Usually at the same level. The triggering threshold could be higher than the deductible but not the opposite.

Table 2.10: Hypothesis validation.

<b>H1</b>		<b>Farm characteristics</b>
✓	H1a	Farm size ↗
X	H1b	Irrigation and diversification ↘
✓	H1c	Diversification ↘
✓	H1d	Recent losses ↗
<b>H2</b>		<b>Farmers' and household characteristics</b>
X	H2a	Lower income level ↘
X	H2b	Household size ↘
<b>H3</b>		<b>Past crop insurance experience</b>
✓	H3a	"Fidelity" or "Inertia" effect ↗
✓	H3b	Having already received compensation ↗
<b>H4</b>		<b>Behavioral variables</b>
X	H4a	Risk aversion ↗
X	H4b	Risk perception ↗
✓	H4c	Preference for the present ↘

preferences, that we assessed with the patience measurement, influence crop insurance adoption (**H4c**) since the least patient farmers are significantly less likely to insure; however the impulsiveness measure has no significant effect. Concerning the other risk management tools and strategies, we show that diversification (**H1c**) has a significant and negative effect, whereas irrigation has no impact (**H1b**). Finally, the perception farmers have of the contract characteristics affect significantly affects their decision, and intrinsic brakes exist in the design of the scheme, such as the administrative burden associated with it and the incompatibility of the proposed contracts with the growing calendar.

Three stages of analysis seem to follow each other in the process of deciding whether or not to buy crop insurance for a farmer.

First: *Is the likelihood of being damaged and compensated for high enough?* This first step is highlighted by the importance of the expected weather in the factors that influence insurance adoption (Fig. 2.3), the perceived probability of compensation in Fig. 2.2, and the significance of the variable *BarrierPROB* in our models (Tables 2.8 and 2.9). Since crop insurance is not mandatory like other traditional insurance contracts, farmers may perceive the crop insurance subscription as an "investment" or a "bet" from which they want a return (effect also highlighted for flood insurance by Kunreuther and Pauly (2005)). This questioning is also influenced by the trust in the insurer: that if losses occur, the insurers do not try to avoid compensation. Trust is more an issue for the non-insured than for the insured (Fig. 2.2), which seems to be counterbalanced by experience with crop insurance and, in particular, having been compensated in the past (Tables 2.8 and 2.9).

Then: *If I receive a compensation, how much will it be? Will this level of compensation satisfy me?* Here, we take a closer look at the contract characteristics and how the combination of these parameters

provides information on the level of compensation for a given loss.<sup>14</sup> The deductible level appears as a major element of consideration for farmers as can be seen by its significance in the regression (Table 2.8), in the classification of the barriers (Fig. 2.2) and in the potential entry factors (Fig. 2.4). This parameter, closely linked to the triggering threshold, reveals the part of the damage not compensated for and, therefore, the level of loss above which compensation will be paid (since the deductible and triggering thresholds are usually at the same level, we suspect a confusion of their roles for some farmers that we did not investigate).

Finally: *Taking into consideration the probability I perceive of being compensated and the “quality” of this compensation, is the premium I have to pay worth it?* According to the interest the farmers assess of adopting crop insurance, they will judge the level of premium required for coverage. The premium level appears as the main barrier, as expected (Figs. 2.2 and 2.4). The price of insured is also significant through the variable *BarrierPRICE* (Table 2.8, model (1)). In order to sustain the offer and reduce the impact of this brake, public authorities have implemented large subsidies. However, this principle of interchange-ability between a reduction of the premium and an increase of the subsidy as a reduction of the premium level appears as the main factor to convince farmers to take out insurance, but an increase in the subsidy level appears only in fifth position among these factors (Fig. 2.4). We assume that the shift between the payment of the premium and the payout of the subsidy is one of the main explanatory factors. Even if it does not appear to be significant in our model, we found, after analysis of the brakes according to income groups, that it is an issue especially for farms with the least cash flow capacity and could be an explanation for the lowest adoption rate of fruit farmers where the high value and vulnerability of the crops induce a high level of premium per hectare. Moreover, crop insurance expenses are consistent with a global risk management allowance. Thus, farmers may decide to invest in other instruments such as prevention tools or bet on other risk management strategies like agricultural and non-agricultural diversification (prevention and diversification level perception appears to be more important for the non-insured (Fig. 2.2), and the variable *BarrierDIVE* negatively and significantly affects the likelihood of crop insurance adoption (Table 2.8, model (1)). Since all of the efforts and investments made for prevention are not valued by a reduction in the level of the premium, even though it decreases the risk-exposure of the farmers, these kinds of instruments are substitutes for crop insurance from the farmer’s point of view.

This whole line of reasoning is influenced by the farmer’s profile. As previously mentioned, time preference, measured with the *Patience* variable, positively and significantly influences the likelihood of crop insurance adoption (Table 2.8), assigning a higher value to future compensation than farmer with a strong preference for the present would assign. Risk perception, impulsiveness and risk attitude do not

<sup>14</sup>A compensation is defined by the loss rate its triggers (i.e., triggering threshold), the share of the losses actually compensated for (i.e., deductible) and the insured amount (i.e., historical yield) associated with the insured price.

have a significant effect on the likelihood to purchase crop insurance.

## 2.5.2 Public policy implications

Three degrees of risks are usually considered. They correspond to the OECD approach in terms of risk management and resilience in agriculture: a normal and usual risk, frequent and with low impact left to the farmer's charge; a marketable risk, less frequent and with higher impact that could be transferred to an insurer if it meets the insurability criteria; and a catastrophic risk, infrequently provoking high damage to production and impacting a large number of farmers for which a public intervention is required. The French government is currently considering this three-layer approach<sup>15</sup> and adapting its risk management policy in agriculture by proposing and subsidizing different tools. In relation to the normal risk (the first layer), French authorities encourage the implementation of prevention tools, which include, self-protection and self-insurance mechanisms (Ehrlich and Becker, 1972). Self-protection tools aimed at reducing the probability of occurrence of the damage, like hail nets, anti-frost devices and irrigation systems, can be the subject of public investment aid. Similarly, the French government promotes self-insurance tools aimed at reducing the damage in the event of risk occurrence. For example, the government encourages precautionary savings through tax deductions with the "*Déduction pour épargne de précaution (DEP)*", which makes it possible to place a share of the annual profits on a specific account with the aim of using it to smooth out the farmer's income in the following years.

For the policy-maker, the challenge is to create or maintain the synergy and complementarity of these tools with crop insurance. The national strategy follows this three-layer approach, where each layer is associated with different instruments. In the name of coherence and efficiency, prevention tools, crop insurance and disaster aids have to be perceived by farmers as being complementary, which is currently not the case. Prevention efforts should be taken into consideration when determining the premium level, and the scope of the agricultural disaster scheme should be clarified. The new reform<sup>16</sup> develops these two points. The next set of specifications drawn up by public authorities will establish measures and practices that are intended to decrease the premium level if implemented by the insured person. The complementarity between crop insurance and disaster scheme is then defined by a threshold of compensation. According to the size of the losses, farmers will be compensated by either their insurers or the FNGRA but with a single point of contact ("one-step service desk"). Moreover, the share of public assistance related to disaster events will slowly decrease for non-insured farmers.

We have seen in our analysis that the deductible level is a major parameter regarding crop insurance contracts, especially for farmers who are already insured. Farmers perceive it as a main barrier and

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<sup>15</sup>Draft law n°4758, reforming the tools for managing climate risks in agriculture, December 1, 2021.

<sup>16</sup>Agricultural orientation law no. 2022-298 of March 2, 2022, concerning the improved distribution of agricultural harvest insurance with the intent to reform agricultural climate risk management tools. JORF n°0052 of March 3, 2022.

it seems to make adoption less attractive since it was still ranked as the second major barrier by the non-insured respondents. The incoming reform (applied as of January 1, 2023) introduces a reduction from 30% to 20% of the deductible level for the basic MRC contract. In their evaluation report, [Boucher et al. \(2019\)](#) state that the deductible reduction option is quasi-systemic for MRC subscribers but implies a considerable increase in the premium since going from a 25% to a 20% level implies, according to their estimation, a 40% surplus of the premium (a 40% subsidy rate is eligible on this surplus). The standardization of the 20% rate may attract more farmers and will be included in the main subsidy rate. The reform also implements a measure originally intended in the OMNIBUS regulation<sup>17</sup> by raising the main subsidy rate from 65% to 70%. This increase in the subsidy is intended to encourage adoption. However, even if the amount of the subsidy is considerable, we argue that the way the subsidy is distributed is also particularly important and should be improved. In order to really perceive the subsidy as a reduction in the premium level, this subsidy should be directly applied when paying the insurance premium, as it is the case in Spain, for example. Public authorities may consider the creation of an entity responsible for handling this time lag, like *AgroSeguro* in Spain.

The stated goal of public authorities is to expand the insured pool as much as possible in order to increase its pooling quality and lessen the standard market failures of insurance markets (moral hazard and adverse selection). The French Federation of Insurance (Fédération Française de l'Assurance, FFA) estimates that 70% of the French agricultural area should be insured to achieve technical and financial equilibrium in the market ([Descrozaille, 2021](#)). This reform should help to move in this direction, but there is no evidence of major changes in the less insured crops that would encourage them to enter the market. Since their implementation, MRC contracts have never convinced the fruit growers, and additional and specific studies in this area seem necessary. It appears that a significant proportion of farmers have a fairly fixed idea about their insurance needs and that this idea is not challenged every year. In our models, the characteristics of the contracts are particularly significant for the insured farmers, whereas the non-insured farmers are more likely to highlight the obstacles related to the compatibility of their situation and the lack of need and trust for insurance coverage. More widespread information on available offers and their greater adaptability could convince new farmers to enter the market.

Our results imply an inertia effect in crop insurance adoption that has previously been highlighted by [Enjolras et al. \(2012\)](#) and [Santeramo \(2019\)](#). [Santeramo \(2019\)](#) particularly underlines the role of information and experience in the crop insurance adoption process in Italy and suggests that it may be relevant to add an additional subsidy to the main one for a first subscription in order to convince farmers to enter the market. Regarding how significant and important the fact of being insured during the previous year is in our results, we can only take up and support this proposal. The problem arises, however, as to the compatibility of such a measure with WTO rules.

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<sup>17</sup>The OMNIBUS regulation was adopted in 2017 by the European Parliament within the framework of the new CAP guidelines. This new regulation should have come into operation in January 2018 but has been delayed.

Further research could focus on the expansion of the scope of risks covered by the current crop insurance contract toward pests, diseases and insect risks. Current single and multi-peril contracts available in France only cover weather-related events, whereas in the US, multi-peril contracts cover weather hazards and pest risks. Since these risks are also major concerns for farmers, the extension of insurance coverage could attract new policyholders and improve the quality of mutualization. The proposal *PESTS* does not appear in the top proposals of potential entry factors (Fig. 2.4), but we assume that it would be ranked higher if our sample was composed of a higher proportion of fruit and vegetable growers.

## 2.6 Conclusion

This paper is part of a debate in France (as well as in other European countries) on the reform of the crop insurance scheme. In particular, since the current scheme encompasses only 30% of the agricultural surface area, the question of the determinants and barriers to the adoption of an insurance contract is relevant. To address this question, we propose an original survey approach that combine different methodologies in order to capture as many as possible of the potential explanations. In this context, we confirm some existing effects (recent loss, inertia, etc.) and we display new ones, especially concerning the behavioral variables (patience) and the identification of relevant barriers (price, deductible, trigger, etc.). We discuss the policy implications of these results.

The collection of the data was complicated and quite long. We succeeded in collecting 288 full answers, but we expected more in the beginning. A deeper analysis could have been made if more responses had been collected. Because of our sample size, we were not able to analyze the crop insurance adopters in greater depth. In particular, we had variables regarding the type of contract and the various options the farmers subscribed to, but we could not use this information in this article. It would have been interesting to look at the differences in contracts adopted regarding risk perception and preferences, as well as at the differences in choices made between farmers who voluntarily subscribe and those who subscribe to respect contractual clauses. Moreover, a main issue regarding the current French crop insurance scheme is the large inequalities of coverage between crops. Unfortunately, we lacked responses from fruit and vegetable growers who are the least insured and among the most exposed to weather hazards and climate change. Further research in these directions should be privileged.

A relevant extension to the current research would be to consider other behavioral variables. First, measuring ambiguity preferences may be an interesting issue. Indeed, the literature has already shown the role of ambiguity aversion in an insurance context, both experimentally and theoretically (Kunreuther et al., 1995; Alary et al., 2013). In addition, farmers' ambiguity aversion has already been quantified, including for French farmers (Bougherara et al., 2017; Tevenart and Brunette, 2021). However, the link between farmers' ambiguity preferences and crop insurance adoption has never been established.

Consequently, measuring ambiguity aversion, in addition to risk aversion, may allow a finer representation of farmers' behavior. To do this, the experimental measurement of ambiguity preferences based on the MPL approach has been proposed by [Chakravarty and Roy \(2009\)](#) and may be helpful. Second, we can envisage including loss aversion, considered in Prospect Theory (PT) ([Kahneman and Tversky, 1979](#)). Indeed, some articles show that French farmers behave, to some extent, in accordance with PT ([Reynaud and Couture, 2012](#); [Bocquého et al., 2014](#); [Bougherara et al., 2017](#)). Expected Utility theory does not distinguish between gains and losses, whereas in PT, outcomes are categorized as either gains or losses as regards a reference point, and individuals can behave differently in each domain. In addition, PT allows us to consider the probability weighting that refers to an individual's tendency to distort objective probabilities. A classical way in experimental economics to estimate the different parameters of the PT is the MPL methodology proposed by [Tanaka et al. \(2010\)](#). Such observations auger particularly interesting avenues for future research.

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## 2.7 Appendix

### 2.7.1 Appendix A. Evolution of the MRC policy since 2005

Table 2.11: Evolution of the MRC policy since 2005.

<i>Diffusion rate</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>Fields Crops</b>	25%	25.8%	27.1%	28.9%	26.0%	27.6%	30.3%	30.8%	31.7%	30.9%	26.5%	26.4%	30.1%	31.0%	32.1%	33.3%
<b>Wine</b>	0.6%	10.2%	11.5%	12.9%	13.7%	15.8%	17.1%	18.8%	19.2%	23.6%	23.3%	25.0%	26.2%	31.5%	32.4%	34.0%
<b>Fruits</b>	0.8%	1.7%	1.9%	2.1%	2.2%	2.4%	2.7%	2.7%	2.4%	2.5%	2.2%	2.6%	2.7%	2.8%	2.8%	3.1%
<b>Vegetables</b>	1.4%	3.5%	7.6%	12.0%	10.7%	12.2%	13.9%	15.5%	15.6%	16.6%	15.0%	14.4%	24.6%	25.2%	27.7%	28.0%
<b>Total without Grassland</b>	<b>22.4%</b>	*	*	*	*	<b>26.5%</b>	<b>29.0%</b>	<b>29.6%</b>	<b>30.3%</b>	<b>29.9%</b>	<b>26.3%</b>	<b>25.8%</b>	<b>29.4%</b>	<b>30.5%</b>	<b>31.6%</b>	<b>32.8%</b>
<b>Total with Grassland</b>												14.8%	16.8%	17.2%	17.9%	18.2%
<b>Number of contracts</b>	57,883	66,936	69,273	70,771	68,029	72,201	77,138	80,454	75,833	75,828	68,378	65,483	69,399	70,126	70,157	71,602
<b>Loss Ratio</b>	81%	97%	130%	57%	87%	80%	104%	90%	127%	62%	69%	231%	108%	91%	*	*

\* for missing official information

*Sources: Authors with public data from the French Ministry of Agriculture and from the 2022 Budget Bill: Agriculture, food, forestry and rural affairs.*



## 2.7.2 Appendix B. Summary of the results of the literature

Table 2.12: Significant effect of variables studied in the literature on crop insurance adoption.

Variables	Positive effect	Negative effect	Lack of significance
<i>Farms characteristics</i>			
Farm size (area)	Knight and Coble (1997); Enjolras and Sentis (2008)	Nieuwoudt et al. (1985)	
Farm size (economic)	Enjolras and Sentis (2008); Enjolras et al. (2012) <i>(for Italy)</i>	Black and Dorfman (2000)	Enjolras et al. (2012) <i>(for France)</i>
Land ownership	Finger and Lehmann (2012); Fahad et al. (2018)	Sherrick et al. (2004)	Vigani and Kathage (2019)
Diversification	Enjolras et al. (2012) <i>(for France)</i>	Nieuwoudt et al. (1985)	
Irrigation	Enjolras and Sentis (2011); Santeramo et al. (2016)	Knight and Coble (1997)	
Disaster payments	Just and Calvin (1994); Smith and Baquet (1996)	Santeramo et al. (2016)	Coble et al. (1996); Serra et al. (2003)
	Deryugina and Kirwan (2018)	Foudi and Erdlenbruch (2011)	
		Nieuwoudt et al. (1985)	
		Van Asseldonk et al. (2002)	
		Meuwissen et al. (2018)	
<i>Farmers' characteristics</i>			
Age	Van Asseldonk et al. (2002)	Black and Dorfman (2000)	Vigani and Kathage (2019)
Education	Wang et al. (2016); Fahad et al. (2018)	Enjolras and Sentis (2011)	Finger and Lehmann (2012)
Having children		Black and Dorfman (2000)	Gardner and Kramer (1986)
Farm experience	Black and Dorfman (2000); Fahad et al. (2018)	Sulewski and Kłoczko-Gajewska (2014)	Enjolras et al. (2012)
Crop failure experience	Enjolras and Sentis (2011)		
	Kurdys-Kujawska and Sompolska-Rzechula (2018)		
	Yanuarti et al. (2019)		
<i>Crop insurance</i>			
Premium subsidies	Garrido and Zilberman (2008); Ginder and Spaulding (2009)		
Crop insurance experience	Enjolras and Sentis (2011); Wang et al. (2016)		
	Santeramo (2019)		
<i>Behavioral variables</i>			
Risk aversion	Zhao et al. (2016, 2017)	van Winsen et al. (2016)	
	Yanuarti et al. (2019)		
	Lyu and Barré (2017)		
Risk perception	Vigani and Kathage (2019)		
Time preferences	Coletta et al. (2018)	Coletta et al. (2018)	

Source: Authors.

## 2.7.3 Appendix C. Dynamic models

Table 2.13: Regression results.

	Crop Insurance adoption					
	(1)	(2)	(3)	(4)	(5)	(6)
L.Insurance	3.06***	3.06***	3.43***	3.17***	3.21***	3.21***
Min. Temperature	0.61	/	0.012	0.108	-0.009	0.177
Max. Temperature	0.61	0.855	0.550*	0.731*	0.742*	0.956*
Total Precipitation	0.002	0.007	0.004	0.007	0.004	0.008
Total Sunshine	-0.004	-0.006	-0.003	-0.004	-0.004	-0.004
Max. Wind Gust	-0.012	-0.026	-0.008	-0.021	-0.004	-0.017
BarrierPRICE	0.006			-0.076	0.206	-0.286
BarrierDED	-0.24			0.006	-0.142	-0.202
BarrierTRIG	0.428			0.332*	0.364*	0.430*
BarrierSHIFT	-0.022			0.027	0.085	0.319
BarrierADMI	-0.218			-0.129	-0.092	-0.041
BarrierINCO	-0.076			-0.008	-0.146	-0.155
BarrierPROB	-0.636			-0.553***	-0.612***	-1.06***
BarrierYIELD	0.111			0.107	-0.042	0.208
BarrierPREV	-0.041			-0.103	0.000	-0.157
BarrierTRUST	-0.201			-0.251*	-0.225*	-0.441**
BarrierDIVE	-0.182			-0.239**	-0.055	-0.114
BarrierCOMP	0.06			0.009	0.047	-0.053
BarrierEARLY	0.171			0.074	0.232	0.186
<i>TypeAgri</i>						
1.Field Crops		0		0		0
2.Wine		-0.151		0.027		-1.069
3.FC and Breeding		-0.455		0.228		0.248
4.Breeding		-2.02		-1.215		-0.952
5.Diversified-other		-0.268		0.076		0.089
<i>Localisation</i>						
1.North		0		0		0
2.West		3.983		0.745		1.705
3.East		1.50		-0.425		-1.514
4.South		0.022		-0.496		-1.497
Surface area		0.005		0.005**		0.009***
Irrigation		-0.304		-0.120		-0.412
Contract		-0.233		-0.193		-0.210
WorkForce		0.641		0.343		0.703
Coop		1.30		1.05**		0.734
Syndicate		-0.172		-0.244		-0.506
FarmExp		1.552		1.320		1.627
FamilyFarm		0.20		0.128		0.692
Label		0.195		0.180		1.109*
Nitrogen		-0.449		-0.384		0.059
Disaster		0.54		0.301		0.222
Compensation			0.710***		0.787***	0.828*
Age			0.870		1.26	
Gender			-0.092		-0.086	0.384
Education			0.027		-0.001	-0.097
<i>Marital</i>						
0.Single			0		0	0
1.Married or Civil-union			0.758*		0.589	1.398*
2.Divorced or Widowed			0.123		-0.216	-0.785
3.NSPP			0.017		-1.296	-1.748
HouseholdSize			-0.067		-0.147	-0.129
<i>SpouseOccupation</i>						
1.Single			0		0	0
2.Yes			-0.423		-0.167	-1.398
3.No			-0.455		-0.433	-2.330**
Income			0.125		0.131	0.044
NonAgriIncome			0.102		0.007	0.259
<i>Statut</i>						0.221
1.Landowner			0		0	0
2.Tenants			-0.276		-1.096*	-2.105**
3.Tenant-Owner			-0.209		-0.614	-1.364**
FarmExposure			0.190		0.224	0.221
CoeffRA			0.045		0.026	-0.020
Patience			0.050		0.057	0.116
Impulsiv			0.116**		0.113**	0.074
Constant	-14.865	-11.70	-6.06	18.81	-11.88	72.85
Number of groups	288	288	288	288	288	288
Observations	576	576	576	576	576	576

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

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## CHAPTER III

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Reform trajectories of European crop  
insurance schemes: reflections from the  
French case

# REFORM TRAJECTORIES OF EUROPEAN CROP INSURANCE SCHEMES: REFLECTIONS FROM THE FRENCH CASE

Richard KOENIG<sup>1</sup>, Fabio Gaetano SANTERAMO<sup>2</sup>

## Abstract

Crop insurance is a major risk management tool in agriculture for which most European Union member states provide a substantial subsidy on the insurance premium to encourage farmers to take out insurance. In this policy paper, we look back at the introduction of a support component for weather risk management instruments in the Common Agricultural Policy and the impact it had on national reforms of crop insurance schemes. By comparing France, Spain and Italy, we show that despite the influence of the same policy, crop insurance development strategies differ between member states.

**Keywords:** Crop insurance, Common Agricultural Policy, Risk Management, Reform, Subsidy

**JEL Classification:** G22: Insurance, Insurance Companies, Actuarial Studies; Q18: Agricultural Policy, Food Policy, Animal Welfare Policy; D81: Criteria for Decision-Making under Risk and Uncertainty

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<sup>1</sup>Université de Lorraine, Université de Strasbourg, AgroParisTech, CNRS, INRAE, BETA, France. Climate Economics Chair (CEC), Paris. richard.koenig@chaireconomieduclimat.org - Corresponding author

<sup>2</sup>University of Foggia, Italy. fabio.santeramo@unifg.it

### 3.1 Introduction

Crop insurance is currently the most frequently promoted risk management instrument in Europe, in the US and in several developed economies. It is an important instrument to cope with economic losses due (predominantly) to weather risks. During the COP23, it was identified as a major tool to adapt to climate change. Crop insurance schemes cover a wide range of contracts, depending on the risks covered and the way they operate (Meuwissen, 2000; Vroege and Finger, 2020). The differences lie not only in the risks covered (single-risk or multi-risk cover) but also in the methods of operation (traditional, parametric or index-based appraisal) or in the calculation of insured values (historical basis, regional basis, cover by crop or at farm level, etc.). Furthermore, while some contracts are eligible for public subsidies, others are not. Insurance for crops was available for European farmers even before the implementation of the Common Agricultural Policy (CAP). However, the design of insurance schemes has considerably evolved in recent decades. Among all of the Member States (MS), France is the biggest beneficiary of subsidies granted by the CAP, with a budget of more than ten billion euros in 2021. Crop insurance is supported by the second “pillar” of the CAP, which is devoted to rural development measures financed by the European Agricultural Fund for Rural Development (EAFRD). France receives the largest share of the MSs, with more than 11 out of the one hundred billion euros allocated for the 2014–2020 period<sup>3</sup>. Despite this important source of support, the adoption of crop insurance schemes in France remains particularly low and unbalanced, casting doubts on the financial sustainability of policy intervention, especially in view of the increasing meteorological risks associated with climate change. We describe how national crop insurance schemes have evolved via the main reforms and orientations of the CAP. We draw conclusions by focusing on the French situation, which is particularly informative due to the large number of reforms it has undergone. We emphasize similarities and differences with Spain and Italy, which are, along with France, among the top Member States in terms of subsidies received by the CAP. We finish with some generalizations that can be extended to other Member States.

### 3.2 Evolution of French crop insurance schemes

Public support for risk management in France was introduced in 1964 with the implementation of a fund to compensate for catastrophic losses and to subsidize premiums for single-risk insurance contracts. More precisely, hail insurance was the only scheme offered at that time. In 1985, insurers introduced a new guarantee in the hail contracts to help farmers to cope with storm risks. The ambitious goal was to develop a functional market that could be sustainable without public intervention. In 1991, subsidies for crop insurance contracts were abolished. However, only three years later (in 1994), subsidies were reinstated due to numerous claims and a spiral of anti-selection (Babusiaux, 2000) that was making the entire scheme unsustainable.

After several decades of support limited uniquely to mono-risk contracts, new contracts were offered

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<sup>3</sup>Fact Sheets on the European Union – 2021 (<https://www.europarl.europa.eu/factsheets/en/home>).

at the local level under the impetus of senatorial reports and great concerns (Babusiaux, 2000; Ménard, 2004), thanks to a large reform implemented at the national level in 2005. The year 2005 marks the introduction of an ambitious crop insurance policy: the MRC contract (Multi-Risk Climate). Since its launch, this policy has channelled the entire public strategy for developing crop insurance in France. The scheme has been available for most crops throughout metropolitan France, covering economic losses due to more than 15 weather hazards. As a kind of catch-all, the government has redirected the subsidies that were previously devoted to hail contracts to the MRC and has increased the level of contributions from as low as ten to 35% (depending on the crops being protected). The launch was successful: in 2005, more than 57,900 contracts were taken out, covering more than 22.3% of the total insured area (excluding grassland). However, despite its overall success, there was a major drawback: crops were unevenly covered by the scheme. While the adoption rate was in the range of 20 to 40% for field crops, it was as low as 1% for fruit crops and even lower (about half of a percent) for vineyards.

Moreover, the launch was followed by years of very low growth of the adoption rate: 23.5% of the total insured area (excluding grassland) in 2006 (with a remaining 1.4% of fruit area insured but an increase to 9.2% of vineyards) to 26.5% in 2010. Faced with such a mixed track record, the French government adopted the change in CAP regulations (in 2009) that allowed Member States to transfer 10% of the budget envelope from the first pillar to the second in order to increase the subsidy rate to 65%. Despite the boost in subsidies, the French market did not register any significant change in terms of adoption. The adoption rate slowly increased up to 30.3% in 2013, with crop coverage remaining constant ( $\pm 30\%$  for field crops,  $\pm 18\%$  for vegetables and  $\pm 2.5\%$  for fruits), with the exception of vineyards, which reached 23.6% of vineyards insured by a MRC policy in 2014.

The slow development and the disparities across crops exacerbated the adverse selection mechanism and increased structural losses for insurers who offered the MRC policy: the average loss ratio was about 92% between 2005 and 2014, whereas insurers require a maximum of 75% for technical balance<sup>4</sup>.

In 2016, these issues led to the first major reform since the implementation of multi-risk contracts. The MRC policies were reformed and now work as a three-layer mechanism: the first layer is a base contract (subsidized at the 65% level), and the second and third layers include additional guarantees (subsidized at a maximum of 45%). This reform has enabled farmers to improve the conditions for compensation. Unfortunately, the adoption trend has not changed. In 2020, 15 years after the introduction of the MRC contract, the subscription rate had only reached 32.8%, with fruit crops still particularly low (3.1%). Remarkably, the average loss ratio was about 101% during the 2005–2018 period and 125% between 2015 and 2018, revealing that this major reform was introduced during a period of significant hazards.

The lack of major results has probably pushed for further reforms. An in-depth restructuring of risk-sharing has been adopted for the 2023 campaign. The intervention modalities of the catastrophic

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<sup>4</sup>This 75% loss ratio ceiling means that the insurer needs around 25% of premiums to finance his/her management, administration and reinsurance costs. A ratio of 100% implies that all premiums are repaid in compensation, leading to a structural loss of associated costs for the insurer (Mahul, 1998).

aids have been clarified and, thanks to the application of the so-called Omnibus regulation<sup>5</sup>, the subsidy rate has been raised to 70% and the threshold of losses with respect to the historical yields has been lowered from 30 to 20%. Within the new scheme, the insurer compensates for losses of between 20% to 50% (or down to 30% for fruit crops and grasslands). Furthermore, the so-called “national solidarity fund” (which is a public fund) indemnifies the losses that exceed the threshold. This reform also favours the creation of a pool of co-reinsurance schemes to facilitate the sharing of data and information across insurers.

Since its introduction, the MRC policy appears to have grown in interest only for winegrowers since the adoption rate remains constant for the other crops, reaching 34% of the total insured area (+23.8 percentage points of coverage since 2006). As for fruits growers, the adoption rate remains as low as 3%, despite several reforms that have targeted high adoption rates. Fruit growers make more use of hail contracts: 84,000 hectares were insured with mono-risk contracts, while only 4,000 were insured under an MRC contract (in 2018), representing 408 M€ and 35 M€ of insured capital, respectively. Among insurable crops, fruits have the highest value per hectare and are considered to be the most sensitive to weather hazards. A possible rationale for the low adoption rate is that the inclusion of about 15 weather-related hazards may have increased the level of insurance premiums, especially with a lack of data due to a structurally small pool. The 2023 reform required insurers to form a co-reinsurance group in order to accurately share their data and set a fairer premium level. The “average rate”, defined as the ratio between contributions and capital, is an average of 5.81% for fruits in hail contracts (1.41% for field crops and 2.96% for vineyards), whereas it is an average of 10.65% for MRC contracts (3.27% for field crops and 3.76% for vineyards)<sup>6</sup>. The relative cost before subsidies is thus two times higher. This is especially an issue since subsidies are paid retrospectively, around 6 months after the premium is paid. Since fruit tree farms are generally small, they may not have the cash flow capacity to cope with such a time lag.

Similarities and differences could be underlined here with the Italian situation. Both countries have decided to abandon all subsidies for single-risk contracts in favour of multi-risk contracts (Santeramo, 2019). However, in Italy, fruit growers, especially apple growers, mainly adopt the most multi-risk oriented policy (51% of the contracts underwritten were in Package A in 2020), whereas winegrowers subscribe to more risk-specific policies (Package B with 41.7% and Package C with 36.9%). This situation is the opposite of the French case and calls for further research to understand the impediments to adoption for fruits growers.

The 2023 reform has reinforced the same strategy adopted since 2005. A single standardized, subsidized contract exists with the possibility of modulating options. However, specific features of the contract that change depending on the crop, and a desire to simplify administrative accessibility and support for farmers. The effectiveness of these changes will be assessed after the next campaigns, but several possibilities can nevertheless be anticipated. The redistribution of risk-sharing should reduce the

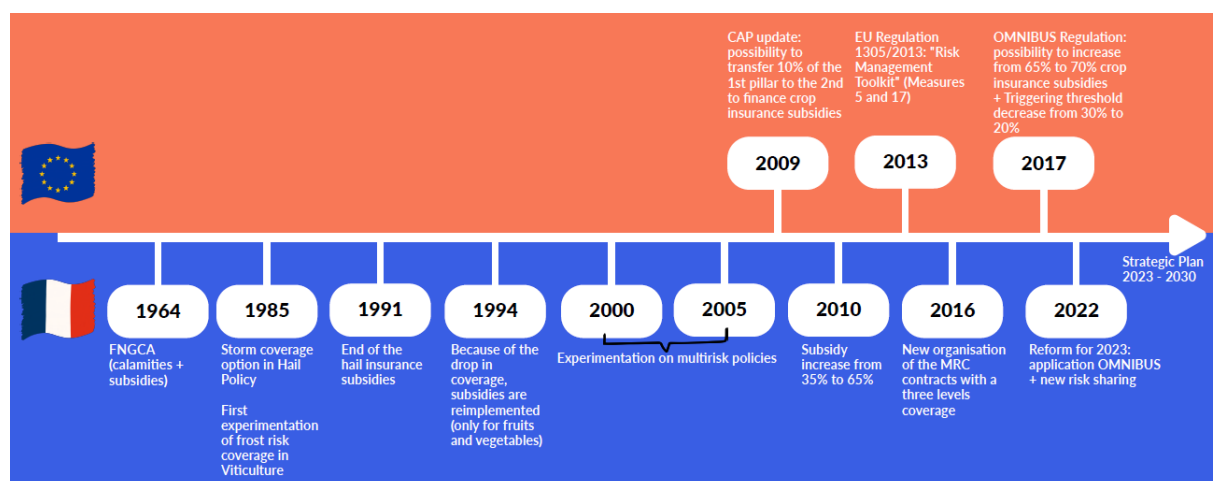
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<sup>5</sup>EU Regulation 2017/2393 of the European Parliament and of the Council of 13 December 2017.

<sup>6</sup>See the *Fédération Française de l'Assurance*'s study in the Descrozaile (2021) report (pp. 58–90).

average level of premiums, which will be subsidized to a greater extent. However, the delay for payment of subsidies and the fact that prevention efforts are poorly considered in insurance pricing are likely to remain major problems (Koenig and Brunette, 2023).

Being able to create synergies rather than competition between instruments is crucial to avoid contradictory incentives. Historically, in France, the system of agricultural disasters ended up discouraging farmers from taking out insurance, meaning that the State was funding two competing instruments (Koenig et al., 2022). The 2023 reform has aimed to correct this dysfunction. Under the reform, uninsured farmers will not have the same rate of compensation (45%, gradually decreasing until 2030) as insured farmers (up to 90%) when the national solidarity indemnity is triggered (replacing the agricultural disaster scheme). While the synergy between crop insurance and the catastrophic compensation instrument seems to be improving, the synergy with prevention instruments deserves greater consideration, as is the case in Spain. Indeed, an additional subsidy of 5% is added to the basic subsidy for “risk reduction practices” in Spain<sup>7</sup>. Such an instrument implies a control or verification mechanism and encourages the introduction of preventive instruments, beneficial to both farmers and insurers.



Source : Authors

Figure 3.1: History of developments in the crop insurance scheme at French and European Union level.

Like France, Spain had an initial offer of crop insurance coverage at the end of the 19th century. Yet, it is Law No. 87/1978 of 28 December 1978 that implemented the current scheme, making it the very first law to be adopted under the Spanish Constitution of 27 December 1978.<sup>8</sup> Both the policies proposed and the organization of the scheme differ from the French case. Currently, two institutions are at the core of the scheme: ENESA and Agroseguro. The first one represents the public administration, administers the budget allocation for subsidies and supervises proposed insurance policies. The second one regroups all private insurers on the market in a co-insurance pool, which manages the contract from the payment of premiums to the evaluation of losses and the payment of indemnities. This organization is probably one of the reasons that makes this scheme the one with the highest rate of crop insurance

<sup>7</sup>ENESA (2023) - *Guía del seguro agrario - 44° Plan de Seguros Agrarios*, p.16.

<sup>8</sup>8 years before Spain joined the European Union.

adoption among the major European countries. In 2022, around 70% of the field crop and fruit growing areas were insured, with a total of 46% for viticulture.<sup>9</sup> Widely cited as an example in reports, the Spanish system inspired the reform applied in 2023 in France. The creation of a pool to regroup insurers has been inspired by the functioning of Agroseguro. In addition, the reform has led to the formation of a national committee for the guidance and development of crop insurance (CODAR), which is an extension of a previous entity, with missions similar to those of ENESA.

### 3.3 National trajectory or EU orientations?

We can legitimately ask if the reforms in France were the result of national developments or the application of European directives. Given that support for crop insurance was included in the CAP in 2009 and then formalized in 2013 (*Art. 5, EU Regulation 1305/2013*), the implementation of MRC contracts and the re-orientation of the subsidies from mono-risk to multi-risk contracts has resulted in a national decision. The CAP's influence on the national trajectory of crop insurance schemes can be summed up as, at most, financing an increase in the level of subsidies and regulating the characteristics of eligible contracts.

Indeed, the 2009 CAP reform allowed a transfer of 10% from the first to the second pillar to support crop insurance adoption. It allowed France to raise subsidies on MRC contracts from 35% to 65% and then to 70%, thanks to the Omnibus application in the 2023 reform, on the condition that the contracts comply with a trigger threshold of 30%, subsequently lowered to 20%. Will it be enough to boost the adoption rate? The several unsuccessful reforms have led to a conclusion: the decision to adopt or not a crop insurance contract may not be just a question of subsidy levels. Other parameters such as the characteristics of the contracts, the support and simplicity of the procedures, and the suitability of the contracts offered in relation to the farmer's overall risk management strategy are all decisive factors.

The inspiration from Spain for the new reform is thus limited to the design of the scheme governance. Regarding policies proposed and the development strategy applied, the difference is substantial. Spain has historically opted for a flexible offer, a variety of insurance policies (called modules) and a special subsidy mechanism where subsidy percentages are added to a basic rate depending on the policyholder's situation (young farmer, implementation of risk reduction instruments, for the first-time or repeat underwriting, etc.). On the other side of the Pyrenees, the French strategy continues to proceed in the same direction: only one type of simple and easy to understand base contract, subsidizable for everyone. This should encourage the adoption of insurance policies but the results are still not satisfactory.

Is the flexibility and diversity of offer the way to go? Following Spain's example, Italy took this path. Like France and in the same periods, Italy has implemented several reforms: introduction of pluri-risk (in 2000) and multi-risk (in 2004) policies, raising the level of subsidies to 55% in 2010 and then to 65% in 2013 and, finally, applying the Omnibus regulation in 2017 ([Santeramo et al., 2022](#)). However, both

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<sup>9</sup>Annual information on Agroseguro website: [agroseguro.es](http://agroseguro.es).

mono-risk and multi-risk contracts were subsidized until mono-risk contracts were removed and a new set of contracts (referred to as “packages”) were implemented in 2015. This was the same strategy of flexibility and diversity of the policies proposed in Spain, but led to different results: Italy continues to have a particularly low (20% of the production value on average), very uneven and spatially concentrated level of insurance adoption (Santeramo, 2019).

France, Spain and Italy have adopted, since their respective first public support, different development strategies with varying effectiveness. While the three countries took the same path, going from mono-risk to progressively multi-risk oriented schemes, the trajectories appear to be increasingly divergent, meaning that the introduction of a risk management component in the CAP has not brought them into line.

For one of them, the reason is simple: Spain relies only on its own governmental budget to finance crop insurance subsidies. In order to have more free will<sup>10</sup> in its design, within the limits of compliance with its agreements on the European internal market and WTO regulations, Spain does not request any of its European envelope under the second pillar for crop insurance support. This allows Spain to use its EAFRD funds for other measures and priorities in its national strategic plan, in particular, Measure 4 relative to “*Investments in physical assets*” (See the summary of Rural Development Programmes)<sup>11</sup>.

Both Italy and France rely on EAFRD funds in order to finance subsidies and thus respect the associated conditions. This means that the 2009, 2013 and 2017 amendments simply redefined the subsidy ceilings and the level of the triggering thresholds.

It is tricky to associate the success of the Spanish scheme with its financial independence. It seems more accurate to interpret the scheme’s independence as a sign of the priority that has been given for decades in Spain to the effective operation of crop insurance. However, the flexibility offered by this independence has certain advantages. For example, Spain subsidizes up to 75% of its module 1 (contracts relating to catastrophic risks). This 75% rate is not restricted by the Omnibus regulation, which sets a ceiling of 70%, and was in place even before 2017 and the vote on this regulation by the EU authorities.<sup>12</sup> The subsidy system for the other modules is also special. While France and Italy have a fixed subsidy, Spain has introduced a basic subsidy percentage (from 18 to 30%) to which are added additional subsidy percentages depending on the farmer’s situation (+21 percentage points for young farmers; +3 for new subscriptions; +6 if subscribed as part of a group, etc.) with a ceiling differentiated by the module but with a maximum of 70%. This approach has the advantage of integrating the insurance tool more closely into other agricultural policies, but would be too complex to apply to other Member States where the market is not very developed. On the other hand, retaining a high basic subsidy, as is currently the case, and coupling it with additional aid, as is the case for initial subscriptions, could attract new farmers to

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<sup>10</sup>According to ENESA’s president Jose María García de Francisco in 2018. ([https://www.euroganaderia.eu/enesa/entrevistas/el-sistema-espanol-de-seguros-agrarios-cuenta-con-solidez-tecnica-y-economica-3595\\_7\\_5272\\_0\\_1\\_in.html](https://www.euroganaderia.eu/enesa/entrevistas/el-sistema-espanol-de-seguros-agrarios-cuenta-con-solidez-tecnica-y-economica-3595_7_5272_0_1_in.html)).

<sup>11</sup>[https://ec.europa.eu/enrd/policy-in-action/rural-development-policy-figures/rdp-summaries\\_fr.html](https://ec.europa.eu/enrd/policy-in-action/rural-development-policy-figures/rdp-summaries_fr.html)

<sup>12</sup>ENESA (2016) – *37° Guía informativa sobre el sistema español de Seguros Agrarios para el Plan 2016*.



the market.

			
Source of subsidy funding	FEADER	FEADER	Public budget
Subsidised contracts	A single multi-risk contract	Various single and multi-risk packages	Traditional and increasing, by modules, multi-risk contracts
Omnibus implementation	2023	2017	Not applied
Insured area	32.8%	10.3%	49.05%
Field crops	33.3%	27.7% (maize)	68.38%
Wine	34.0%	28.6%	46.44%
Fruits	3.1%	46.4% (apple)	53.57% (without olive)
Loss Ratio (average 2015-2019)	137.2%	96.5%	108.8%
Year of the data Main source	2020 <i>Descrozaille (2021)</i>	2020 <i>isMEA.it</i>	2022 <i>agroseguro.es</i>

Source : Authors

Figure 3.2: Summary table of schemes in place in France, Italy and Spain.

### 3.4 Policy reflections

Increasing the level of the subsidy and reducing the level of the trigger threshold and the deductible are undoubtedly beneficial measures with a view to boosting the adoption rate. However, assessing the impact of these changes will require several years. We argue that the impact of this part of the reform is not likely to be substantial, especially if compared to the (admittedly modest) impact of the 2010 reform to raise the subsidy from 35% to 65%. Furthermore, similarities to the Italian case, and the negligible impact that the application of the Omnibus regulation has had in Italy, strengthen the likelihood of our forecast.

Nevertheless, the reorganization of risk-sharing and the restructuring of the authorities overseeing the scheme has to be prioritized. First, as highlighted in [Koenig and Brunette \(2023\)](#), the design and administration of the market are far from being optimal. The low level of trust of non-insured farmers is not likely to be improved by changes in the level of subsidies and the trigger threshold. Moreover, regardless of the subsidy level, the fact that farmers have to pay the whole premium, apply for the

subsidy, and receive it 6 months later, leads to significant cash flow problems (Koenig and Brunette, 2023). Following the Spanish example, it would be worthwhile learning from the role that Agroseguro plays in paying out insurance premium, enabling farmers to pay a premium net of subsidies.

The challenges for the future are clear: how will our insurance schemes cope with the consequences of climate change? The Spanish system appears to be quite resilient, having recently been able to cope with some particularly disastrous years.<sup>13</sup> On the opposite, France is facing structural losses that need to be fixed. EU and national authorities must push for greater risk-management support for farmers by encouraging the adoption of prevention and insurance instruments and ensuring that they work in complementarity rather than in competition. There are major disparities regarding crop insurance adoption between Member States, but also within them. There are huge inequalities in insurance cover between crops in France, between regions in Italy and even in Spain, where certain crops such as olives are currently very poorly covered.<sup>14</sup> Greater flexibility in the regulatory framework for subsidizing contracts and additional subsidy percentages indexed to the payment, for example, of other second-pillar aid (young farmers, agri-environmental and climate measures, etc.) would make it possible to create multiple positive incentives along the lines of what is being done in Spain today.

*Harmonised formatting for the thesis manuscript of the version currently under review  
for EuroChoices journal.*

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<sup>13</sup>According to Jose María García de Francisco, Director of ENESA: [https://www.euroganaderia.eu/enesa/entrevistas/el-sistema-espanol-de-seguros-agrarios-cuenta-con-solidez-tecnica-y-economica\\_3595\\_7\\_5272\\_0\\_1\\_in.html](https://www.euroganaderia.eu/enesa/entrevistas/el-sistema-espanol-de-seguros-agrarios-cuenta-con-solidez-tecnica-y-economica_3595_7_5272_0_1_in.html)

<sup>14</sup>7% of area insured in 2022, Agroseguro Annual Report.

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## CHAPTER IV

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# Climate change perception, impact and adaptation: implications for crop insurance

# CLIMATE CHANGE PERCEPTION, IMPACT AND ADAPTATION: IMPLICATIONS FOR CROP INSURANCE

Richard KOENIG<sup>1</sup>, Marielle BRUNETTE<sup>2</sup>

## Abstract

Weather-related events represent a main threat for French farmers, and their frequency and intensity are expected to increase due to climate change. In this context, we analyse the link between climate change perception, expected impact of climate change, and potential adaptation strategies that can be implemented to face climate change. For that purpose, we analysed the results of a survey conducted in 2021 on 288 French farmers. On the basis of these data, we created two indexes: a climate change perception index and an index of concern towards the expected impact of climate change. We first present some interesting correlations between adaptation strategies and hazards. We then identify some determinants of climate change perception and the expected impacts of climate change. Finally, we highlight two adaptation paths favoured by farmers. Depending on the characteristics of their farms and their perception of exposure today, some will favour farming adaptation, while others will favour the diversification of their income. We then discuss these results in terms of the existing crop insurance scheme in France.

**Keywords:** Climate change, Perception, Crop insurance, Adaptation, France.

**JEL Classification:** G22: Insurance, Insurance Companies, Actuarial Studies; Q54: Climate, Natural Disasters and Their Management, Global Warming

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<sup>1</sup>Université de Lorraine, Université de Strasbourg, AgroParisTech, CNRS, INRAE, BETA, France. Climate Economics Chair (CEC), Paris. richard.koenig@chaireeconomieduclimat.org

<sup>2</sup>Université de Lorraine, Université de Strasbourg, AgroParisTech, CNRS, INRAE, BETA, France. Climate Economics Chair (CEC), Paris. marielle.brunette@inrae.fr

## 4.1 Introduction

European agriculture is exposed to various weather-related events that threaten food production and the provision of environmental services. Indeed, climate change impacts agriculture through two major vectors, temperature and precipitation. Higher temperatures affect yields and favour pest invasion, whereas changes in precipitation regimes increase the likelihood of short-term crop failures and long-term production decline (Nelson et al., 2009). In addition, climate change has an impact on the frequency and intensity of weather-related events. Brás et al. (2021) have shown that crop losses tripled between 1961 and 2015 in Europe due to the severity of drought and heat waves.

In order to face these increasing risks, farmers may implement adaptation strategies. Among them, the adoption of a crop insurance contract is important since it has been identified by the COP23 as a major tool to adapt to climate change (Drieux et al., 2019). Crop insurance contracts are available in most European countries (Meuwissen et al., 2018). In France, a multi-peril crop insurance (MPCI) contract is available.<sup>3</sup> It offers coverage against 15 hazards (drought, hail, storm, etc.). The contract is unique and available for all farmers independently of location and crop. The insurance premium is subsidized up to 70% through the Common Agricultural Policy (CAP).<sup>4</sup> Currently, only around 30% of the French agricultural area is insured.

In a context of increasing risks due to climate change, this low level of insurance adoption is cause for concern. However, the implementation of adaptation strategies is expected to increase due to climate change, as is the demand for crop insurance. Consequently, in this paper, we analyse the role of climate change perception and its impact on adaptation decisions with an emphasis on crop insurance as one of the available adaptation tools. More precisely, we question whether or not the existing MPCI contract in France is still relevant in a context of climate change. Indeed, if farmers do not correctly perceive the risks and their expected impacts, then their behaviours in terms of adaptation strategies may not be adapted, leading to huge economic consequences. We also take a look at the link between insurance and the other adaptation strategies.

The literature on farmers' perceptions of climate change and the strategies they use to adapt to it is an emerging subject that draws on behavioural economics methods, in particular. Recently, Ricart et al. (2023) published a comprehensive review on the literature focused on climate change awareness, its perceived impacts and what farmers do to adapt to it. Using a sample of 465 articles published between 2010 and 2020, they conducted a specific analysis on 108 of them. They highlight the emergence of the subject since the vast majority of articles from the last decade were published in the last 3 years. Economics journals are relatively under-represented in terms of publications. The journals with the greatest number of articles published on the subject are those dealing with climate change and sustainable development. The case studies are very diverse, dealing as much with farmers' perceptions of climate change in developed countries (particularly the USA) as in developing countries (sub-Saharan

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<sup>3</sup>The MRC policy (*Assurance MultiRisque Climatique sur récoltes*) available since 2005.

<sup>4</sup>The French insurance scheme is defined in greater detail in Koenig and Brunette (2023).

Africa and South-East Asia). On the other hand, with the exception of Germany, European countries are poorly represented in the corpus. The question of adopting crop insurance as one of the main adaptation measures was addressed by [Jin et al. \(2015\)](#), [Mase et al. \(2017\)](#) and [Akinbile et al. \(2018\)](#) for China, the United States and Nigeria respectively. Moreover, [Woods et al. \(2017\)](#) carried out a survey in which Danish farmers were questioned about their concerns and beliefs regarding climate change, the expected effects and their planned adaptation strategy. The authors found, among other adaptation strategies, that the more the farmers believed in climate change and the more they worried about its impacts, the greater their chances of taking out more or better insurance policies was. In the same vein, [Schattman et al. \(2016\)](#) studied climate change perception and forecasting from the point of view of farmers in Vermont. They interviewed farmers about the ecological and economic risks presented by climate change. They highlighted the importance of the psychological impact on climate change forecasting and anxiety. It appears that farmers are more likely to implement a risk adaptation strategy than a mitigation strategy in terms of the respective effect of both on their farm. Regarding the literature concerning the adaptation of French farmers to climate change, we can mention, in particular, [Gouache et al. \(2012\)](#) and [Lungarska and Chakir \(2018\)](#). The first one addresses the notion of adapting crop phenology in agronomic terms and, in particular, the importance of studying genetic variations that are resistant to heat shock for future choices of cultivated varieties. The second one deals with greenhouse gas abatement curves and highlights the positive interactions between mitigation and adaptation practices. They also show that, depending on the climate scenarios, there will be a change in land use, with a reduction in forest area in favour of an increase in agricultural land, which could be limited by the introduction of a carbon tax.

In this article, the objective is to analyse the link between climate change perception, the expected impact of climate change, and potential adaptation strategies that can be implemented by French farmers. For that purpose, we analysed the results of a survey conducted in 2021 on 288 French farmers. We collected information about their perception of climate change, its expected impact and their adaptation strategies. We also asked them questions about the characteristics of the farms and the farmers. We created two indexes: a climate change perception index and an index of concern towards the expected impact of climate change. We first present some interesting correlations between adaptation strategies, indicating that they are substitutes two-by-two. Concerning correlations between hazards, we show that storm is the hazard whose frequency is the least correlated with the frequency of another hazard. We then identify some determinants of climate change perception (having received an insurance compensation in the past, education level, farm exposure and having recently suffered from a loss due to a weather-related event) and the expected impact of climate change (having received an insurance compensation in the past, farm exposure and type of agricultural activity). Finally, we show that the perception of climate change only has a significant and negative impact on the diversification of crops as a potential adaptation strategy, whereas the expected impact of climate change never impacts the adaptation strategy. We discuss these results with regard to the existing crop insurance scheme in France.



The rest of the paper is organised as follows. Section 4.2 presents the materials and methods used. Section 4.3 indicates the results, which are then discussed in Section 4.4. Finally, Section 4.5 provides a conclusion.

## 4.2 Materials and methods

### 4.2.1 Data

We used survey data taken from a questionnaire answered by 288 French farmers in 2021. The survey was composed of 57 questions and is fully described in [Koenig and Brunette \(2023\)](#). The survey was carried out online and distributed via the French Chambers of Agriculture. Before going further and presenting the three variables of interest for our analysis and describing the sample in terms of the characteristics of the farm and the farmers, we demonstrate that the question addressed in this article is of utmost importance by showing that weather-related events represent a real threat for French farmers.

#### Are weather-related events a real threat?

In the survey, farmers ranked, in terms of importance according to their perception, the following six major categories of risk: weather-related events, variations in crop prices, pests and diseases, legislative and regulatory changes, increases in input costs, and lack of production outlets. The following graph shows the breakdown of the rankings of the 288 respondents (Fig. 4.1).

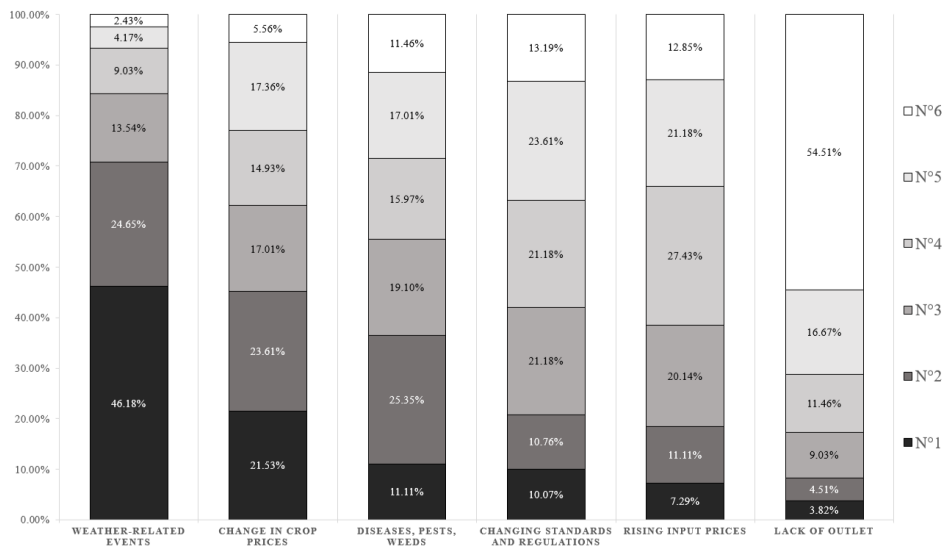


Figure 4.1: Classification of different sources of risk.

In our sample, weather-related events are the major risk that farmers have to cope with since 46.18% of our sample ranked this proposal as number one and it appears to be one of the two main sources of risk for 70% of them. Each of these risks involves various management tools. The variation in crop prices can be controlled by a contractual or future market process (contract for the sale of production upstream of the harvest at a set price). Pests, weeds and diseases are generally controlled by the use of chemical inputs, particularly pesticides (insecticides, herbicides and fungicides). Weather-related events may be insured.

Now that we have shown that weather-related events represent a major threat for French farmers, we analyse the way that farmers perceive climate change that will affect these events. In weather-related events, we include the “Disease, pests, weeds” category in order to discuss their insurability.

### **The three variables of interest: climate change perception, expected impact and adaptation strategy**

We focused on the questions from the survey that dealt with climate change perception, impact and adaptation. More precisely, we focused our analysis on three variables.

The first variable was linked to the farmers’ perceptions of climate change. Four possible answers were available: doesn’t believe in climate change, climate change doesn’t impact and will not affect my farm, climate change will soon impact my farm, climate change is already impacting my farm.

The second variable was about the perceived impact of climate change. We asked the farmers who believe in climate change if climate change means an increase, decrease or no change in the frequency and intensity of six hazards on their farm (drought, storm, flooding, frost, hail, “diseases, pests, weeds” (D.P.W)). We chose to separate the dimensions of frequency and intensity of the proposed risks since they require different risk management tools. For a hazard whose frequency but not its intensity is expected to increase, farmers could rely on farm-level tools or insurance. On the contrary, if the farmer expected the hazard to remain stable or to decrease in frequency but increase in intensity, he or she could expect to rely on the disaster scheme,<sup>5</sup> for example.

The last variable of interest was related to adaptation. More precisely, we asked the farmers who believe in climate change to select the proposals that would best qualify the response to protect them from the effects of climate change (adaptation strategy) with five possible options: diversification of crops (*DCROP*), greater use of insurance schemes (*INS*), changing crop management practices (*PRA*), diversification of income sources (*DINC*), no particular change (*NOCH*).

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<sup>5</sup>In France, a public fund has existed since 1964 to compensate farmers for particularly devastating weather events. The reform of the crop insurance scheme, which has been in operation since 2023, sets the fund’s intervention threshold at losses in excess of 50% of historical yield (for most crops).

## Characteristics of the farms and the farmers

We also used other variables collected during the survey. These variables are presented in Table 4.1 and divided into two parts: farmers' characteristics and farm characteristics. This table allows us to precisely describe our sample.

Concerning the farmers' characteristics, we can observe that the sample is composed of 80% of men, with a mean age of 50 years and a mid education level. We divided France into four zones: North, West, East and South. The least represented zone is North, with 10.76% of the sample, and the most well-represented zone is South, with 36.46%. The household is composed of four or more person for more than one-third of the sample. Income level presents a high variability, with 8% of the sample living with less than €1000 per month and 5.56% with more than €5000. The most well-represented interval is between €1000 and €2000. More than half of the farmers have a spouse working outside the farm, and almost 40% receive non-agricultural income. We can also observe that the farmers in our sample are quite impatient, with a low degree of impulsiveness,<sup>6</sup> and that they are risk-averse (coefficient of relative risk aversion of 1.32).<sup>7</sup>

Concerning the farm characteristics, we observe that the mean agricultural area in the sample is almost 100 hectares. The farmers have extensive experience in terms of management, with an average of 20 years as farm manager. Several types of agriculture are present in the sample, with field crops and wine representing more than half of the sample. Almost 30% of the farmers use irrigation and are involved in a contractualisation process, 80% are members of a cooperative and 60% of a trade union. More than 60% of the farmers are owners or tenants. Most of the farms were previously managed by a family member. Some farmers are certified (36.46%), use employees on the farm (51.04%), supply nitrogen to crops (83.33%), have already received disaster payments (48.61%) and have suffered from yield losses due to weather events in the last 2 years (65.97%). The farms have a level of exposure to risk of 3.31/5.<sup>8</sup>

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<sup>6</sup>Impatience and impulsiveness are captured with self-assessment scales from 0 = very impatient (resp. not impulsive) to 10 = very patient (resp. very impulsive).

<sup>7</sup>Farmers' preferences towards risk are measured with an Ordered Lottery Selection task adapted from [Eckel and Grossman \(2002, 2008\)](#).

<sup>8</sup>The level of exposure towards risk of the farm is measured through a self-assessment scale from 0 = very little to 5 = very strongly.

Table 4.1: Statistics of the sample.

Variables	Detail	
<b>Farmers characteristics</b>		
Age	Age of the farmer	49.65 (10.3)
Gender	1 for men	0.816
		in %
Location	(1) = North of France (2) = West of France (3) = East of France (4) = South of France	10.76 29.17 23.26 36.81
Education	(1) = No diploma (2) = General Certificate of Secondary Education (3) = High School Diploma (4) = 1 and 2 years university level (5) = 3 years university level (6) = 4 years university level (7) = 5 years university level (8) = 6 to 8 years university level	1.04 18.06 27.08 27.08 27.43 4.51 11.46 1.39
Marital	(0) = Single (1) = Married or Civil-union (2) = Divorced or Widowed (3) = NSPP	15.28 70.83 8.68 5.21
HouseholdSize	(1) = 1 person (2) = 2 people (3) = 3 people (4) = 4 or more people	12.15 31.94 19.44 36.46
Income	(1) = <€1000 (2) = [1000:2000[ (3) = [2000:3000[ (4) = [3000:4000[ (5) = [4000:5000[ (6) = >€5000 (7) = Prefers not to answer	7.99 31.94 23.61 17.36 6.60 5.56 6.94
SpouseOccupation	(0) = I live alone (1) = Spouse works outside of farm (2) = Spouse doesn't work outside of farm	16.32 53.82 29.86
NonAgriIncome	Non-agricultural activity income	41.32
Patience	0=very impatient to 10=very patient	5.98 (2.4)
Impulsiv	0=not impulsive to 10=very impulsive	4.28 (2.5)
CoeffRA	0=neutral	1.32 (1.0)
<b>Farms characteristics</b>		
Surface area	Cultivated hectares	98.13 (100.7)
FarmExp	Years as farm manager	20.51 (12.7)
		in %
TypeAgri	Agricultural activity (1) = Field Crops (2) = Wine (3) = Field Crops and Breeding (4) = Breeding (5) = Diversification (all others)	27.43 28.82 17.36 9.03 17.36
Irrigation	Irrigation user	29.17
Contract	In a contractualization process	28.47
Coop	Member of a cooperative	78.47
Syndicate	Member of a trade union	57.64
Statut	(1) = Owner (2) = Tenant (3) = Tenant-Owner	23.26 13.19 63.54
FamilyFarm	Farm previously managed by a family member	71.88
Label	Certification	36.46
WorkForce	Working with others on the farm	51.04
Nitrogen	Nitrogen supply to crops	83.33
Disaster	Already received a disaster payment	48.61
RecentLoss	Yield losses due to weather events in the last 2 years	65.97
Compensation	Having received compensation for crop losses from an insurer	55.21
FarmExposure	0=very little to 5=very strongly	3.31 (0.98)

## 4.2.2 Method

We proceeded in three steps. These steps are represented in Figure 4.2.

First (Step 1 in Fig. 4.2), we looked at the descriptive statistics concerning our variables of interest: perception of climate change, impact of climate change and adaptation. We attempted to identify some trends in the results. In addition, we computed two additional variables: *CC\_PERCEPTION* and

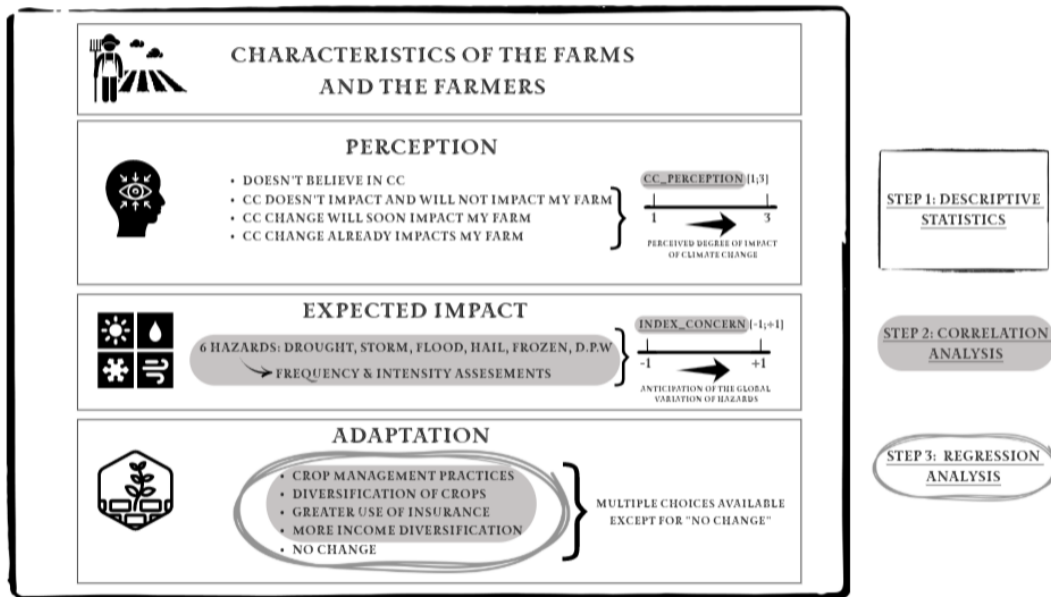


Figure 4.2: Variables and steps of the approach.

*INDEX\_CONCERN*. The first one deals with the perceived degree of impact of climate change and varies between 1 and 3 with 1 = climate change doesn't impact and will not affect my farm, 2 = climate change will soon impact my farm, 3 = climate change is already impacting my farm. The higher the value of the variable *CC\_PERCEPTION* is, the higher the perceived impact will be. The second variable is related to the expected impact of climate change. It is an aggregated variable computed as follows: for each hazard and for both frequency and intensity, we assumed that if the farmer selects a decrease, then the variable equals "-1", an increase "+1" and no change "0". This means that for each farmer, we have an index that is an average of 12 variables (six (hazards)  $\times$  2 (freq. and intensity)) coded between -1 and +1. The higher the score is, the greater the farmer's concern towards the impact of climate change will be.

Second (Step 2 in Fig. 4.2), we proposed a correlation analysis for the variables linked to adaptation and impact. Indeed, we wanted to observe if the adaptation strategies were correlated among themselves. In addition, we wondered whether or not the perceived hazards were correlated among themselves as well. For that purpose, we presented the results of the Pearson correlation coefficients in correlation matrices.

Finally (Step 3 in Fig. 4.2), the last step is dedicated to the regression analysis. We conducted three different regressions. The first regression is an ordinal logit regression that aims to identify determinants of the variable *CC\_PERCEPTION* using characteristics of the farms and the farmers as potential explanatory variables. The second regression is a Tobit regression that attempts to identify the determinants of the variable *INDEX\_CONCERN* using the characteristics as explanatory variables as well. Finally, the last regressions are intended to identify some determinants of the adoption of each of the four adaptation strategies and the "no particular change" option. For that purpose, we could argue that adaptation strategies are either independently adopted or simultaneously selected. Thus, under the

first option, we ran five independent probit regressions for each of the strategies and the “no change” option. For a complementary analysis, we ran a multivariate probit model using the *cmp* command in Stata (Roodman, 2011). The results are presented in Table 4.11 in the Appendix. For all models, the explanatory variables are the characteristics of the farms and the farmers as well as the variables related to the perception and impact of climate change.

The first model analyses the factors explaining the degree of perception of climate change. Our variable of interest *CC\_PERCEPTION* comprises, as a reminder, three modalities. Using an Ordered Logistic Model, we attempted to estimate how farm and farmers’ characteristics influence climate change perception. The model takes the following form:

$$\ln \left( \frac{P(W_i \leq j | X_i, V_i)}{1 - P(W_i \leq j | X_i, V_i)} \right) = \alpha_j - \beta_1 X_i + \beta_2 V_i \quad (4.1)$$

where  $W$  is the dependent variable of climate change perception,  $j$  is the different modalities of the *CC\_PERCEPTION* variable,  $X$  is a vector of farmers’ characteristics and  $V$  a vector of farm characteristics (Table 4.1).

The second model investigates the parameters that explain the intensity of the *INDEX\_CONCERN* variable. Our interest variable is continuous over the interval  $[-1; +1]$ . The closer to 1 the farmer’s index is, the more the farmer thinks that the hazards will increase due to climate change in terms of frequency and intensity. Using a Tobit model bounded between -1 and +1, the model takes the following form:

$$Pr(Z_i | X_i, V_i) = \begin{cases} -1 & \text{if } z_i^* < -1 \\ \beta_1 X_i + \beta_2 V_i + \epsilon_i & \text{if } z_i^* - 1 < y < +1 \\ +1 & \text{if } z_i^* > +1 \end{cases} \quad (4.2)$$

where  $Z$  is the dependent variable of concern,  $X$  is a vector of farmers’ characteristics,  $V$  a vector of farm characteristics (Table 4.1) and  $\epsilon$  is a random error term ( $\epsilon \sim \mathcal{N}(0, \sigma^2)$ ).

The last models are run for each of the five adaptation strategies considered: *PRA*, *DCROP*, *INS*, *DINC*, *NOCH*. All five adaptation strategies are assumed to be independent and are therefore not considered as explanatory variables in the other models. Since the modalities can only be “No” (=0) or “Yes” (=1) to the question of whether they intend to adopt each strategy, we ran five similar probit models:

$$Pr(y_s = 1 | X_i, V_i) = \Phi[\beta_{1s} X_i + \beta_{2s} V_i] \quad (4.3)$$

where  $y$  is the binary variable relative to the adaptation strategy,  $s$  is the adaptation strategy analysed,  $X$  is a vector of farmers’ characteristics and  $V$  a vector of farm characteristics (Table 4.1).

## 4.3 Results

The results are presented following the three steps of the method described in Fig. 4.2.

### 4.3.1 Descriptive statistics

The descriptive statistics related to perception of climate change and adaptation are presented in Table 4.2.

Table 4.2: Perception of climate change and adaptation.

Variables	Detail	in%
Perception	(1) Doesn't believe in CC	2.78
	(2) CC doesn't impact and will not affect my farm	2.78
	(3) CC will soon impact my farm	17.01
	(4) CC already impacts my farm	77.43
Adaptation strategy		
PRA	Changes crop management practices	54.02
DCROP	Diversification of crops	52.11
INS	Greater use of insurance	28.74
DINC	More income diversification	52.87
NOCH	No change	6.79
		Average [std dev]
CC_PERCEPTION	Perceived degree of CC impact	2.77 [0.486]
Number Adapt.	Number of adaptation strategies selected	1.88 [0.049]

**Perception.** Out of our 288 respondents, 2.78% of the sample (i.e., eight farmers) did not believe in climate change, 2.78% thought they would not be impacted, 17.01% (i.e., 49 farmers) believed they would soon be affected, and a large majority, 223 farmers, already considered themselves impacted by climate change. This means that around 95% of the farmers were convinced of the climate change impacts. Our index of climate change perception *CC\_PERCEPTION* has a mean value of 2.77, which is quite high. The eight respondents who said they did not believe in climate change did not have access to the following questions concerning adaptation and impact.

**Adaptation.** We then questioned the 280 respondents about adaptation. More than 50% of the sample (i.e., 141 farmers) were willing to change their crop management practices to adapt to climate change impact. Diversification in terms of income and crop was also selected by more than 50% of the farmers, whereas insurance seemed to be the least interesting adaptation tool, with only 28.74%. This means that few farmers intended to increase their use of insurance to adapt to climate change. We also observed that on average, each farmer selects 1.88 adaptation strategies among the four possible ones (variable *NumberAdapt.*). More precisely, 95 farmers selected only one strategy, 108 selected two strategies, 53 selected three strategies and only five selected the four possible strategies.

**Impact.** We also questioned the 280 respondents about their subjective belief of how the frequency and the intensity of the six considered hazards will vary as a result of climate change. The results are presented in Table 4.3. The farmers believe that all six proposed hazards will increase as a result of climate change, both in terms of frequency and intensity. However, only droughts are unanimously expected to increase. For the other hazards, we consistently have between 36% and 47% of our sample that expect no change in intensity or frequency. It appears that farmers expect slightly more of an increase in frequency than in intensity, but the results are fairly similar. Storm is ranked as the number two hazard expected to increase in our sample, even though the expected effect of climate change on this hazard is not clear in the literature (Jouzel and Planton (2022) and ONERC (2018)). One important result is that the category “Disease, pests, weeds” is not currently insured in the French MPCIC contract, whereas this hazard appears to be important for the farmers, and more than 55% of them perceive that this hazard will increase both in frequency and intensity.

Table 4.3: Impact of climate change.

Hazard	Frequency			Intensity		
	↗	=	↘	↗	=	↘
Drought	265	13	2	257	21	2
Storm	178	101	1	171	105	4
Flood	158	114	4	164	112	4
Disease, pests, weeds	158	114	8	155	117	8
Hail	147	131	2	135	141	4
Frost	120	105	55	110	119	51
	Average [Std dev]					
INDEX_CONCERN	0.56 [0.278]					

The expected variations of some hazards (floods, hail, frost) are different as a function of the location (North, West, East, South) and of the farmer’s activity (field crops, wine, fields crops+breeding, breeding, diversification), as presented in Appendix 4.6.1. Indeed, Table 4.6 shows that South and West perceived to be more subject to floods as a result of climate change, both in terms of frequency and intensity, than North and East. In the same manner, Table 4.7 indicates that East and South perceived to be more subject to hail as a result of climate change, both in terms of frequency and intensity, than North and West. Finally, in Table 4.8, we observe that North and West expect a decrease of frost both in terms of frequency and intensity as a result of climate change, whereas the opposite is true for East and South. Concerning the impact of the farmer’s activity, Table 4.9 shows that independently of the farmer’s activity, farmers never expect the frequency and intensity of hail to decrease. Although the more robust activities expect no change in this risk, the more vulnerable crops (wine and others) expect hail to increase. Finally, Table 4.10 shows that wine growers highly expect the frequency and intensity of frost to increase compared to the other farmers’ activities.

The average of the variable *INDEX\_CONCERN* is 0.56. It should be recalled that this variable ranges from -1 to +1. The distribution of this index is presented in Fig. 4.3.

It should be noted that the index is rarely negative, only for three farmers. We can observe that



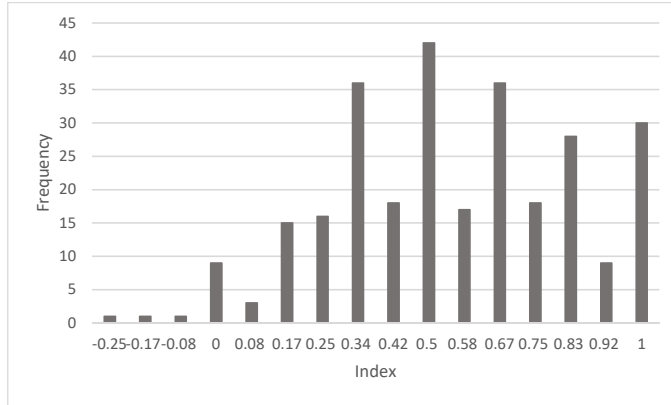


Figure 4.3: Distribution of the index of concern.

10.71% of the sample has always selected an increase (in frequency and intensity for all six of the hazards).

### 4.3.2 Correlation analysis

**Adaptation.** We looked at the potential correlation between the adaptation strategies through the following correlation matrix.

$$\text{Adapt. correlation} = \begin{bmatrix} & \text{PRA} & \text{DCROP} & \text{INS} & \text{DINC} \\ \text{PRA} & 1 & & & \\ \text{DCROP} & -0.02 & 1 & & \\ \text{INS} & -0.09 & -0.15^{**} & 1 & \\ \text{DINC} & -0.22^{***} & -0.01 & -0.18^{***} & 1 \end{bmatrix}$$

With [\*]  $p < 0.10$ ; [\*\*]  $p < 0.05$ ; [\*\*\*]  $p < 0.01$

We can observe that the correlation coefficients are always negative between the four adaptation strategies, meaning that they are substitute two-by-two. Some correlations are significant, e.g., insurance with diversification of crops and with income diversification. This is in accordance with the classical result of [Ehrlich and Becker \(1972\)](#) indicating that insurance and prevention are substitutes.

**Impact.** We looked at the potential binary correlation between: 1/ frequency and intensity for one hazard (“Hazard correlation” matrix); 2/ the frequency between hazards, two by two (“Freq. correlation” matrix); 3/ the intensity between hazards, two by two (“Intensity correlation” matrix). These three analysis correspond to the three correlation matrices below.

$$\text{Hazard correlation} = \begin{bmatrix} & \text{Drought} & \text{Flood} & \text{Frost} & \text{Storm} & \text{Hail} & \text{D.P.W.} \\ \text{Drought} & 0.45^* & & & & & \\ \text{Flood} & & 0.73^* & & & & \\ \text{Frost} & & & 0.79^* & & & \\ \text{Storm} & & & & 0.74^* & & \\ \text{Hail} & & & & & 0.74^* & \\ \text{D.P.W} & & & & & & 0.83^* \end{bmatrix}$$

With [\*]  $p < 0.10$ ; [\*\*]  $p < 0.05$ ; [\*\*\*]  $p < 0.01$

This first correlation matrix reveals that for each hazard, the frequency and the intensity are positively and significantly correlated. This result is in line with what we already observed in Table 4.3. The farmers who believe in climate change expect both the intensity and frequency of hazards to increase. Some correlations are associated with a high coefficient value like the intensity and frequency of D.P.W, whereas others are associated with a lower Pearson correlation coefficient like intensity and frequency of drought.

We then separated the analysis of the frequency and the intensity in order to study the potential correlation between hazards.

$$\text{Freq. correlation} = \begin{bmatrix} & \text{Drought} & \text{Flood} & \text{Frost} & \text{Storm} & \text{Hail} & \text{D.P.W.} \\ \text{Drought} & 1 & & & & & \\ \text{Flood} & 0.17^{***} & 1 & & & & \\ \text{Frost} & 0.05 & 0.07 & 1 & & & \\ \text{Storm} & -0.01 & -0.05 & 0.02 & 1 & & \\ \text{Hail} & 0.15^{**} & 0.13^{**} & 0.21^{***} & 0.06 & 1 & \\ \text{D.P.W} & 0.17^{***} & 0.16^{***} & 0.13^{**} & 0.19^{***} & 0.19^{***} & 1 \end{bmatrix}$$

With [\*]  $p < 0.10$ ; [\*\*]  $p < 0.05$ ; [\*\*\*]  $p < 0.01$

In this second correlation matrix, we can observe that storm is the hazard whose frequency is the least correlated with the frequency of another hazard. Indeed, the frequency of storm is only significantly and positively correlated with D.P.W. On the contrary, the frequency of some hazards is significantly and positively correlated with all the other hazard frequencies such as D.P.W and, to a lesser extent, Hail (except with Storm).

$$\text{Intensity correlation} = \begin{bmatrix} & \text{Drought} & \text{Flood} & \text{Frost} & \text{Storm} & \text{Hail} & \text{D.P.W} \\ \text{Drought} & 1 & & & & & \\ \text{Flood} & 0.18^{***} & 1 & & & & \\ \text{Frost} & 0.12^* & 0.05 & 1 & & & \\ \text{Storm} & 0.31^{***} & 0.26^{***} & 0.05 & 1 & & \\ \text{Hail} & 0.17^{***} & 0.27^{***} & 0.21^{***} & 0.43^{***} & 1 & \\ \text{D.P.W} & 0.17^{***} & 0.18^{***} & 0.12^{**} & 0.04 & 0.20^{***} & 1 \end{bmatrix}$$

With [\*]  $p < 0.10$ ; [\*\*]  $p < 0.05$ ; [\*\*\*]  $p < 0.01$

Several comments can be made on the basis of the third correlation matrix. First, the intensity of D.P.W is positively and significantly correlated with the intensity of all hazards except storm. This is currently the only hazard proposed here that is not included in the MPCCI contract in France. Second, the intensity of drought is positively and significantly correlated with the intensity of all the other hazards.

### 4.3.3 Regression analysis

We first present the regressions aimed at identifying determinants of climate change perception and the index of concern, and we then present the results of the regression according to adaptation strategy.

#### Determinants of climate change perception and the index of concern

Table 4.4 presents the two regression analyses of the variables *CC\_PERCEPTION* and *INDEX\_CONCERN*. The explanatory variables considered are those of Table 4.1.

Concerning the variables with a significant and positive impact on the perception of climate change, we identified the variables *RecentLoss*, *Compensation*, *Education* and *FarmExposure*. This means that having suffered losses in the past two years due to weather-related events and having already received an insurance compensation in the past are associated with a higher perception. A similar result is obtained concerning the level of education and the self-assessed level of exposure of the farm.

Concerning the variables with a significant and positive impact on the index of concern, we identified two types of crops (*Wine*, *Diversified – other*), the variables *Compensation* and the self-assessment *FarmExposure*. Once again, this means that having already received an insurance compensation in the past is associated with a higher concern. A similar result is obtained concerning the self-assessed level of exposure of the farm.

Table 4.4: Regression results for perception and concern (N=280).

	CC_PERCEPTION	INDEX_CONCERN
<i>TypeAgri</i>		
2.Wine	0.577	0.130*
3.FC and Breeding	0.647	0.058
4.Breeding	1.157	0.083
5.Diversified-other	-0.459	0.109*
<i>Location</i>		
2.West	-0.139	0.054
3.East	0.530	0.076
4.South	-0.330	0.057
Surface Area (ha)	0.000	0.000
Irrigation	0.252	-0.011
Contract	-0.073	0.023
WorkForce	-0.304	-0.033
Coop	-0.654	0.073
Syndicate	0.288	-0.019
FarmExp	0.001	-0.003
FamilyFarm	0.165	-0.014
Label	0.389	0.022
Nitrogen	-0.991	-0.052
Disaster	0.636	-0.034
RecentLoss	1.046**	0.009
Compensation	0.738*	0.090**
Age	-0.021	0.002
Gender	0.331	-0.003
Education	0.349**	0.009
<i>Marital</i>		
1.Married or Civil union	0.057	-0.007
2.Divorced or Widowed	-0.169	-0.103
3.NSPP	1.060	0.087
HouseholdSize	-0.112	0.008
<i>SpouseOccupation</i>		
0.I live alone	0.407	0.054
2.No	0.181	0.013
Income	0.181	0.004
NonAgriIncome	-0.218	0.008
<i>Statut</i>		
2.Tenant	0.900	-0.093
3.Tenant-Owner	0.229	-0.069
FarmExposure	0.465**	0.029*
CoeffRA	-0.133	0.023
Patience	0.125	0.004
Impulsiv	0.012	0.001
Constant		0.200
Log likelihood	-130.628 45	-13.152 381
Pseudo R <sup>2</sup>	0.2064	0.6499

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## Determinants of each adaptation strategy

The following table presents the regression results according to adaptation strategy. Several interesting comments can be made on this basis.

First, when we look at the adaptation strategies, we can observe that eight variables may explain the changes in practices (PRA). Some variables have a positive impact like having a label, gender, the size of the household and being a tenant, and others have a negative impact like the area of the farm, the fact that the spouse works outside of the farm (positive effect of “I live alone” with respect to this

Table 4.5: Regression results for the adaptation strategies.

	Adaptation strategies				
	PRA	DCROP	INS	DINC	NOCH
<i>TypeAgri</i>					
2.Wine	0.171	-1.961***	0.077	0.443	0.574
3.FC and Breeding	0.291	0.064	0.050	-0.220	-0.025
4.Breeding	-0.202	-1.045**	0.179	0.648	0.483
5.Diversified-other	0.213	-0.233	-0.636*	0.231	0.071
<i>Location</i>					
2.West	0.263	0.383	-0.549	0.227	-0.299
3.East	0.197	0.328	0.168	-0.036	-0.432
4.South	0.368	0.811**	-0.358	0.335	-0.071
Surface Area (ha)	-0.002*	0.001	-0.001	0.003**	0.001
Irrigation	0.125	-0.016	0.132	0.151	-0.033
Contract	0.056	0.279	0.261	-0.368*	-0.400
WorkForce	0.131	0.210	0.003	-0.591***	-0.093
Syndicate	-0.291	-0.340	0.303	-0.771	-0.059
Coop	-0.208	-0.002	-0.054	0.114	-0.481
FarmExp	0.009	-0.014	-0.002	0.006	0.002
FamilyFarm	-0.108	0.065	0.098	0.228	0.227
Label	0.404*	0.130	0.173	-0.518**	-0.202
Nitrogen	0.084	-0.683**	-0.057	0.283	0.084
Disaster	0.044	0.064	-0.100	-0.015	0.253
RecentLoss	0.296	-0.084	0.067	-0.041	-0.184
Compensation	-0.171	-0.168	0.705***	-0.178	0.110
Age	-0.002	-0.015	0.024	-0.014	0.013
Gender	0.408*	0.254	-0.122	0.040	0.160
Education	0.077	0.128*	0.031	0.094	0.058
<i>Marital</i>					
1.Married or Civil union	0.197	-0.049	-0.724*	0.040	0.509
2.Divorced or Widowed	-0.267	0.247	-0.437	0.177	0.213
3.NSPP	0.184	0.134	-0.429	-1.012*	0.325
HouseholdSize	0.270**	-0.055	-0.193	0.227**	0.045
<i>SpouseOccupation</i>					
0.I live alone	0.746*	-0.158	-0.962**	0.166	-0.001
2.No	-0.179	0.099	0.011	0.458**	-0.064
Income	-0.194**	0.006	0.143	-0.044	-0.043
NonAgriIncome	0.139	-0.160	0.345	0.234	0.175
<i>Statut</i>					
2.Tenants	0.693**	-0.072	0.126	0.238	-0.505
3.Tenant-Owner	0.299	0.034	-0.099	0.275	0.002
FarmExposure	-0.164*	-0.165	0.296***	0.207**	0.144
CC_PERCEPTION	0.089	-0.434**	-0.146	0.023	-0.340
INDEX_CONCERN	0.479	0.255	0.481	-0.033	-0.319
CoeffRA	-0.017	-0.005	0.116	-0.056	-0.037
Patience	0.011	-0.018	-0.078*	0.011	-0.004
Impulsiv	0.034	0.063	0.023	-0.020	0.100
Constant	-0.975	2.541**	-2.970**	-1.628	-2.731
Observations	261	261	261	261	280
Log likelihood	-155.721 94	-133.494 11	-121.768 23	-153.052 29	-57.063 623
Pseudo R <sup>2</sup>	0.1352	0.2612	0.2221	0.1520	0.1784

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

modality), the level of risk exposure of the farm and income. The significant and negative impact of *SurfaceArea* is interesting since it reveals a form of inertia: the greater the surface area is, the lower the probability of changing practices. This may correspond to a specialisation and investment effect. Similarly, having a label significantly increases the likelihood of changing practices. The labelling process is precisely a process of adapting previous cultivation practices to a new paradigm (in this case, the label specifications). To be awarded a label, the farmer has to follow precise specifications and generally make investments beforehand. We argue that if the farmers who have labels have been able to change their

practices, it seems reasonable to think that they will be able to do so in the future to cope with new constraints. *FarmExposure* has a negative and significant effect. This sign indicates that farmers who claim the greatest exposure of their farm to weather-related events are the least likely to change their farming practices in order to cope with climate change. In fact, these farmers are the most likely to want to diversify their income with respect to their farming activity (see the negative and significant correlation between the two practices in the adaptation correlation matrix and the influence of this same variable for the *DINC* strategy).

Six variables have a significant impact on the diversification of crops (DCROP). The results indicate that winegrowers and livestock farmers will diversify significantly less than field crop growers. Vineyards are lands that are inherently dedicated to growing wine grapes, where each hectare has a high economic value (depending on the terroir) and is therefore difficult to convert into another crop. As far as livestock farmers are concerned, the explanation is likely to lie both in land constraints and the impossibility of converting areas of pasture into arable land, but also in a structural debt that is a major handicap (Chartier and Chevrier, 2015). Livestock farming is a capital-intensive activity, with low returns and a very strong inertia effect. Being in the South has a significant and positive effect on the adoption of crop diversification compared to being located in the North. Farmers who use nitrogen are significantly less inclined to adopt crop diversification. The higher the education level is, the more often crop diversification will be selected as a potential adaptation strategy. Finally, climate change perception appears has negative and significant. This means that the higher the perception is, the lower the propensity to adopt crop diversification will be. This result reveals that being aware of climate change does not necessarily mean implementation of adaptation strategies, in particular, crop diversification.

The third adaptation strategy is insurance (INS), and several variables influence its adoption, some positively like *Compensation*, *Spouseoccupation* (negative influence of living alone compared to the situation of the spouse working outside of the farm) and *FarmExposure*, whereas the others such as *TypeAgri5*, *Marital1* and *Patience* have a negative effect. Having received an insurance compensation in the past highly encourages farmers to adopt insurance. This result is in line with the literature that highlights an inertia effect regarding past experience with insurance on subsequent crop insurance adoption (Enjolras et al., 2012; Santeramo, 2019; Koenig and Brunette, 2023). Moreover, the higher the degree of exposure of the farm to risks, the higher the propensity to insure. Farmers who are married or in civil unions will adopt this strategy significantly less than single farmers. However, this appears to be counterbalanced if the spouse works off the farm. Finally, the fifth category of *TypeAgri* that groups together the most diversified farms in the sample appears to be negative and significant in relation to the first category for field crop growers. Diversification and insurance are natural substitutes.

The last adaptation strategy is diversification of income (DINC). Eight variables have a significant impact. Diversification of income means seeking a source of income other than farming (from tourism

or taking up a position in a third-party company, for example). We then easily understand that variables like *Contract*, *WorkForce* or *Label* have a significant and negative effect on the diversification of income. Regarding the family situation, both the number of people in the household and the fact that the spouse does not work outside of the farm (compared to the situation where he or she does), have a positive and significant influence on the probability of diversifying income. Embarking on a new entrepreneurial adventure may be easier if there are two people involved, or it may simply be easier for one of the partners to diversify the household income working outside of the farm if this is not yet the case. The degree of exposure to hazards also has a positive influence on the adoption of this strategy insofar as the farmer would be inclined to make his/her income less correlated with weather conditions.

Finally, the last column of Table 4.5 reveals no significant determinant for the “no change” (NOCH) planning.<sup>9</sup>

To conclude, it appears that *CC\_PERCEPTION* is not a prerequisite to the adoption of adaptation strategies. This may be due to the fact that almost 80% of our sample already feels the impact of climate change (modality 3). Nevertheless, it has a negative impact on one adaptation strategy: crop diversification. We can also note that although location seems to play a role on the perception of climate change impact (as discussed in Section 4.3.1 and presented in Appendix 4.6.1), it has no effect on the choices in terms of adaptation strategies. Indeed, the variables dedicated to location are never significant, except for the impact of *South* on crop diversification.

## 4.4 Discussion

### 4.4.1 The two paths of adaptation: farming adaptation vs. farming deviation

Our results suggest that French farmers are clearly aware of climate change. Starting from there, the way that they cope with it will be determined by their characteristics and those of their farms. We particularly argue that one crucial element is how exposed to weather-related events farmers consider themselves to be today. Two paths of adaptation arise from that distinction. The first path is about farming adaptation. The second one concerns the farmers who are willing to adapt by deviating their activity from farming. The first element that depicts this dichotomy is the negative coefficient of correlation between *PRA* and *DINC* in the *Adaptation* correlation matrix. The farmers will either change, adapt or modify their farming practices, or they will diversify their income sources. A look at the determinants of each strategy in Table 4.5 allows us to draw a fairly typical portrait. The farmers most likely to adopt the first path are characterised by an important inertia effect. This so-called inertia effect imposes a

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<sup>9</sup>Running the same model without the *TypeAgri* variable makes the impulsiveness positive and significant. The more the farmers define themselves as “impulsive”, the more likely that they will not adopt any specific adaptation strategy.

low degree of flexibility on farmers who manage farms, whereas “labelled” farms have natural barriers that prevent them from deviating from the agricultural activity (in particular, due to the investments made), and farm managers who have workers on their farms are also less likely to diversify their income source. Moreover, a distinct opposition is detectable regarding the *FarmExposure* variable. The more the farmers consider themselves to be exposed to weather-related events today, the more likely they will deviate from pure farming activities and the less likely they will cope with climate change by modifying their farming practices. In summary, we distinguish, on the one hand, farmers who feel less exposed to weather-related events today, aware of the present and future impacts of climate change, and who will cope with it by adapting the operation of their farm. On the other hand, we distinguish farmers who feel particularly exposed to weather-related events today and who, since climate change impacts them, are likely to turn away from farming.

#### 4.4.2 Implications for the development of crop insurance

Considering these two adaptation paths and the expected impacts of climate change has implications for the development of the crop insurance market. First of all, the *Adaptation* correlation matrix highlights the negative and significant correlation of insurance adoption with both diversification of crops and income. This means that these tools are substitutes: either the farmers insure or they implement diversification. Table 4.1 shows that the greater use of insurance is the least selected strategy (28.74% of the sample) despite being highly promoted (Drieux et al., 2019). One variable that clearly explains this adoption is *Compensation*, the fact of having already received compensation from an insurer in the past. This echoes the notion of farmers’ trust in insurers mentioned in Koenig and Brunette (2023). Indeed, if farmers have already experienced a loss and have been compensated for it, then they trust their insurer and are more inclined to remain longer in the insurance scheme. Insurance appears as a fairly isolated strategy, which may be an important issue for the availability of such an instrument. Crop insurance adoption is already low today in France (around 30% of the French agricultural area without grassland insured by the main contract), which leads to the poor quality of pooling and structural losses for the insurer, with an average loss ratio of 101% between 2005 and 2018 (Koenig et al., 2022). Such losses threaten to drive private insurers out of the market, especially since expected climatic variations are likely to increase claims. These losses automatically lead to an increase in premiums. The market is currently in a situation where farmers perceive insurance to be too expensive, while premiums are too low from the insurers’ point of view. It seems necessary to ask whether this low propensity to take out insurance might not be explained by the nature of the offer available to them. Expectations in terms of coverage and, in particular, the relationship between the price paid and the risks covered, may not be in line with what is currently on offer.



#### 4.4.3 Multi-peril vs. single-peril crop insurance contract

In France, the only contract that entitles farmers to a premium subsidy is the unique multi-peril crop insurance contract that covers 15 hazards. Although the simplicity of such an offer and the number of hazards covered may seem attractive, farmers may find these contracts too expensive in relation to the coverage they would like to have. Indeed, all the hazards are not perceived in the same manner so that a unique insurance contract for all hazards does not seem to be the good option. Determining the level of the insurance premium is a delicate and not very transparent matter, but it takes a number of parameters into account such as the capital covered (type of crop, historical yield, etc.), the geographical location, the history of the farmer and, of course, the hazards covered. Therefore, the same farmer insuring the same crop on the same area with a multi-risk policy or a single-risk policy will not pay the same premium. For example, the average rate (ratio of premium/capital) for a field crop grower was 3.68% in 2018 for an MRC policy, compared to 1.45% for a single-risk hail policy (See the FFA study (p.c58-90) in the appendix of the [Descrozaille \(2021\)](#) report). The “relative cost” of an MRC contract compared to a hail contract was therefore 2.5 times higher in 2018 (for an average of 2.43 over the period 2012-2018). This difference is relatively the same for other types of crops with an average of 4.03% and 11.54%, respectively, on the MRC policy for vineyards and fruits, compared to 2.96% and 5.81% on the hail policy (for the same period). This difference is reflected in a substantial difference in premiums: the average premium paid by farmers insured under the MRC policy in 2018 was €4689, compared to €2220 for those insured under the hail policy (the differences in premiums paid are very large between crops, particularly in terms of premiums per hectare, but we do not have the precise data available.<sup>10</sup>

Since the cost of insurance is particularly significant, especially for the smallest farms, deviating from the strategy of a single contract in order to have an offer that provides less generic cover and that is more in line with farmers’ expectations could convince them to enter the market. For example, farmers from North and West expect frost to decrease, so that the parameter related to the risk of frost in the calculation of the MPCCI premium may discourage them from adopting the insurance contract. On the contrary, for wine-growers, the expected increase of this hazard may justify the adoption of a specific frost insurance contract that exists but is not currently subsidized. In other countries, single-peril crop insurance exists, like in Germany, where a mature single-peril hail insurance market for crops exists ([Meuwissen et al., 2018](#)) and in Spain, a country that has freed itself from the CAP in order to have more flexibility and that subsidizes the crop insurance premium with government funds.

Based on the assumption that variations in frequency or intensity do not involve the same management tools (although they are highly correlated with each other; see the “Hazard correlation” matrix), we can focus on the correlations in frequency between hazards (“Freq. correlation” matrix) to discuss the insurance tool. This matrix indicates that farmers do not perceive the increase in the frequency of certain hazards to be significantly correlated. For example, variations in the hazards *Frost* and *Storm*

<sup>10</sup>As an example, the Ariège prefecture simulated fictitious subscriptions in 2016 and the orders of magnitude were as follows: a net subsidy cost per hectare of MRC insurance of €31 for field crops, €116 for vineyards and €1,681.75 for fruit (these amounts are simply indicative of the orders of magnitude, as some examples differed depending on whether certain additional options were taken out).

are only weakly correlated with the other hazards, while *Hail* and *D.P.W* are positively and significantly correlated with almost all the hazards. If the cost of insurance is expected to increase as a result of climate change and the systemic nature it implies, this result indicates that farmers would be more inclined to take out specific policies for these correlated hazards. Similarly, Table 4.8 in the Appendix shows that over 60% of farmers in eastern France expect an increase in the frequency and intensity of frost events, whereas only 9.7% do in northern France (most of whom expect no change). If we carry out the analysis by crop type, we see in Table 4.9 that cereal growers do not expect an increase in the frequency and intensity of hail events, unlike wine growers, for example (38.5% compared to over 60%). The MPCCI contract currently on offer covers the first four hazards (Drought, Flood, Frost, Storm and Hail), but does not cover the risk of crop pests (Disease, Pests, Weeds) unlike in the USA where plant disease cover is included in the Federal Crop Insurance Program (Skorbiansky et al., 2022). Moreover, important implications exist regarding the introduction of the cover of such risks since it could also be an instrument to promote the use of more environmentally-friendly farming practices by reducing the use of pesticides (Feinerman et al., 1992). However, empirical results indicate a positive correlation in the use of crop insurance and pesticides, underlining the importance of farmers' attitudes towards risk (Chakir and Hardelin, 2014; Möhring et al., 2020). Reducing the use of these chemical inputs is a major objective of the Common Agricultural Policy and of the European Green Deal (Lefebvre et al., 2015; Tataridas et al., 2022), even more so with the emergence of pesticide resistance in treated pests (Beckie et al., 2019).

In our sample, this risk is ranked as even more worrisome than purely meteorological risks by at least 11.11% of our sample who ranked it first among the six sources of risk 4.1). Regarding the future use of crop insurance, our results suggest that “dual-risk” offers covering a meteorological hazard and the risk of pests and diseases could be of interest to farmers. However, the pricing of such a contract is subject to many uncertainties. Insurers lack the experience and data to measure this risk, so high premiums are to be expected.

#### 4.4.4 Bundled contracts vs. separate ones

We can link the results of this article to the experimental economic literature about bundled insurance contracts vs. separate insurance contracts. The results are not unanimous since Slovic et al. (1977) and Schade et al. (2012) showed that individuals have a greater willingness to pay for a bundled contract than for two separate ones, whereas Schoemaker and Kunreuther (1979) obtained the reverse result, and Robinson and Botzen (2022) intermediary results. Slovic et al. (1977) tested whether 151 subjects prefer to insure against a low-probability/high impact risk when insurance covers a likely risk of loss as well. They showed that subjects in their experiment were willing to spend 30% more on insurance that covers both risks than the sum of their expenditures for two separate policies. Schade et al. (2012) conducted a survey whereby 254 students were either offered insurance that covers the risk of fire and theft of an inherited painting or sculpture, or individual policies that cover these risks separately. The authors showed similar results. Schoemaker and Kunreuther (1979) obtained the opposite results on a sample of

158 students and 68 clients of an insurance agency. Finally, [Robinson and Botzen \(2022\)](#) showed that the demand is greater to insure separate risks than to cover all risks together in a bundled insurance policy in the UK, whereas no significant difference was found in the Netherlands.

The literature and our results indicate that there is a delicate trade-off between a simplified, generic offer and a specific, more complex offer.

## 4.5 Conclusion

In this article, we analysed the link between the perception of climate change, the expected impact of climate change, and adaptation strategies towards climate change. We tackled this question through a survey carried out on 288 French farmers in 2021. We approached the process of adaptation by farmers as a sequential process of perception: assessing the imminence of climate change, anticipating its impacts and then defining the best strategy or strategies to adopt. Our results show that the majority of farmers are already feeling the impact of climate change. However, the exposure felt today and the expected variations in the frequency and intensity of the various hazards differ according to the characteristics of the farm and the farmer. These same characteristics lead to a dichotomy in adaptation profiles. Farmers who feel relatively less exposed to meteorological hazards, and with the strongest farm “inertia” (salaried or “labelled” farmers), are more inclined to adapt their farming methods, while others, already feeling more exposed, are more likely to decouple their income with respect to meteorological conditions by diversifying their sources of income. Insurance as a tool for coping with the consequences of these meteorological hazards seems to be struggling to find its place, and is only now being adopted by farmers already familiar with the system. The prospect of increasing weather hazards does not specifically encourage farmers to take an interest in this instrument. The low uptake of insurance is already leading to problems of market equilibrium, despite the fact that the offer is heavily subsidized. Under these conditions, worsening weather conditions are likely to aggravate the situation and to compromise the availability of the insurance tool in the future. Our results suggest that diversifying the contracts on offer by making them less generic could potentially meet the expectations of certain farmers in terms of coverage needs. Dual-risk contracts (like the ones that existed in the past) and the integration of pest and disease risks are areas worth exploring.

Our study naturally has a number of limitations. Firstly, the analysis was carried out on a limited sample, which, although relatively well distributed geographically, was mainly made up of field crop growers and winegrowers. Greater representation of market gardeners and fruit growers could have provided valuable information. In addition, more precise options for adaptation strategies could have been proposed. These questions were included in a broader survey on perceived barriers to the adoption of crop insurance contracts, and were therefore constrained in terms of size and time. More elements included in the questionnaire could have enabled a study to be carried out within the framework of the analysis of the effect of uncertainty and ambiguity on the parameters studied, but the same conditions as indicated above constrained it. This field of study is particularly wide-ranging and calls for numerous

studies. The prospect theory framework, for example, seems well-suited to better understanding farmers' perceptions and induced reactions. As far as the insurance market is concerned, the development of index-based and parametric products also offers interesting opportunities for improving and reducing the cost of the products offered.

*Harmonised formatting for the thesis manuscript of the version published in  
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## 4.6 Appendix

### 4.6.1 Appendix A. Expected frequency and intensity variation of flood according to farmer location.

Table 4.6: Expected frequency and intensity variation of flood according to farmer location.

FLOOD	Frequency			Intensity			N
	↗	=	↘	↗	=	↘	
North	48.4%	51.6%	0%	51.6%	48.4%	0%	31
West	63%	34.6%	2.5%	63%	35.8%	1.2%	81
East	38.5%	58.5%	3.1%	43.1%	55.4%	1.5%	65
South	65%	31.1%	3.9%	67%	31.1%	1.9%	103

### 4.6.2 Appendix B. Expected frequency and intensity variation of hail according to farmer location.

Table 4.7: Expected frequency and intensity variation of hail according to farmer location.

HAIL	Frequency			Intensity			N
	↗	=	↘	↗	=	↘	
North	45.2%	54.8%	0%	45.2%	48.4%	6.5%	31
West	42%	56.8%	1.2%	38.3%	61.7%	0%	81
East	56.9%	41.5%	1.5%	55.4%	43.1%	1.5%	65
South	60.2%	39.8%	0%	52.4%	46.6%	1%	103

### 4.6.3 Appendix C. Expected frequency and intensity variation of frost according to farmer location.

Table 4.8: Expected frequency and intensity variation of frost according to farmer location.

FROST	Frequency			Intensity			N
	↗	=	↘	↗	=	↘	
North	9.7%	54.8%	35.5%	9.7%	54.8%	35.5%	31
West	30.9%	37%	32.1%	24.7%	51.9%	23.5%	81
East	61.5%	32.3%	6.2%	61.5%	27.7%	10.8%	65
South	50.5%	35.9%	13.6%	45.6%	40.8%	13.6%	103

#### 4.6.4 Appendix D. Expected frequency and intensity variation of hail according to farmer activity.

Table 4.9: Expected frequency and intensity variation of hail according to farmer activity.

HAIL	Frequency			Intensity			N
	↗	=	↘	↗	=	↘	
Field crops	38.5%	61.5%	0%	38.5%	61.5%	0	78
Wine	65.8%	32.9%	1.3%	60.8%	36.7%	2.5%	79
Field crops + breeding	48.9%	48.9%	2.1%	42.6%	55.3%	2.1%	47
Breeding	46.2%	53.8%	0%	46.2%	50%	3.8%	26
Diversification	60%	40%	0%	50%	50%	0%	50

#### 4.6.5 Appendix E. Expected frequency and intensity variation of frost according to farmer activity.

Table 4.10: Expected frequency and intensity variation of frost according to farmer activity.

FROST	Frequency			Intensity			N
	↗	=	↘	↗	=	↘	
Field crops	21.8%	47.4%	30.8%	17.9%	56.4%	25.6	78
Wine	75.9%	21.5%	2.5%	69.6%	26.6%	3.8%	79
Field crops + breeding	29.8%	48.9%	21.3%	29.8%	44.7%	25.5%	47
Breeding	23.1%	46.2%	30.8%	15.4%	57.7%	26.9%	26
Diversification	46%	32%	22%	46%	36%	18%	50

### 4.6.6 Appendix F. Multivariate probit model

Table 4.11: Multivariate probit model (N=261).

	Adaptation strategies			
	PRA	DCROP	INS	DINC
<i>TypeAgri</i>				
2.Wine	0.157	-1.972***	0.172	0.403
3.FC and Breeding	0.306	0.049	0.087	-0.250
4.Breeding	-0.224	-1.059**	0.170	0.575
5.Diversified-other	0.172	-0.252	-0.584	0.223
<i>Location</i>				
2.West	0.275	0.391	-0.546	0.207
3.East	0.216	0.320	0.152	-0.048
4.South	0.394	0.793**	-0.407	0.283
Surface Area (ha)	-0.002*	0.001	-0.001	0.003**
Irrigation	0.117	-0.003	0.029	0.139
Contract	0.050	0.273	0.223	-0.375*
WorkForce	0.141	0.215	-0.012	-0.597***
Syndicate	-0.302	-0.308	0.246	-0.081
Coop	-0.213	-0.012	0.003	0.147
FarmExp	0.009	0.063	-0.001	0.005
FamilyFarm	-0.101	0.138	0.099	0.242
Label	0.403*	0.138	0.141	-0.457**
Nitrogen	0.102	-0.695**	-0.012	0.276
Disaster	0.034	0.067	-0.072	-0.013
RecentLoss	0.274	-0.172	0.065	-0.077
Compensation	-0.178	-0.018	0.687***	-0.164
Age	-0.002	-0.018	0.023	-0.013
Gender	0.384	0.238	-0.088	0.040
Education	0.079	0.126*	0.039	0.096
<i>Marital</i>				
1.Married or Civil union	0.178	-0.051	-0.677*	0.048
2.Divorced or Widowed	-0.280	0.262	-0.405	0.166
3.NSPP	0.177	0.151	-0.349	-0.984*
HouseholdSize	0.274**	-0.060	-0.187	0.223**
<i>SpouseOccupation</i>				
0.I live alone	0.725*	-0.173	-0.943**	0.156
2.No	-0.181	0.091	-0.013	0.435*
Income	-0.187**	0.004	0.148	-0.052
NonAgriIncome	0.119	-0.156	0.352	0.241
<i>Statut</i>				
2.Tenants	0.644**	-0.102	0.182	0.150
3.Tenant-Owner	0.280	0.006	-0.070	0.259
FarmExposure	-0.162*	-0.165	0.306***	0.223**
CC_PERCEPTION	0.098	-0.441**	-0.097	0.018
INDEX_CONCERN	0.489	0.282	0.490	-0.007
CoeffRA	-0.021	-0.006	0.119	-0.059
Patience	0.011	-0.016	-0.078*	0.007
Impulsiv	0.037	0.060	0.015	-0.025
Constant	-1.727	2.877**	-2.313	-1.664
Log likelihood	-500.91639			

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

### 4.6.7 Appendix G. Adaptation strategies.

Table 4.12: Adaptation strategies.

	Yes	No	N
Changing crop management practices	141	120	261
Income diversification	138	123	261
Crop diversification	136	125	261
Greater use of insurance schemes	75	186	261
No particular change	19	261	280

### 4.6.8 Appendix H. Score Frequency

Table 4.13: Score Frequency.

ScoreFreq	Freq.	Percent.	Cum
1	36	12.50	12.85
1.16	47	16.32	26.39
1.33	51	17.71	44.79
1.5	62	21.53	64.24
1.66	44	15.28	82.99
1.83	28	9.72	90.28
2	15	5.21	98.26
2.16	4	1.39	99.65
2.5	1	0.35	100.00
Total	288	100.00	

### 4.6.9 Appendix I. Score Intensity

Table 4.14: Score Intensity.

ScoreFreq	Freq.	Percent.	Cum
1	37	12.85	12.50
1.16	39	13.54	28.82
1.33	53	18.40	46.53
1.5	56	19.44	68.06
1.66	54	18.75	83.33
1.83	21	7.29	90.28
2	23	7.99	98.26
2.16	4	1.39	99.65
2.5	1	0.35	100.00
Total	288	100.00	



# Bibliography - Chapter IV

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## General conclusion



Over the course of these chapters, we have studied the development of the crop insurance offer, the relationship that farmers have with the instrument today and the place they intend to give it in the future.

The starting point for this thesis was the following: why, despite major subsidies, is the insured area still so low in France? The first thing we can say is that this is not a French specificity. Countries where the crop insurance market works well are more of an exception.

If we were to answer this question simply, we could say that it is a combination of dysfunction in the administration of the scheme, problems in farmers' perception of the insurance tool and failures in matching offers to farmers' real needs. That said, the difficulties involved in resolving these issues are considerable. Decades of inefficient crop insurance provision have led to a market that is poorly resilient and badly perceived. Insurers are suffering structural losses and farmers perceive insurance as too expensive. The window of opportunity for establishing an effective market seems slim. As weather conditions worsen under the influence of climate change, crop insurance in its current state is likely to disappear if financial equilibrium and a wider scale of pooling are not established.

To cut a long story short, the priority points in the French case, in my view, are the work that needs to be done to change farmers' perception of the instrument. How can we explain the fact that they perceive insurance as being too expensive when, structurally, the loss ratio is close to 1? Because of the nature of the risk and the crops covered, crop insurance is expensive. This is one of the reasons why there is a consensus in the literature that public support, in the form of a premium subsidy, is necessary for a market to exist (particularly for multi-risk policies). In France, this subsidy exists and has grown steadily since 1964. However, our results suggest that farmers do not perceive this subsidy as an incentive. As mentioned above, farmers currently pay 100% of the premium, carry out administrative procedures (which add to the already administratively burdensome management of their farms) and then receive 70% of the subsidy several months later. Over and above the simple cash flow problems for the smallest farms, the majority of farmers decorrelate the subsidy received from an insurance premium amount paid months before. These subsidies are in addition to other subsidies, particularly CAP subsidies, that they may receive as part of their activity.

The other major problem is the lack of confidence that some farmers have in insurers. The tool is badly perceived and suffers from the cliché that the insurer will always find a way to avoid compensating losses, which could also apply to other insurance markets. However, unlike many other insurances taken out by farmers, this one is not compulsory, and making it compulsory would, in my opinion, trigger opposition and a very significant trade union demonstration.

What France lacks, unlike Spain (or the United States, which are little mentioned in this thesis but well documented in the literature), are entities for the supervision and governance of crop insurance. It is for this reason that the 2023 reform is, in my opinion, an important starting point, thanks in particular to the future creation of the pool of insurers. An entity such as Agroseguro in Spain or the Risk Management Agency in the United States could work to improve the image of crop insurance,

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puts in place incentive mechanisms for initial adoption, which is a key element in creating this “fidelity” effect to insurance, and could financially assume the time lag between payment of the premium and receipt of the subsidy, so that farmers pay a premium net of subsidy (as in Spain and in the United States).

Another key point is the appropriateness of crop insurance in the overall risk management strategy and, by extrapolation, in the overall strategy for adapting to climate change. Although crop insurance is the instrument most supported by the public authorities, it is in the middle of other risk management instruments. To return to the triptych of prevention, insurance and national solidarity, the challenge is to make these instruments work together rather than making them compete (as was the case before the reform between insurance and the agricultural calamities scheme). Farmers are putting in place a variety of preventive instruments at farm level that represent an investment and reduce the likelihood of them being subject to compensation. These prevention efforts are complementary to insurance, under the condition that they significantly reduce the insurance premium. Today, because of the way insurance is priced, prevention and insurance are operating in competition with each other.

The trade-off between simplicity and clarity of the offer and meeting farmers’ specific cover needs (leading to a multiplicity of offers) remains a difficult one. The challenge is, as much as possible, to create customised products that are easy to understand. This can only be achieved with farmers who are familiar with how crop insurance works. The last chapter underlines this idea, but leads to another problematic observation. What would appeal to farmers and be likely to bring them into the crop insurance market is precisely what insurers want to avoid: insuring risks that are correlated with each other. In particular, we feel it is extremely important to work on the insurability of pest, weed and disease. Not only would it meet a need among farmers, but it could also contribute to national policies to reduce the use of plant protection products, such as EcoPhyto or the European Green Deal. Over and above the obvious moral hazard issues associated with covering such a risk (farmers stopping all measures and treatment to address the risk), there is the question of the correlation of this risk with the other risks covered (pests and diseases are more likely to develop after heavy rain, for example) and its impact on the premium and therefore the cost of the insurance. This will raise the issue of monitoring the treatments applied by farmers. Moreover, the effectiveness of introducing such a risk into the MRC offer, for example, will depend on the differential in willingness to pay to cover this hazard with the increase in the level of the premium due to the introduction of this cover (which the subsidy will be supposed to partially offset).

As an economist, taking an interest in a subject like this raises a lot of questions. The crop insurance market concentrates many of the defects that a market can have and behaviours that seems irrational. Moral hazard and asymmetric information, of course (perhaps even overestimated by the insurers), but above all, in my opinion, a questioning of what pure rationality would indicate. How can we

explain the fact that uninsured farmers don't take out insurance while their insured counterparts are structurally winning? Professional and geographical connections should disseminate this information. A network economy analysis could also highlight "pockets" of insured farmers. Of course, all the behavioural parameters studied in this thesis provide part of the answer to this question. But above all, and this is a question I have been asked many times during my various presentations, why are insurers still in the market when they are suffering structural losses? What's more, new players have recently entered the market. I don't have a scientific answer to that, just some intuitions that I can't prove.

The difficulties observed by this market are so numerous and structural in all countries that in the preface to a book concluding the 86th EAAE seminar in 2004, John D. Wright entitled his speech "*Why Government Crop Insurance?*".<sup>11</sup> He points out that with the abundant literature on crop insurance, the question is no longer "how" but "why"? Why do governments around the world continue to set up subsidised insurance schemes, which are costly for the taxpayer and condemn them to ever-increase the level of support of scheme which, moreover, cannot do without a catastrophic aid program? Leaving his question open, he concludes that there is great scope for research on crop insurance and that "*economists still have a valid role in documenting their effects, minimizing the waste they cause, and improving their design*".

Concerning the avenues of research, they seem to me to be numerous today. The first of these, which has recently attracted a great deal of scientific interest, is the role of index or parametric insurance. In this thesis, the question is not dealt with very much. Concentrating on MRC insurance, the index dimension only concerns grassland supply. Available since 2016 and still very little adopted, I have concentrated on traditional insurance with expertise, which is still in the majority worldwide. Parametric insurance offers the possibility of reducing insurance costs (lower administration and expertise costs) while avoiding asymmetry of information problems. However, in addition to the basis risk<sup>12</sup> usually opposed to the development of this instrument, there is the challenge of developing a multitude of indices to be adapted to different crops, locations and hazards, which means that the tool is unlikely to be a solution to the development of insurance in the short term.

Another point not addressed in this thesis is the role of reinsurers. Their role is important in assisting insurers with the losses they incur with the MRC offer and could be even more important in the future given the challenges that insurance (in general) will face as a result of climate change. This thesis focused on crop insurance from an analysis involving farmers, insurers and the State, but future developments will require us to consider a wider range of actors, including reinsurers, cooperatives and agri-food companies upstream and downstream of production.

Another priority area for research is the culture-specific analysis of the issues. This thesis proposes

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<sup>11</sup>Wright, B. D. (2006). Why government crop insurance? *Income Stabilization in Agriculture: The Role of Public Policies*.

<sup>12</sup>This is the difference between the hazard measured by the index and the farmer's reality in the field.

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a particularly cross-cultural analysis, as it focuses in particular on the MRC offer, which is unique and available to all. However, as we have seen throughout these chapters, the differences in adoption between cultures are sometimes very significant. In particular, the specificities associated with fruit crops and their very low coverage would deserve further study. Unfortunately, fruits growers were very poorly represented in our survey. In my opinion, some of the issues mentioned earlier are even more determinant for this type of farmer. Fruits are the crops that are the most sensitive to hazards, particularly late frosts and hailstorms. What's more, given the cost of insurance to cover such high-value crops per hectare, the issue of the subsidy lag and the failure to take into account prevention efforts is all the more problematic. One of the most common prevention tools for this population, for example, is the anti-hail net, which itself represents a very substantial investment and for which the adequacy of insurance deserves particular consideration. Irrigation is another extremely important factor today, and one that is set to become even more so. A hot topic in the French media during this thesis was the installation of “*mégabassines*”. Intended to meet the water needs of farmers during the summer months, these huge water reserves have provoked strong protests, particularly from environmental associations, because of their environmental impact (notably on biodiversity) but also because of the privatisation of water. Irrigation is naturally a crucial tool for farmers in times of drought, but these periods of drought are very often associated with periods of restricted irrigation use. Managing this resource is undeniably one of the main challenges for agriculture in the face of climate change.

Finally, an issue that I'm keen to address underlying these risk management issues is the question of the impact on the farmer and his family. Farming is physically demanding, time-consuming and leaves very little time for holidays. Combined with a whole range of socio-economic factors, isolation and stress, this lead to a situation where farmers are more exposed to mental health problems and are over-represented in suicide statistics. The MSA, the compulsory social security scheme for agricultural workers, has launched a programme to prevent ill-being in 2021 in response to the following finding: in 2016, the risk of death by suicide was 43.2% higher among MSA policyholders aged between 15 and 64 than among policyholders in the same age group in the general (non-agricultural) scheme. A previous study showed that the suicide rate for farmers was 28% higher than for the rest of the population in 2008<sup>13</sup> (livestock farmers being the most at risk). On this subject, Chaudat *et al.*<sup>14</sup> (2021) point to a multitude of causes for this grim finding: job insecurity, feelings of marginalisation, working conditions, administrative workload, exhaustion at work (in 2019, farmers reported working an average of 55 hours a week compared with 37 for the rest of the working population).

In a context of multiple sources of stress, it is clear that the occurrence of a meteorological hazard that destroys part of the harvest is a traumatic event that can have long-term repercussions. I have

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<sup>13</sup>Sénat.(17 mars 2021). Suicides en agriculture : mieux prévenir, identifier et accompagner les situations de détresse. *Rapport d'information n° 451 (2020-2021)*.

<sup>14</sup>Chaudat, P., Gaillon, D., Bah, T. (2021). Pourquoi tant de suicides chez les agriculteurs? The Conversation. 7 juillet 2021.



personally witnessed the impact that a devastating weather event can have on a farmer's health. In such a context, the quality of ex-post support is crucial both in terms of the amount of compensation and the way in which it is provided. Reducing and simplifying administrative burdens, cutting out intermediaries and shortening compensation times are all areas for improvement.





# Appendix



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# Survey



## Etude des Déterminants et Freins à l'Adoption de l'Assurance Récolte

L'enquête à laquelle vous allez participer est destinée à l'étude des comportements d'assurance des agriculteurs français. A l'heure actuelle, à peine 30% de la surface agricole française est assurée en MRC (multirisques climatiques des récoltes). Cette étude vise notamment à comprendre les freins et les déterminants à l'assurance récolte en France.

Cette enquête est menée dans le cadre d'un projet conjoint entre INRAE (Institut National de la Recherche pour l'Agriculture, l'Alimentation et l'Environnement) et la Chaire Economie du Climat (CEC).

Il n'y a pas de bonne ou de mauvaise réponse, juste des comportements différents à observer. Vos réponses seront analysées de manière anonymes et utilisées à des fins uniquement scientifiques.

Votre opinion est importante pour nous !

Répondre aux questions vous prendra environ 15 minutes et nous fournira des informations utiles pour mieux comprendre vos comportements, et pour orienter les recherches futures.

L'enquête sera composée de différentes parties avec des questions sur :

- 1) Votre exploitation
- 2) Vos choix d'assurance
- 3) Vos perceptions du futur et notamment du changement climatique
- 4) Votre comportement face au risque et au temps
- 5) Vos caractéristiques socio-démographiques

**Merci de compléter le questionnaire en entier.**

**Pour chaque questionnaire entièrement complété, une donation de 2€ sera réalisé à l'Association Petits Princes.**

Depuis 1987, l'Association Petits Princes réalise les rêves des enfants et des adolescents gravement malades atteints de cancer, de leucémies ou de certaines maladies génétiques.

Chaque jour, un rêve d'enfant est réalisé.

[www.petitsprinces.com](http://www.petitsprinces.com)

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# Study of the Determinants and Barriers to Crop Insurance Adoption

The survey you are about to take part in is designed to study the insurance behaviour of French farmers. At present, just under 30% of French farmland is insured against multirisk weather-related crop damage. One of the main aims of the study is to understand the obstacles to and determinants of crop insurance in France.

This survey is being conducted as part of a joint project between INRAE (Institut National de la Recherche pour l'Agriculture, l'Alimentation et l'Environnement) and the Climate Economics Chair (CEC).

There are no right or wrong answers, just different behaviours to observe. Your answers will be analysed anonymously and used for scientific purposes only.

Your opinion is important to us!

Answering the questions will take about 15 minutes and will provide us with useful information to better understand your behaviour and to guide future research.

The survey will be made up of different parts with questions on:

- 1) Your farm
- 2) Your insurance choices
- 3) Your perceptions of the future and in particular of climate change
- 4) Your attitude to risk and the weather
- 5) Your socio-demographic characteristics

**Please complete the questionnaire in full.**

**For each fully completed questionnaire, a donation of €2 will be made to the Association  
Petits Princes.**

Since 1987, the Petits Princes Association has been making dreams come true for seriously ill children and teenagers suffering from cancer, leukaemia or certain genetic diseases.

Every day, a child's dream comes true.

[www.petitsprinces.com](http://www.petitsprinces.com)



**Farm characteristics**

1. TypeAgri (Type(s) of agriculture)
2. GrandesCultures (Type(s) of field crops)
3. Elevage (Type(s) of livestock breeding)
4. MainCulture (What is the main culture)  
...
5. Hectare (Cultivated surface)  
...
6. Statut (Land ownership)
  - 1 = Owner
  - 2 = Tenant
  - 3 = Owner and Tenant
7. Irrigation (Use of irrigation)
  - 0 = No
  - 1 = Yes
8. FreqIrrig (Frequency of irrigation use)
  - 1 = Daily
  - 2 = As a backup
  - 3 = Exceptionally
9. Contract (Contracting or integrated chain approach)
  - 0 = No
  - 1 = Yes
10. MembreCoop (Member of an agricultural cooperation)
  - 0 = No
  - 1 = Yes
11. MembreSyndic (Member of a syndicate)
  - 0 = No
  - 1 = Yes
12. AnneeGestion (Number of years of farm management)  
...
13. AntecedentExploi (Farm previously owned by a family member)
  - 0 = No
  - 1 = Yes

- 
14. Label (Certification)  
0 = No  
1 = Yes
15. TypeLabel (Name of the label(s))  
...
16. TravailAvecPers (Work on farm with others)  
0 = No  
1 = Yes
17. NombrePersTravail (How many work units)  
...
18. TypePersTravail (Link with theses persons)  
TypePersTravailFAM = Member of the family (0=no/1=yes)  
TypePersTravailPERM = Permanent worker (0=no/1=yes)  
TypePersTravailMT = Half-time worker (0=no/1=yes)  
TypePersTravailSAI = Seasonal worker (0=no/1=yes)
19. ApportAzote (Use of fertilizer)  
0 = No  
1 = Yes
20. TypeAzote (Kind of fertilizer)  
1 = Mineral  
2 = Organic  
3 = Mineral and Organic
21. Calamites (Experience of agricultural disasters)  
0 = No  
1 = Yes
22. AleasSubis (Crop losses due to severe weather events in the last two years)  
0 = No  
1 = Yes
23. MesureExposition (Ranking from 1=very little to 5=very strongly the perceived degree of exposure to weather on the farm)  
1; 2; 3; 4; 5
24. SourceRisk (Ranking of the proposals according to the importance of the risk they represent for the farm)  
A1 = Meteorological hazards  
A2 = Change in crop prices  
A3 = Pests, Weeds, Diseases  
A4 = Lack of outlet  
A5 = Rising input prices

**A6** = Changing standards and regulations

**25.** Assurance (Do you have or will you take out crop insurance for the 2020-2021 campaign?)

**0** = No

**1** = Yes

### **Crop insurance**

**26.** TypeAss (Type of crop insurance contract)

**MRC** = Climate Multi-risk Insurance

**GRL** = Hail Insurance

**PRAI** = Grassland Insurance (indexed)

**CA** = Revenue Insurance

**GEL** = Frost Insurance

**PARA** = Parametric Insurance (index-linked, excluding Grassland Insurance)

**27.** TypeMRC (Type of MRC contract subscribed)

**1** = Culture group

**2** = Farm level contract

**3** = Doesn't know

**28.** SurfaceAss (Percentage of area cultivated insured)

...

**29.** SubvPrime (Reception of a subsidy for the premium)

**1** = Yes

**2** = No, but did the application

**3** = No, and did not apply for

**30.** Options (Subscription of additional options to base contracts)

**1** = Yes

**2** = No

**3** = Doesn't know

**31.** TypeOptions (Type(s) of additional options subscribed)

**FRAN** = Reduction of the deductible level

**SEUI** = Reduction of the trigger threshold

**PRIX** = Guaranteed price supplement

**RDT** = Increase in guaranteed historical yield

**QUA** = Covering the loss of crop quality

**RESE** = Reseeding costs

**NSP** = Doesn't know

**other** = ...

**32.** Assureur (Same insurer for coverage of the crops and the buildings and equipment)

**0** = No

**1** = Yes

33. AssT1 (Insurance of the crops last campaign)  
 0 = No  
 1 = Yes
34. AssT2 (Insurance of the crops two years ago)  
 0 = No  
 1 = Yes
35. AnneeAss (Total number of years of subscription to a crop insurance contract)  
 ...
36. IndemnisationAss (Have you already received compensation for crop loss from an insurer?)  
 0 = No  
 1 = Yes
37. PerceptionCC (Perception of climate change)  
 1 = Doesn't believe in climate change  
 2 = Climate change doesn't impact and will not affect my farm  
 3 = Climate change will soon impact my farm  
 4 = Climate change is already impacting my farm

### Determinants and drivers of crop insurance adoption

38. EncouragingFactors (Ranking of the TOP3 proposals that most encourage you to insure your crops)  
**WEATHER** = Bad weather forecasted/anticipated  
**COUNCILS** = External councils (cooperative members, neighbours, insurers...)  
**SUBSIDY** = The level of subsidy  
**LOSSES** = Having previously suffered losses due to weather-related hazards  
**FLEXIBILITY** = The flexibility of the contract and the options available  
**OBLIGATIONS** = The obligations (due to contracting or the integrated sector, owner's request...)  
**CHANGES** = A change of rotation or crop
39. PotentialFactors (Ranking the TOP3 proposals that **would** most encourage you to insure your crops)  
**PREMIUM** = Lower insurance price  
**SUBSIDY HIGHER** = A higher level of subsidy  
**SUBSIDY DIRECT** = A grant applied directly at the time of payment  
**ADMINISTRATIVE** = Reduced administrative procedures  
**DEDUCTIBLE** = A lower deductible and threshold for triggering compensation  
**INSURED YIELD** = A higher insured yield  
**INSURED PRICE** = A higher guaranteed price for compensation  
**QUALITY** = Cover for loss of quality  
**PESTS** = Cover for losses due to pests, diseases and weeds

### Barriers to the adoption of crop insurance

40. AccordFreins (Express the level of agreement or disagreement for each proposed reasons for not using the MRC contract)

**Strongly disagree / Somewhat disagree / Indifferent / Somewhat agree / Strongly agree**

**PRICE** = The price is too high

**DED** = The deductible is too high

**TRIG** = The threshold for triggering compensation is too high

**SHIFT** = The time lag between the payment of the insurance and the payment of the grant generates cash flow problem

**ADMI** = Too much administrative documents

**INCO** = The proposed contracts are incompatible with my growing calendar

**PROB** = The probability of receiving compensation seems too low to me

**YIELD** = The method used to calculate the guaranteed return (based on historical data) makes the coverage too low

**PREV** = I already have enough measures in place to prevent or fight against weather hazards

**TRUST** = I do not trust insurers

**DIVE** = I have diversified my activities enough to withstand a loss caused by weather hazards

**COMP** = The time limit for receiving compensation for crop loss is too long

**EARLY** = I have to make my decision to subscribe too early in my campaign

41. ClassificationFreins (Among the proposals in the previous question, select the TOP3 that you consider to be the most important barriers)

**PRICE** = The price is too high

**DED** = The deductible is too high

**TRIG** = The threshold for triggering compensation is too high

**SHIFT** = The time lag between the payment of the insurance and the payment of the grant generates cash flow problem

**ADMI** = Too much administrative documents

**INCO** = The proposed contracts are incompatible with my growing calendar

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**EARLY** = I have to make my decision to subscribe too early in my campaign

### Perceptions

42. FreqIntensAleasCC (In your opinion, does climate change mean an increase, decrease or no change in the frequency and intensity of the following hazards on your farm?)

	FREQUENCY			INTENSITY		
	Increase	No change	Decrease	Increase	No change	Decrease
Droughts						
Floods						
Frozen						
Storms						
Hail						
Diseases, Pests, Weeds						

- SEC** = Droughts  
**INO** = Floods  
**GEL** = Frozen  
**TEM** = Tempests  
**GRL** = Hail  
**RAV** = Diseases, Pests, Weeds  
**A1** = Frequency Increase  
**A2** = Frequency No change  
**A3** = Frequency Decrease  
**B1** = Intensity Increase  
**B2** = Intensity No change  
**B3** = Intensity Decrease

- 43.** ReactionCC (Proposals would best qualify the response to protect from the effects of climate change)  
**DIVC** = Diversification of crops  
**ASS** = Greater use of insurance schemes  
**PRA** = Changing crop managements practices  
**DIVR** = Diversification of income sources (agricultural and non-agricultural)  
**NOCH** = No particular change

**Tests**

- 44.** RiskTest (*Reynaud and Couture, 2012* adaptation of the Eckel and Grossman risk aversion test)

Choix de la loterie 50/50	Gain 1	Gain 2
Loterie A	40	40
Loterie B	32	51
Loterie C	24	64
Loterie D	16	78
Loterie E	12	86
Loterie F	8	91,5
Loterie G	6	92,9
Loterie H	4	93,4
Loterie I	1	93,5

**A,B,C,D,E,F,G,H,I**

- 45.** Patience (Subjective patience test as *Vischer et al. 2013*, self-ranking from 0 to 10 "how patient in general" they are)  
**0** = "very impatient"

...

**10** = "very patient"

- 46.** Impuls (Subjective impulsiveness test as *Vischer et al. 2013*, self-rank from 0 to 10 to their degree of impulsiveness)

**0** = "not at all impulsive"

...

**10** = "very impulsive"

### Socio-economic characteristics

- 47.** Age (Age of the respondent)

...

- 48.** Sexe (Gender)

**F** = Female**M** = Male

- 49.** Departement (Two first number of the administrative departement code, french territorial subdivision between the region and the municipality)

...

- 50.** Education (Highest level of education)

**NODI** = Without diploma**BRE** = Secondary school diploma**BAC** = High-school diploma**other** = High-school diploma + ... years

- 51.** Marital (Family situation)

**1** = Single**2** = Married**3** = Civil partnership**4** = Divorced**5** = Widower**6** = Prefers not to answer

- 52.** PersFoyer (Number of people in the household)

**1** = 1**2** = 2**3** = 3**4** = 4 and more

**53.** NbreEnfant (Number of children among the people in the household)

...

**54.** TravailConjoint (Is the spouse working)

**1** = Yes

**2** = No

**3** = Single

**55.** RevenuHorsExploi (Do you receive a regular non-agricultural income? (work, real-estate...))

**0** = No

**1** = Yes

**56.** RevenuHorsConj (Apart from the spouse's income, do you receive receive any other form of non-agricultural income? (work, real-estate...))

**0** = No

**1** = Yes

**57.** Revenu (Range of net monthly household income)

**1** = <1000€

**2** = [1000:2000[

**3** = [2000:3000[

**4** = [3000:4000[

**5** = [4000:5000]

**6** = >5000€

**7** = Prefers not to answer



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# Data paper



## ARTICLE INFORMATION

### Article title

Data on subjective barriers and determinants to crop insurance adoption in France.

### Authors

Claire Montagné-Huck\*

Richard Koenig

Marielle Brunette

### Affiliations

Claire Montagné-Huck.\* Université de Lorraine, Université de Strasbourg, AgroParisTech, CNRS, INRAE, BETA, 54000, Nancy, France

Richard Koenig. Université de Lorraine, Université de Strasbourg, AgroParisTech, CNRS, INRAE, BETA, 54000, Nancy, France ; Chaire économie du Climat, Paris, France.

Marielle Brunette. Université de Lorraine, Université de Strasbourg, AgroParisTech, CNRS, INRAE, BETA, 54000, Nancy, France ; Chaire économie du Climat, Paris, France.

### Corresponding author's email address and Twitter handle

[claire.montagne-huck@inrae.fr](mailto:claire.montagne-huck@inrae.fr)

### Keywords

Farmers; survey; insurance contract; climatic change; risk

### Abstract

We present here data on crop insurance adoption by farmers in France. Data were collected via an original questionnaire survey available online from February 2021 to October 2021. We collected 465 responses of which 288 were complete. The survey contained 57 questions divided into 7 parts: 1/ Farm characteristics; 2/ Crop insurance; 3/ Determinants and factors in the adoption of crop insurance; 4/ Barriers to the adoption of crop insurance; 5/ Future perceptions; 6/Tests; 7/Socioeconomic characteristics. We use different methodologies (binary or multiple choices questions, experimental tests, Likert scales, self-ranking, etc.) in order to assess farmers preferences for crop insurance adoption. This data set was used for the first time in the paper: Koenig, R. and Brunette M. 2023. "Subjective barriers and determinants to crop insurance adoption" WP BETA 2023-25.

## SPECIFICATIONS TABLE

<b>Subject</b>	Agricultural economics
<b>Specific subject area</b>	Determinants of crop insurance adoption
<b>Data format</b>	Raw data
<b>Type of data</b>	Table, MS Excel file
<b>Data collection</b>	Data were collected using online questionnaire survey (in French) sent to French farmers from February 2021 to October 2021, through the French Chambers of Agriculture network. French Chambers of Agriculture are national and local institutional representative organisations for farmers and rural areas. English version of the questionnaire is available.
<b>Data source location</b>	Data were collected at the national level including farmers from French metropolitan area.
<b>Data accessibility</b>	Repository name: Recherche Data Gouv Data identification number: 10.57745/TAEOPD Direct URL to data: <a href="https://doi.org/10.57745/TAEOPD">https://doi.org/10.57745/TAEOPD</a>
<b>Related research article</b>	[1] Koenig, R. and Brunette M. 2023. "Subjective barriers and determinants to crop insurance adoption" WP BETA 2023-25.

## VALUE OF THE DATA

- This data set provide information that we could not find in any previously existing dataset.
- This original data set provides information on French Farmer's objective adoption behaviour and subjective preferences for crop insurance.
- The data allow for eliciting preferences of farmers for adoption of crop insurance and risk attitudes.
- The data provide information on risk management practices and could inform policy makers about obstacles and motivations for crop insurance development.
- The data could be re-used by scientist in order:
  - to replicate the results published in [1],

- to make comparison of risk preference and crop insurance adoption with other case studies or meta-analysis,
- to investigate other topics related to crop insurance adoption and risk preferences of French farmers.

## DATA DESCRIPTION

This data paper describes the data set used for the original research published in [1].

Raw data is available in the data repository : Data Recherche Gouv.

Three documents are available for download:

-The PDF file, titled READ-ME. It presents provide some meta-data, explanation and encoding of variables

-The MS Excel File, titled DATA\_Crop\_Insurance\_Adoption is the original database, presenting survey answers.

The original survey contained 57 questions devoted to understand French farmers preferences towards crop insurance and agricultural risks. It is divided into 7 parts:

1/ Farm characteristics; Questions 1 to 25

2/ Crop insurance; Questions 26 to 37

3/ Determinants and factors in the adoption of crop insurance; Questions 38 to 39

4/ Barriers to the adoption of crop insurance; Questions 40 to 41

5/ Future perceptions; Questions 42 to 43

6/ Tests; Questions 44 to 46

7/ Socioeconomic characteristics; Questions 47 to 57

Table 1 gives some sample characteristics.

*Table 1: Sample characteristics N=288 (Standard deviation in parenthesis)*

Variable	Detail	
<b>Farm Characteristics</b>		
Surface area	Cultivated hectares	98.13 (100.7)
Farm Exp	Years as farm manager	25.51 (12.7)
Type agric	Agricultural activity = Field crops	27.43%
	Agricultural activity = Wine	28.82%
	Agricultural activity = Field crops and breeding	17.36%
	Agricultural activity = Breeding	09.03%
	Agricultural activity = Diversification (all other)	17.36%
Irrigation	Irrigation user	29.17%
Contract	In a contractualization process	28.47%
Ccop	Member of a cooperative	78.47%

Syndicate	Member of a trade union	57.64%
Tenure	Owner	23.26%
	Tenant	13.19%
	Owner and tenant	63.54%
Family Farm	Farm previously managed by a family member	71.88%
Label	Certification	36.46%
Work Force	Working with others on the farm	51.04%
Nitrogen	Nitrogen supply to crops	83.33%
Disaster	Already received disaster payment	48.61%
Recent loss	Yield losses due to climatic events in the last 2 years	65.97%
Insurance	Insured	49.31%
<b>Farmer's characteristics</b>		
Age	Age of the farmer	49.65 (10.3)
Gender	1 for male	0.816
Education	No diploma	01.04%
	General certificate of secondary education	18.06%
	High school diploma	27.08%
	1- and 2-years university level	27.08%
	3-years university level	27.43%
	4-years university level	04.51%
	5-years university level	11.46%
6- to 8-years university level	01.39%	
Location	North of France	10.76%
	West of France	29.17%
	East of France	23.26%
	South of France	36.81%
Household size	1 person	12.15%
	2 persons	31.94%
	3 persons	19.44%
	4 or more persons	36.46%
Income	<€1000	07.99%
	[€1000 : €2000]	31.94%
	[€2000 : €3000]	23.61%
	[€3000 : €4000]	17.36%
	[€4000 : €5000]	06.60%
	>€5000	05.56%
No answer	06.94%	
Spouse Occupation	Spouse works outside of farm	53.82%
	Spouse doesn't work outside of farm	29.86%
	Single	16.32%
Non Agri Income	Non agricultural activity income	41.32%

## EXPERIMENTAL DESIGN, MATERIALS AND METHODS

The survey was designed using the statistical survey software: LimeSurvey.

We contacted (by email and phone call) the National, departmental and inter-departmental offices of the French Chambers of Agriculture to allow the distribution of our questionnaire to the farmers in their network.

The aim was to spread the survey among farmers in Metropolitan France, regardless of crop category or geographical location. (French Chambers of Agriculture are groups of public organizations run by elected professionals from agricultural syndicates that represents French farmers and rural areas.)



The data was obtained through an electronically administered questionnaire survey during the period: February 2021 to October 2021.

To encourage farmers to respond, it was mentioned that a donation of 2€ was made, for each questionnaire fully completed, to the “Petits Princes” association. This association aims to finance the realization of “dreams” for children suffering from serious illnesses.

We obtained a total of 465 responses among which 288 were fully completed.

We asked for farm characteristics, respondent’s socio-economic characteristics and crop insurance behaviour and preferences using classical multiple choice or opened questions. We used self-ranking and Likert scales We also conducted an experimental test for risk preferences using lottery choices (Ordered Lottery Selection).

## LIMITATIONS

As our survey was sent to farmers via the Chambers of Agriculture (emails to farmers, newsletters, etc.), it was not possible for us to precisely know if the survey was sent to all the French departments, nor the exact number of people who received the survey. Thus we were not able to control the representativeness of our sample.

## ETHICS STATEMENT

Respondents were fully informed about the aim and scope of the study.

All the responses were anonymous with the two-digit department code as the most detailed information and only used for research purpose.

## CRedit AUTHOR STATEMENT

*Claire Montagné-Huck*, Conceptualization, Methodology, Software, Validation, Formal analysis, Data Curation, Writing - Original Draft, Writing - Review & Editing, Visualization.

*Richard Koenig*, Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing - Review & Editing, Visualization.

*Marielle Brunette*, Conceptualization, Methodology, Writing - Review & Editing, Supervision, Project administration, Funding acquisition

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## DECLARATION OF COMPETING INTERESTS

- The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## REFERENCES

[1] Koenig, R. and Brunette M. 2023. "Subjective barriers and determinants to crop insurance adoption" WP BETA 2023-25.

[2] Koenig, Richard; Brunette, Marielle, 2023, "Data on subjective barriers and determinants to crop insurance adoption in France.", <https://doi.org/10.57745/TAE0PD>, Recherche Data Gouv, V1, UNF:6:Uepv8qFd4Zg7/+9DAtOQtQ==

## READ ME

**Title:** Study of the Determinants and Barriers to Crop Insurance Adoption

**Author and contact:** Richard KOENIG – [richard.koenig@chaireconomieduclimat.org](mailto:richard.koenig@chaireeconomieduclimat.org)

**Survey format:** Internet survey – LimeSurvey

**Data collection period:** February 2021 to October 2021

**Population surveyed:** French farmers

**Observation number:** 288

**Number of questions:** 57 questions divided into 7 groups.

<u>Variables description:</u>				
Survey related question	Group of variable	Variable Name	Description	Type of data
0		id	Respondent anonymous identifier	Numerical
1	<b>Type of agricultural activity</b>	TypeAgriGC	1 if arable crops ; 0 otherwise	Binary
1		TypeAgriMAR	1 if market gardening ; 0 otherwise	Binary
1		TypeAgriVIT	1 if viticulture ; 0 otherwise	Binary
1		TypeAgriARB	1 if arboriculture ; 0 otherwise	Binary
1		TypeAgriHOR	1 if horticulture ; 0 otherwise	Binary
1		TypeAgriELE	1 if breeding ; 0 otherwise	Binary
1		TypeAgriother	detail for other activity ; 0 otherwise	Alphanumeric
2	<b>Type of field crops</b>	GrandesCulturesCER	1 if cereal crops ; 0 otherwise	Binary
2	<i>if TypeAgriGC=1</i>	GrandesCulturesOLE	1 if oilseed ; 0 otherwise	Binary
2		GrandesCulturesPRO	1 if protein crops ; 0 otherwise	Binary
2		GrandesCulturesBET	1 if sugar beet ; 0 otherwise	Binary
2		GrandesCulturesPDT	1 if potatoes ; 0 otherwise	Binary
2		GrandesCulturesCF	1 if forage crops ; 0 otherwise	Binary
2		GrandesCulturesPT	1 if textile crops ; 0 otherwise	Binary
2		GrandesCulturesother	Detail for other arable crops ; 0 otherwise	Alphanumeric
3	<b>Type of breeding</b>	ElevageBA	1 if suckler cows ; 0 otherwise	Binary
3	<i>if TypeAgriELE=1</i>	ElevageBL	1 if dairy cows ; 0 otherwise	Binary



3		ElevagePOR	1 if swine ; 0 otherwise	Binary
3		ElevageVOL	1 if poultry ; 0 otherwise	Binary
3		ElevageOV	1 if sheep ; 0 otherwise	Binary
3		ElevageEQ	1 if equidae ; 0 otherwise	Binary
3		Elevageother	Detail for other breeding ; 0 otherwise	Alphanumeric
4	<b>Main culture</b>	MainCulture	Detail for main culture	Alphanumeric
5	<b>Farm size</b>	Hectare	Farm size in hectare	Numerical
6	<b>Land ownership</b>	StatutPRO	1 if owner, 0 otherwise	Binary
6		StatutLOC	1 if tenant, 0 otherwise	Binary
6		StatutPL	1 if owner and tenant, 0 otherwise	Binary
7	<b>Irrigation use</b>	Irrigation	1 if irrigation use ; 0 otherwise	Binary
8	<b>Irrigation frequency</b>	FreqIrrigationQUO	1 if every day or nearly every day use ; otherwise	Binary
8	<i>If irrigation=1</i>	FreqIrrigationAPP	1 if occasional use ; otherwise	Binary
8		FreqIrrigationEXC	1 if exceptional use ; otherwise	Binary
9	<b>Contractualization</b>	Contract	1 if engaged in a contractualization process ; 0 otherwise	Binary
10	<b>Agricultural cooperation</b>	MembreCoop	1 if member of a cooperative ; 0 otherwise	Binary
11	<b>Agricultural union</b>	MembreSyndic	1 if member of a trade union ; 0 otherwise	Binary
12	<b>Management duration</b>	AnneeGestion	Years as farm manager	Numerical
13	<b>Family farm</b>	AntecedentExploi	1 if farm previously managed by a family member ; 0 otherwise	Binary
14	<b>Label</b>	Label	1 if certification scheme ; 0 otherwise	Binary
15	<i>if label=1</i>	TypeLabelSQ002	write the name of the first label	Alphanumeric
15		TypeLabelSQ003	write the name of the second label	Alphanumeric
15		TypeLabelSQ004	write the name of the third label	Alphanumeric
16	<b>Salaried workers</b>	TravailAvecPers	1 if other people working in the farm ; 0 otherwise	Binary
17	<i>if salaried worker =1</i>	NombrePersTravail	Number of co-workers in the farm	Numerical
18		TypePersTravailFAM	1 if family member ; 0 otherwise	Binary
18		TypePersTravailPERM	1 if full time worker ; 0 otherwise	Binary
18		TypePersTravailMT	1 if part time worker ; 0 otherwise	Binary
18		TypePersTravailSAI	1 if seasonal worker ; 0 otherwise	Binary
19	<b>Nitrogen</b>	ApportAzote	1 if nitrogen input on the farm ; 0 otherwise	Binary
20	<i>if ApportAzote=1</i>	TypeAzoteMIN	1 if mineral nitrogen ; 0 otherwise	Binary
20		TypeAzoteORG	1 if organic nitrogen ; 0 otherwise	Binary
20		TypeAzoteMO	1 if mineral and organic nitrogen ; 0 otherwise	Binary
21	<b>Agricultural disasters</b>	Calamites	1 if already receive compensation for agricultural disaster ; 0 otherwise	Binary
22	<b>Recent losses</b>	AleasSubis	1 if agricultural damages due to climatic conditions last 2 years ; 0 otherwise	Binary
23	<b>Self-assessment of expoure</b>	MesureExposition	Exposure to climatic hazards (1- very low to 5- very high)	Scale
24	<b>Source of risks ranking</b>	SourceRisk1		Alphanumeric

24		SourceRisk2	Ranking of main sources of risk : A1 = Climatic hazards ; A2 = Price volatility ; A3 = Pathogens or disease ; A4 = Collapse of sales ; A5 = Input prices increase ; A6 = standards and regulation changes	Alphanumeric
24		SourceRisk3		Alphanumeric
24		SourceRisk4		Alphanumeric
24		SourceRisk5		Alphanumeric
24		SourceRisk6		Alphanumeric
25	<b>Insurance</b>	AssuranceOUI	1 if insurance for 2020-2021 ; 0 otherwise	Binary
25		AssuranceNON	1 if no insurance for 2020-2021 ; 0 otherwise	Binary
26	<i>if AssuranceOUI=1</i>	TypeAssMRC	1 if insurance type = climatic multirisk ; 0 otherwise	Binary
26		TypeAssGRL	1 if insurance type = hail ; 0 otherwise	Binary
26		TypeAssPRAI	1 if insurance type = prairies ; 0 otherwise	Binary
26		TypeAssCA	1 if insurance type = revenue ; 0 otherwise	Binary
26		TypeAssGEL	1 if insurance type = ice ; 0 otherwise	Binary
26		TypeAssPARA	1 if insurance type = parametric ; 0 otherwise	Binary
26		TypeAssother	1 if insurance type = other ; 0 otherwise	Binary
27	<i>if TypeAssMRC=1</i>	TypeMRCGRP	1 if contract by crop group ; 0 otherwise	Binary
27		TypeMRCEXP	1 if contract by farm ; 0 otherwise	Binary
27		TypeMRCNSP	1 if Don't know; 0 otherwise	Binary
28	<i>if AssuranceOUI=1</i>	SurfaceAss	Percentage of insured land from 0 to 100	Percentage
29	<b>Subsidy</b>	SubvPrimeOUI	1 if subsidy for insurance premium obtained ; 0 otherwise	Binary
29		SubvPrimeDDE	1 if subsidy for insurance premium requested ; 0 otherwise	Binary
29		SubvPrimeNDE	1 if subsidy for insurance premium not requested ; 0 otherwise	Binary
30	<i>if AssuranceOUI=1</i>	OptionsOUI	1 if supplementary insurance options subscribed ; 0 otherwise	Binary
30		OptionsNON	1 if no supplementary insurance options subscribed ; 0 otherwise	Binary
30		OptionsNSP	1 if don't know about subscription of supplementary insurance options ; 0 otherwise	Binary
31	<i>if optionOUI=1</i>	TypeOptionsFRAN	1 if insurance deductibles reduction subscribed ; 0 otherwise	Binary
31		TypeOptionsSEUI	1 if trigger threshold reduction subscribed ; 0 otherwise	Binary
31		TypeOptionsPRIX	1 if guaranteed price complement subscribed ; 0 otherwise	Binary
31		TypeOptionsRDT	1 if increase in guaranteed historical return subscribed ; 0 otherwise	Binary
31		TypeOptionsQUA	1 if coverage of loss of crop quality subscribed ; 0 otherwise	Binary
31		TypeOptionsRESE	1 if seedling costs coverage subscribed ; 0 otherwise	Binary
31		TypeOptionsNSP	1 if don't know about type of insurance option subscribed ; 0 otherwise	Binary
31		TypeOptionsother	1 if other type of insurance option subscribed ; 0 otherwise	Binary
32	<i>if AssuranceOUI=1</i>	Assureur	1 if same insurance company for crops and buildings ; 0 otherwise	Binary

33	<b>Previous crop insurance subscription (last year)</b>	AssT1	1 if crop insurance subscribed the year before ; 0 otherwise	Binary
34	<b>Previous crop insurance subscription (two years ago)</b>	AssT2	1 if crop insurance subscribed the two years ago ; 0 otherwise	Binary
35		AnneeAss	number of years of subscription of crop insurance	Numerical
36		IndemnisationAss	1 if compensation received from crop insurance ; 0 otherwise	Binary
37	<b>Climatic change perception</b>	PerceptionCCNOCC	1 if belief in climatic change ; 0 otherwise	Binary
37		PerceptionCCNOIM	1 if no belief in climatic change impact on my farm activity ; 0 otherwise	Binary
37		PerceptionCCSOON	1 if belief in climatic change impact on my farm activity soon ; 0 otherwise	Binary
37		PerceptionCCNOW	1 if belief in climatic change impact on my farm activity now ; 0 otherwise	Binary
38	<b>Determinants of insurance subscription</b>	FacteursEncourageant1	Ranking of motives for insurance adoption (3 main motives among 7) : MET = Meteorological concerns ; CONS = External advices ; SUB = Subsidies ; PERT = Previous losses ; FLEX = Insurance contracts flexibility ; OBLI = External requirement ; CHAN = Changes in agricultural activity	Alphanumeric
38	<i>if AssuranceOUI=1</i>	FacteursEncourageant2		Alphanumeric
38		FacteursEncourageant3		Alphanumeric
38		FacteursEncourageant4		Alphanumeric
38		FacteursEncourageant5		Alphanumeric
38		FacteursEncourageant6		Alphanumeric
38		FacteursEncourageant7		Alphanumeric
39	<b>Potential determinants for insurance subscription</b>	FacteursPotentiel1	Ranking of potential factors influencing insurance adoption (3 main motives among 9) : PASS = lower insurance price ; SUBV = higher subsidy level ; SDIR = Direct subsidy payment ; ADMI = simplifying administrative procedures ; FSEUI = lower deductible and trigger threshold ; RDT = higher guaranteed yield ; PGAR = higher guaranteed price ; QUAL = coverage of quality loss ; RAVA = Pests and diseases losses coverage	Alphanumeric
39	<i>if AssuranceNON=1</i>	FacteursPotentiel2		Alphanumeric
39		FacteursPotentiel3		Alphanumeric
39		FacteursPotentiel4		Alphanumeric
39		FacteursPotentiel5		Alphanumeric
39		FacteursPotentiel6		Alphanumeric
39		FacteursPotentiel7		Alphanumeric
39		FacteursPotentiel8		Alphanumeric
39		FacteursPotentiel9		Alphanumeric
40	<b>Barriers to crop insurance adoption Agreement</b>	AccordFreinsPRIX	Degree of agreement or disagreement for explaining the non subscription of crop insurance (climatic multirisk) : Insurance price is too high Scale 1 = to 5 =	Scale
40		AccordFreinsFRAN	Degree of agreement or disagreement for explaining the non subscription of crop insurance (climatic multirisk) : Deductible is too high Scale 1 = to 5 =	Scale
40		AccordFreinsSEUI	Degree of agreement or disagreement for explaining the non subscription of crop insurance (climatic multirisk) : Trigger threshold is too high Scale 1 = to 5 =	Scale
40		AccordFreinsDECA	Degree of agreement or disagreement for explaining the non subscription of crop insurance (climatic multirisk) : Delay between insurance purchase and subsidy payment is too high Scale 1 = to 5 =	Scale
40		AccordFreinsADMI	Degree of agreement or disagreement for explaining the non subscription of crop	Scale

			insurance (climatic multirisk) : Cumbersome administrative procedures Scale 1 = to 5 =	
40		AccordFreinsINCO	Degree of agreement or disagreement for explaining the non subscription of crop insurance (climatic multirisk) : Unsuitable insurance contracts Scale 1 = to 5 =	Scale
40		AccordFreinsPROB	Degree of agreement or disagreement for explaining the non subscription of crop insurance (climatic multirisk) : Probability to receive any compensation is too low Scale 1 = to 5 =	Scale
40		AccordFreinsRDT	Degree of agreement or disagreement for explaining the non subscription of crop insurance (climatic multirisk) : Disagreement with the guaranteed yield calculation Scale 1 = to 5 =	Scale
40		AccordFreinsPREV	Degree of agreement or disagreement for explaining the non subscription of crop insurance (climatic multirisk) : Don't need of specific crop insurance (specific prevention measures) Scale 1 = to 5 =	Scale
40		AccordFreinsCONF	Degree of agreement or disagreement for explaining the non subscription of crop insurance (climatic multirisk) : Don't trust in insurance companies Scale 1 = to 5 =	Scale
40		AccordFreinsDIVE	Degree of agreement or disagreement for explaining the non subscription of crop insurance (climatic multirisk) : Don't need of specific crop insurance (sufficient crop diversification) Scale 1 = to 5 =	Scale
40		AccordFreinsDEL	Degree of agreement or disagreement for explaining the non subscription of crop insurance (climatic multirisk) : Delay between damage and insurance compensation is too long Scale 1 = to 5 =	Scale
40		AccordFreinsTOT	Degree of agreement or disagreement for explaining the non subscription of crop insurance (climatic multirisk) : Decision to subscribe an insurance contract is too early Scale 1 = to 5 =	Scale
41	<b>Barriers to crop insurance adoption Ranking</b>	ClassificationFreins1	Ranking of the 3 main motives explaining non insurance subscription PRIX = Insurance price is too high ; FRAN = Deductible is too high ; SEUI = Trigger threshold is too high ; DECA = Delay between insurance purchase and subsidy payment is too high ; ADMI = Cumbersome administrative procedures ; INCO = Unsuitable insurance contracts ; PROB = Probability to receive any compensation is too low ; RDT = Disagreement with the guaranteed yield calculation ; PREV = Don't need of specific crop insurance (specific prevention measures) ; CONF = Don't trust in insurance companies ; DIVE = Don't need of specific crop insurance (sufficient crop diversification) ; DEL = Delay between damage and insurance compensation is too long ; TOT = Decision to subscribe an insurance contract is too early	Alphanumeric
41		ClassificationFreins2		Alphanumeric
41		ClassificationFreins3		Alphanumeric
41		ClassificationFreins4		Alphanumeric
41		ClassificationFreins5		Alphanumeric
41		ClassificationFreins6		Alphanumeric
41		ClassificationFreins7		Alphanumeric
41		ClassificationFreins8		Alphanumeric
41		ClassificationFreins9		Alphanumeric
41		ClassificationFreins10		Alphanumeric
41		ClassificationFreins11		Alphanumeric
41		ClassificationFreins12		Alphanumeric
41		ClassificationFreins13		Alphanumeric
42	<b>Expectations in the evolution of the frequency and intensity of hazards</b>	FreqIntensAleaCCSEC1	Drought frequency A1 = increase ; A2 = no change ; A3 = decrease	Alphanumeric

42		FreqIntensAleaCCSEC2	Drought intensity B1 = increase ; B2 = no change ; B3 = decrease	Alphanumeric
42		FreqIntensAleaCCINO1	Flood frequency A1 = increase ; A2 = no change ; A3 = decrease	Alphanumeric
42		FreqIntensAleaCCINO2	Flood intensity B1 = increase ; B2 = no change ; B3 = decrease	Alphanumeric
42		FreqIntensAleaCCGEL1	Ice frequency A1 = increase ; A2 = no change ; A3 = decrease	Alphanumeric
42		FreqIntensAleaCCGEL2	Ice intensity B1 = increase ; B2 = no change ; B3 = decrease	Alphanumeric
42		FreqIntensAleaCCTEM1	Storm frequency A1 = increase ; A2 = no change ; A3 = decrease	Alphanumeric
42		FreqIntensAleaCCTEM2	Storm intensity B1 = increase ; B2 = no change ; B3 = decrease	Alphanumeric
42		FreqIntensAleaCCGRL1	Hail frequency A1 = increase ; A2 = no change ; A3 = decrease	Alphanumeric
42		FreqIntensAleaCCGRL2	Hail intensity B1 = increase ; B2 = no change ; B3 = decrease	Alphanumeric
42		FreqIntensAleaCCRAV1	Pests and diseases frequency A1 = increase ; A2 = no change ; A3 = decrease	Alphanumeric
42		FreqIntensAleaCCRAV2	Pests and diseases intensity B1 = increase ; B2 = no change ; B3 = decrease	Alphanumeric
43	<b>Anticipation of adoption of adaptation measures</b>	ReactionCCDIVC	Crop diversification 1 = Agree ; 0 = Disagree	Binary
43		ReactionCCASS	Insurance subscription 1 = Agree ; 0 = Disagree	Binary
43		ReactionCCPRA	Changes in agricultural practices 1 = Agree ; 0 = Disagree	Binary
43		ReactionCCDIVR	Income diversification (agricultural and non agricultural) 1 = Agree ; 0 = Disagree	Binary
43		ReactionCCNOCH	No change 1 = Agree ; 0 = Disagree	Binary
44	<b>Measurement of risk preference</b>	RiskTestA	Choice of Gamble A => RRA Ranges : $r > 1.37$	Binary
44		RiskTestB	Choice of Gamble B => RRA Ranges : $0.68 < r < 1.37$	Binary
44		RiskTestC	Choice of Gamble C => RRA Ranges : $0.44 < r < 0.68$	Binary
44		RiskTestD	Choice of Gamble D => RRA Ranges : $0.4 < r < 0.44$	Binary
44		RiskTestE	Choice of Gamble E => RRA Ranges : $0.15 < r < 0.4$	Binary
44		RiskTestF	Choice of Gamble F => RRA Ranges : $-0.13 < r < 0.15$	Binary
44		RiskTestG	Choice of Gamble G => RRA Ranges : $-0.47 < r < -0.13$	Binary
44		RiskTestH	Choice of Gamble H => RRA Ranges : $-0.93 < r < -0.47$	Binary
44		RiskTestI	Choice of Gamble I => RRA Ranges : $r < -0.93$	Binary
45	<b>Measurement of patience</b>	PatiencePATI	0 = very impatient to 10 = very patient	Scale
46	<b>Measurement of impulsivity</b>	ImpulsIMPU	0 = not impulsive to 10 = very impulsive	Scale
47	<b>Socioeconomic information</b>	Age	Age in years	Numerical
48		Sexe	M if Male ; F if Female	Binary
49		Departement	Department code	Numerical

50		EducationNODI	1 if no diploma ; 0 otherwise	Binary
50		EducationBRE	1 if junior secondary school diploma ; 0 otherwise	Binary
50		EducationBAC	1 if senior secondary school diploma ; 0 otherwise	Binary
50		Educationother	Number of study years after seconfdary school diploma	Numerical
51		MaritalCELI	1 if single ; 0 otherwise	Binary
51		MaritalMARI	1 if married ; 0 otherwise	Binary
51		MaritalPACS	1 if civil union contract ; 0 otherwise	Binary
51		MaritalDIVO	1 if divorced ; 0 otherwise	Binary
51		MaritalVEUF	1 if widowed ; 0 otherwise	Binary
51		MaritalNSPP	1 if no response ; 0 otherwise	Binary
52		PersFoyer1	1 if only 1 person in the family ; 0 otherwise	Binary
52		PersFoyer2	1 if 2 persons in the family ; 0 otherwise	Binary
52		PersFoyer3	1 if 3 persons in the family ; 0 otherwise	Binary
52		PersFoyer4ETC	1 if 4 persons or more in the family ; 0 otherwise	Binary
53		NbreEnfant	Number of children	Numerical
54		TravailConjointOUI	1 if husband or spouse is working outside the farm ; 0 otherwise	Binary
54		TravailConjointNON	1 if husband or spouse is not working outside the farm ; 0 otherwise	Binary
54		TravailConjointSEUL	1 if the respondent is single ; 0 otherwise	Binary
55	<b>Non agricultural income</b>	RevenuHorsExpl	1 if non agricultural income is perceived ; 0 otherwise	Binary
56	<b>Non agricultural income (apart from spouse)</b>	RevenuHorsConj	1 if non agricultural income is perceived (non related to spouse or husband non agricultural activity) ; 0 otherwise	Binary
57	<b>Income range</b>	RevenuINT1	1 if net monthly family Income < 1000€ ; 0 otherwise	Binary
57		RevenuINT2	1 if 1000€ > Net monthly family income > 2000€ ; 0 otherwise	Binary
57		RevenuINT3	1 if 2000€ > Net monthly family income > 3000€ ; 0 otherwise	Binary
57		RevenuINT4	1 if 3000€ > Net monthly family income > 4000€ ; 0 otherwise	Binary
57		RevenuINT5	1 if 4000€ > Net monthly family income > 5000€ ; 0 otherwise	Binary
57		RevenuINT6	1 if Net monthly family income > 5000€ ; 0 otherwise	Binary
57		RevenuNSPP	1 no answer ; 0 otherwise	Binary

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Weather hazards and crop insurance: a  
history of risk sharing

Aléas météorologiques et assurance récolte : Une histoire de  
partage du risque  
Weather hazards and crop insurance: a history of risk sharing

Richard KOENIG<sup>15</sup>, Marielle BRUNETTE<sup>16</sup>

**Abstract**

Les aléas météorologiques représentent une menace grandissante pour l'agriculture française sous l'effet du changement climatique. Il convient donc de s'intéresser, dans cet article, à la manière dont le risque est « partagé » entre les agriculteurs, les assureurs et l'État au cours du temps. Nous montrons que l'histoire peut être découpée en trois périodes distinctes : 1/ L'État encourage à recourir essentiellement au marché privé de l'assurance ; 2/ L'État se réimplique dans la couverture du risque en agriculture ; 3/ Instauration d'un partenariat public-privé pour la couverture de ces aléas.

Meteorological hazards represent a growing threat to French agriculture under the effect of climate change. This article proposes to retrace this sharing of risk between farmers, insurers, and the State over time. We show that history can be broken down into three distinct periods: 1/ The State encourages people to mainly use the private insurance market; 2/ The State is re-involved in risk coverage in agriculture; 3/ Establishment of a public-private partnership to cover these hazards.

**Keywords:** Agriculture, Risque, Assurance, Changement climatique, Subvention – Agriculture; Risk; Insurance; Climate change; Subsidy

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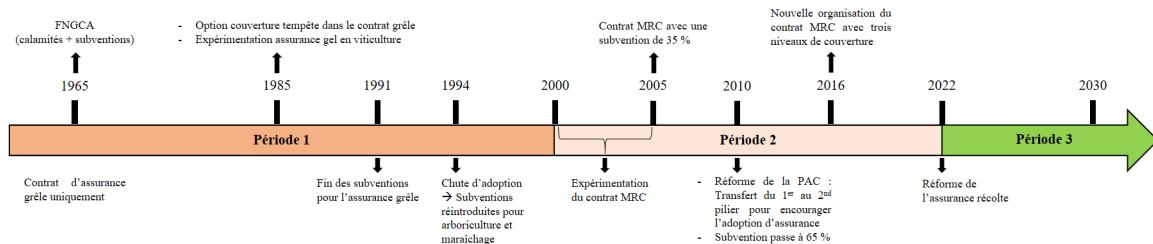
<sup>15</sup>Université de Lorraine, Université de Strasbourg, AgroParisTech, CNRS, INRAE, BETA, France. Climate Economics Chair (CEC), Paris. richard.koenig@chaireeconomieduclimat.org - Corresponding author

<sup>16</sup>Université de Lorraine, Université de Strasbourg, AgroParisTech, CNRS, INRAE, BETA, France. marielle.brunette@inrae.fr; Associate researcher at the Climate Economics Chair (CEC), Paris.



## Introduction

Les sources d'incertitudes et d'expositions aux risques sont nombreuses pour les agriculteurs et grandissantes sous l'effet du changement climatique. La France se distingue, notamment au regard des risques météorologiques, par une exposition à l'ensemble des principaux aléas météorologiques (épisodes de grêle, chutes brutales de température provoquant des gels tardifs, périodes de sécheresse, qui, en 2022 ont affecté les trois quarts des sols superficiels français<sup>17</sup>). L'occurrence de ces événements peut engendrer des pertes de récoltes et donc de revenus pour l'exploitant agricole. Pour y faire face, ce dernier établit une « gestion du risque », consistant à anticiper, se prémunir et se protéger au mieux de ces aléas, en se dotant de divers instruments réduisant la probabilité de survenue de l'aléa et/ou son intensité ou en atténuant son impact économique. Les contrats d'assurance transfèrent et mutualisent les risques à l'échelle nationale afin d'offrir une indemnisation en cas de pertes de récoltes. De plus, certains fonds publics nationaux apportent une aide exceptionnelle aux agriculteurs à la suite de catastrophes météorologiques. Bien qu'aujourd'hui la gestion du risque météorologique soit partagée entre l'agriculteur, l'assureur et l'État, le paradigme de répartition des rôles de chacun a évolué au cours des dernières décennies. La frise chronologique suivante présente les trois périodes historiques que nous identifions et présentons dans les sections suivantes.



Source : Les auteurs

Figure 5.1: Développement historique du régime d'assurance récolte en France.

### Une orientation vers le privé de la gestion du risque météorologique [1964-2000]

Historiquement, l'assurance, un outil à disposition des agriculteurs depuis le XVIII<sup>e</sup> siècle, couvrait uniquement le risque grêle. Le rôle de l'État dans la gestion des risques météorologiques s'est formalisé à partir de la loi n°64-706 du 10 juillet 1964. Cette loi, mise en place deux ans après l'instauration de la Politique Agricole Commune (PAC), a instauré un fonds public : le Fonds National de Gestion des Calamités Agricoles<sup>18</sup> (FNGCA). Ce fonds indemnisait les pertes subies par les agriculteurs à la suite d'événements météorologiques exceptionnels appelés « régime des calamités agricoles » et a introduit une subvention à la prime d'assurance sur les contrats grêle existants.

L'État aspire ainsi à soutenir le développement d'un marché de l'assurance récolte qui, à terme, devrait fonctionner avec un minimum d'intervention publique. Cette subvention qui ne devait, à l'origine,

<sup>17</sup>Météo France, « 2022, année la plus chaude en France », Infos Climat, 23 janvier 2023.

<sup>18</sup>Remplacé en 2010 par le Fonds National de Gestion des Risques en Agriculture (FNGRA).

n'être distribuée que pour les sept premières années de souscription et de manière dégressive devient cependant une subvention fixe. L'encouragement étatique à l'émergence d'un marché de l'assurance s'est également manifesté au travers du fonctionnement du régime des calamités agricoles qui délimite le champ d'intervention de l'État sur les risques considérés comme non assurables (pour lesquels aucune offre privée n'était disponible).

L'assurance récolte évolue en 1985 avec l'introduction d'une garantie « tempête » dans les contrats d'assurance grêle proposés par les assureurs privés ouvrant la voie à la couverture d'autres aléas. Les orientations en faveur d'une gestion privée du risque météorologique atteignent leur paroxysme en 1991 lorsque l'État arrête de subventionner les contrats d'assurance récolte. Cependant, les années suivantes sont marquées par une forte sinistralité, une augmentation des primes et une spirale d'anti-sélection. La dégradation de l'équilibre entre les cotisations et les indemnités, par la concentration dans le pool des assurés des « plus à risque », entraîne une spirale cumulative où le déséquilibre d'une année conduit à une augmentation du niveau des primes d'assurance, encourageant les assurés les « moins à risque » à sortir du marché, dégradant encore davantage la qualité du pool d'assurés. Les subventions sont donc réinstaurées en 1994 pour les cultures les plus sensibles à la grêle (Babusiaux, 2000).

A partir de 1998, des travaux et discussions s'engagent au sujet d'une restructuration de la gestion du risque météorologique en agriculture sous l'influence des accords de Marrakech<sup>19</sup> et du développement rapide d'un marché de l'assurance récolte en Espagne et en Amérique du Nord.

### **Une réimplication croissante de l'État via un soutien à l'offre privée [2000-2022]**

En s'inspirant des expériences étrangères, la France expérimente localement de nouveaux contrats entre 2000 et 2005, avec le soutien du FNGCA. Ces expérimentations ont conduit à la conception d'un contrat multirisque unique qui est désormais le seul à ouvrir droit à une subvention étatique : le contrat MultiRisque Climatique sur récolte (MRC).

Ce contrat a été introduit en 2005 sur l'ensemble du territoire métropolitain pour quasi tout type de production agricole. Il propose d'indemniser les pertes économiques dues à des pertes de récolte provoquées par un ou plusieurs des 15 événements météorologiques considérés comme assurable. Ce contrat est proposé par les principaux assureurs privés mais est entièrement défini et délimité par l'État. Seuls les contrats respectant les caractéristiques définies sont associés à une subvention de la prime d'assurance à hauteur de 70% depuis le 1er janvier 2023 (loi n°2022-298 du 2 mars 2022) contre 45% à 65% auparavant.

L'ambition de l'instauration d'un unique contrat pour tous était de démocratiser et simplifier le recours à l'assurance. Malgré une très bonne diffusion la première année (22,4% de la surface agricole de France métropolitaine hors prairies assurées en MRC en 2005), le recours à cette assurance a

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<sup>19</sup>Où les discussions autour de l'instauration d'une nomenclature des aides apportées en agriculture (« boîtes ») ont mis en avant le soutien aux instruments de gestion du risque.

particulièrement stagné depuis, atteignant, en 2020, 32,8% de la surface agricole française hors prairies<sup>20</sup>.

En plus du manque d'adhésion des agriculteurs, des problèmes existent également du côté de l'offre puisque les assureurs sont déficitaires sur les contrats MRC. Le ratio sinistres/primes est, en effet, en moyenne trop élevé pour assurer une viabilité de long terme au marché. Ce ratio, devant être d'environ 75% pour assurer un équilibre technique, est, sur la période 2005-2018, en moyenne de 101%, traduisant des pertes structurelles pour les assureurs. C'est dans ce contexte que la réforme du système a vu le jour.

### **L'institutionnalisation d'un partenariat public-privé [2022-...]**

La loi n°2022-298 du 2 mars 2022, entrée en vigueur au 1er janvier 2023, réforme le système d'assurance récolte français. Cette réforme propose un nouveau partage du risque entre l'agriculteur, l'assureur et l'État, et institue de ce fait un partenariat public-privé dans la gestion des aléas météorologiques en agriculture française.

Dans ce nouveau dispositif à trois étages, les dommages associés au risque de faible intensité sont pris en charge par l'agriculteur via la prévention (1), les dommages associés au risque d'intensité moyenne sont à la charge de l'assureur via les contrats MRC (2), alors que les risques d'ampleur exceptionnelle sont pris en charge par l'État via l'Indemnité de Solidarité Nationale (ISN) qui remplace dorénavant le régime des calamités agricoles (3).

Par rapport à la période précédente de « privatisation du système », le rôle de l'assureur a diminué alors que l'État devient omniprésent. Ce dernier met en place des incitations financières à la prévention pour le premier étage, comme la réduction d'impôt « Déduction pour Épargne de Précaution », initie la constitution d'un pool de co-réassurance et subventionne la prime d'assurance à hauteur de 70% pour le deuxième étage, et prend en charge les dommages associés au troisième étage, avec un reste à charge de 10% pour l'assureur.

Dans ce système, l'objectif est d'inciter à l'adoption d'un contrat d'assurance. Plusieurs mesures en ce sens ont été prises. Alors que le seuil de déclenchement de l'assurance était auparavant de 30%, il est dorénavant de 20%, réduisant donc le reste à charge. De même, la prime d'assurance devrait diminuer car elle ne tient compte que des dommages compris entre 20% et 50% et car la subvention de la prime a augmenté. Enfin, le système opère une distinction forte entre agriculteur assuré qui bénéficie d'une ISN supérieure et agriculteur non-assuré pour qui l'indemnisation est dégressive d'année en année jusqu'en 2030.

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<sup>20</sup>Koenig et al. (2022) identifient des raisons potentielles à cette faible souscription.

## À quoi peut-on s'attendre pour la suite ?

Deux axes de réflexion peuvent être abordés : comment le marché évoluerait-il sans l'intervention de l'État ? Comment le marché évoluera-t-il dans le cadre institué par la réforme ?

Si l'État n'intervenait pas sur le marché, on pourrait s'attendre à ce que les assureurs se retirent du marché car les risques deviendraient tellement importants, notamment sous l'effet du changement climatique, qu'ils mettraient en péril leur équilibre financier. Les exemples de retrait se multiplient dans le secteur assurantiel pour d'autres types de contrats (Brunette et al., 2019). Une offre multirisque pleinement privée serait donc probablement inexistante sans l'intervention étatique en raison du caractère systémique des risques météorologiques, qui s'accroît sous l'effet du changement climatique. Accroître la qualité de la mutualisation, augmenter le taux de diffusion de l'assurance et développer la nature multirisque de la couverture apparaissent aujourd'hui comme des objectifs primordiaux qui ne pourront pas être atteints sans l'intervention de l'État.

La nouvelle réforme montre une implication de l'État grandissante et un recadrage du rôle des assureurs. Dans ce contexte, on pourrait se demander si l'avenir de la couverture du risque météorologique ne se fera pas sans le secteur privé. Cette voie ne semble cependant pas privilégiée actuellement. En effet, on s'aperçoit, avec la récente réforme, que l'État ne souhaite pas que les assureurs sortent du système, ou que certains risques ne soient plus assurés. L'État appuie la notion de partenariat public-privé. L'enjeu est important car l'assurance MRC couvre les 15 aléas les plus dommageables pour l'agriculture française tout en étant accessible à tous indépendamment de la culture et de la localisation. De plus, la réforme met également en place un « guichet unique » qui implique que les assureurs deviennent l'interlocuteur unique et privilégié des agriculteurs. L'État fait ainsi reposer une partie de son système d'assurance agricole sur le marché privé de l'assurance, notamment du fait de son ancrage territorial historique et de la proximité déjà existante entre les assureurs du monde rural et la population des agriculteurs français.

Par ailleurs, les assureurs tendent à expérimenter de nouvelles offres et modalités de couverture. Les nouvelles technologies et l'avènement d'une agriculture de plus en plus connectée font émerger de nouvelles offres d'assurance « sur-mesure » avec notamment le développement de l'assurance indicielle, aussi appelée « paramétrique ». Ce type d'assurance faisant reposer le déclenchement de l'indemnisation sur une télédétection ou un calcul d'indice prédéfini, réduit les frais d'expertise et d'administration des contrats et pourrait permettre d'obtenir une offre soutenable totalement privée (en parallèle de l'offre MRC). L'efficacité des nouvelles offres proposées pourrait, dans le futur, justifier l'élargissement de la subvention à ces contrats à l'instar des expérimentations menées sur la période 2000-2005 menant à l'introduction du contrat MRC.

*Mise en page harmonisée pour le manuscrit de thèse de la version prochainement  
publiée dans la revue Regards Croisés sur l'économie.*

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## French summary





# L'ASSURANCE RÉCOLTE : DE SA PERCEPTION ET DES PROBLÈMES D'ADOPTION AUX ENJEUX D'ADAPTATION

## Contexte

*“L’agriculteur n’ignore pas que cette fluctuation des rendements est dans l’ordre des choses..., il accepte un destin rendu souvent précaire par les caprices de la nature et les lois du marché. Mais il arrive cependant que les accidents naturels ont une gravité exceptionnelle et anéantissent parfois en quelques instants récolte, verger ou troupeau. En présence de ces risques qui ne peuvent plus être considérés comme “risques professionnels”, le paysan est désarmé et ne bénéficie pratiquement d’aucune protection. L’agriculture, en effet, est un des domaines où les risques ne trouvent pas leur contrepartie dans des profits réguliers et globalement intéressants. Les risques, en l’espèce, ne peuvent être calculés car ils sont, hélas ! imprévisibles. Contre l’eau, le gel, les glissements de terrain, l’inondation, la sécheresse, on ne lutte pas ; on ne peut que secourir les victimes”.*

Par ces mots, M. Marcel Bousseau, député de la 2e circonscription de Vendée de 1962 à 1973, cite M. Kléber Loustau auteur d’un rapport d’information présenté à la Commission de la production et des échanges. Ces propos ont été tenus dans l’hémicycle de l’Assemblée Nationale le jeudi 16 avril 1964 lors de la discussion du projet de création d’un régime de garantie contre les calamités agricoles<sup>21</sup>. Ce discours et les échanges entre parlementaires et représentants du gouvernement marquent l’institutionnalisation de l’intervention publique pour soutenir les agriculteurs face aux pertes économiques causées par les aléas météorologiques. L’agriculture est une activité risquée, mais comme l’a souligné M. Georges Juskiewinski lors de la même session, en citant le professeur Jules Milhau : *“le risque est inhérent à toutes les formes de l’activité économique et, d’une façon générale, à toutes les formes de l’activité humaine ; mais c’est probablement la vie agricole qui réunit les risques les plus nombreux et graves”*. A l’issue de ces débats, la loi du 10 juillet 1964 fut votée, instaurant la mise en place d’un régime français de garantie des calamités agricoles au travers de la création du Fonds National de Garantie des Calamités Agricoles (FNGCA).

Cette loi répond en partie à une problématique majeure pour les agriculteurs : *que vais-je faire si un événement météorologique extrême venait à détruire mes récoltes cette année ?*

La loi du 10 juillet 1964 donne deux missions au FNGCA : indemniser les agriculteurs ayant subis un événement météorologique catastrophique, défini comme calamité agricole, et promouvoir le développement de l’assurance récolte en France en encourageant les agriculteurs à s’assurer au travers de la mise en place d’une subvention sur la prime d’assurance.

L’assurance récolte est un contrat de transfert de risque entre un agriculteur et une compagnie d’assurance par lequel, en contre-partie du paiement d’une prime, l’assurance s’engage à indemniser

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<sup>21</sup>Journal Officiel de la République Française (1964). Compte rendu intégral des séances - 7ème séance. Séance du jeudi 16 avril 1964. Débats Parlementaires, Assemblée Nationale.

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l'agriculteur si l'un des aléas météorologiques considéré dans le contrat détruit tout ou partie des récoltes assurées.

La première commercialisation de contrat d'assurance récolte en France date du début du XIX<sup>ème</sup> siècle et provenait d'une compagnie toulousaine qui proposait aux agriculteurs dans les "40 lieues" autour de Toulouse de couvrir leurs pertes de récolte due à la grêle. Cependant, l'idée d'appliquer les principes de l'assurance à la couverture des pertes de récoltes remontait à la fin du XVIII<sup>ème</sup> siècle. Les premières traces de cette idée se trouveraient dans deux articles publiés respectivement le 23 juin 1785 et le 18 septembre 1788 dans *Le Journal de Paris* et signés par "Des soucis d'un ami des champs" (Hamon, 1930)<sup>22</sup>. Dans la première lettre, ce mystérieux auteur explique que le fermier "trouve sa ruine sur la terre. Ce sont les grêles, les vents, les pluies, les sécheresses, les gelées, les inondations, qui en sont la cause, et, s'il était possible de soumettre au calcul les ravages dus à l'intempérie des saisons, on pourrait donner une théorie exacte à cette espèce d'assurance" tandis que dans la seconde, il s'insurge que "les spéculateurs des villes n'ont pas songé à créer des compagnies d'assurance contre la grêle".

Couvrir ses récoltes contre la grêle sera progressivement faisable dans toute la France métropolitaine au fur et à mesure du développement de l'assurance récolte durant deux siècles suivant. Cependant, le reste des aléas mentionnés dans cette première lettre devront attendre la fin du XX<sup>ème</sup> siècle et surtout le début du XXI<sup>ème</sup> pour être enfin assurables.

Lorsque le FNGCA rentre en activité, en 1964, seuls des contrats d'assurance grêle sont distribués par les compagnies d'assurance. L'Etat amorce son intervention sur ce marché, au travers de la mise en place de cette subvention, afin de le dynamiser et le développer. Le régime d'assurance récolte français va progressivement évoluer, l'intervention de l'Etat va croître jusqu'en 2005, date de la mise sur le marché d'un contrat ambitieux : le contrat d'assurance multirisque climatique sur récolte (MRC). Cet ambitieux contrat est supervisé et encadré par l'Etat. Ambitieux car il s'agit d'un contrat unique, disponible pour quasi l'ensemble des agriculteurs sans distinction de culture ou de localisation. Chaque année, le gouvernement redéfinit le cahier des charges de l'ensemble des caractéristiques du contrat qui est distribué par les assureurs privés. Ambitieux également car pour inciter à l'adoption de ce contrat, le taux de subvention a progressivement été augmenté jusqu'à un niveau de 65% (et même 70% à partir 2023).

Cependant, malgré d'importants efforts de subvention et des réformes successives, l'assurance MRC peine à se diffuser. En 2020, le taux d'adhésion n'était que de 32,8% de la surface agricole utile française (hors prairies), alors qu'il était déjà de 22,4% la première année de la politique en 2005. En outre, l'offre de MRC souffre d'importantes disparités dans la distribution entre les cultures. Alors que 33,3% des grandes cultures et 34% des vignes sont assurées dans le MRC, seulement 3,1% de la surface fruitière est couverte en 2020. Les enjeux de développement sont importants. Ce faible taux de distribution est associé à un ratio sinistres/primes structurellement déficitaire pour les assureurs, avec une moyenne de 101% sur la période 2005-2020, alors que l'assurance reste l'outil de gestion des risques agricoles le plus

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<sup>22</sup>Hamon, G.-M. (1930). Origines et statistique de l'assurance contre la grêle. *Journal de la société française de statistique*, 71:323-334.

encouragé par l'Etat. Ce constat est le point de départ de cette thèse. Et la question principale de cette thèse est : pourquoi les agriculteurs s'assurent-ils si peu ? Pour comprendre les difficultés actuelles, il faut comprendre l'évolution historique de l'offre.

A partir de 1964, l'analyse du développement du marché de l'assurance récolte nécessite de s'intéresser à l'intervention publique, à la fois en termes de couverture des événements catastrophiques et de soutien au marché de l'assurance, mais aussi aux propositions des assureurs et surtout aux attentes des agriculteurs. Le défi que représente la couverture des agriculteurs contre les pertes économiques liées aux conditions météorologiques est intemporel, mais il ne cesse de croître. Les risques météorologiques sont appelés à augmenter en raison du changement climatique, alors même que les agriculteurs jouent un rôle décisif dans la séquestration des émissions.

Les enjeux de la couverture peuvent être distingués à plusieurs niveaux. Tout d'abord, il s'agit d'assurer un revenu à l'agriculteur et surtout d'éviter que l'exploitation ne s'arrête ou ne fasse faillite. Au-delà des conséquences directes pour l'agriculteur et son ménage, il s'agit également de protéger l'ensemble des salariés agricoles. Pour donner une idée de l'ampleur du paysage agricole français, on peut s'appuyer sur les données Agreste du recensement agricole de 2020. En 2020, la France comptait environ 416 000 exploitations agricoles, d'une surface moyenne de 65 hectares. Ces exploitations emploient 814 000 personnes à temps plein, dont 523 000 personnes travaillant comme chefs d'exploitation ou coexploitants agricoles. L'ensemble de ces exploitations a produit l'équivalent de 77 milliards d'euros de production agricole en 2019, faisant de la France la première puissance agricole d'Europe. L'agriculture est un secteur stratégique pour la France, puisque, combinée au secteur agroalimentaire, elle représentait 3,4% du PIB français en 2019. De plus, l'agriculture a un impact considérable sur la géographie et la dynamique rurale : 52% du territoire de la France métropolitaine sont des terres agricoles (dont 45% sont consacrées aux grandes cultures). Entretenir les paysages ruraux, fournir un grand nombre de services écosystémiques, séquestrer le carbone dans les sols agricoles, assurer l'approvisionnement alimentaire des villes, maintenir la biodiversité... autant d'enjeux cruciaux auxquels l'agriculture française doit faire face et qui dépendent en grande partie de l'activité de tous ces agriculteurs. La sécurisation de ces activités est donc vitale non seulement pour eux, mais aussi pour l'économie et la société dans son ensemble.

L'estimation des pertes effectivement subies par les agriculteurs français du fait des événements météorologiques est une tâche quasi impossible. Les aléas sont si divers dans leur nature et leur localisation, les défauts de déclaration et d'indemnisation si nombreux, qu'il est nécessaire d'utiliser des indicateurs de substitution pour se faire une idée de la situation. Pour se faire une idée des ordres de grandeur du marché de l'assurance récolte, il convient d'examiner les bilans des assureurs. Dans le rapport Descrozaille (2021)<sup>23</sup>, l'annexe contient des informations sur le coût des sinistres entre 2016 et 2020 pour Groupama, le principal assureur du marché français de l'assurance récolte. Les montants totaux versés par cet assureur à ses assurés varient parfois du simple au double d'une année sur l'autre. En 2016, 420 millions d'euros d'indemnités ont été versés (57% pour l'excès d'eau et 19% pour les pertes

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<sup>23</sup>Descrozaille, F. (2021). Rapport sur la gestion des risques en agriculture. *Rapport du Député de la première circonscription du Val de Marne au Ministre de l'Agriculture*, pages 1–329.

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dues à la grêle). En 2017, le montant total s'est élevé à 190 millions d'euros, dont 50% au titre du gel. Pour 2020, le total devrait dépasser 300 millions d'euros, la sécheresse représentant 55% de ce montant. Sur la période 2017-2019, l'assureur reporte un taux de sinistralité global de 98% en moyenne. Un simple bilan de ces quelques années, en prenant en compte les données agrégées pour la France métropolitaine et tous secteurs confondus, montre qu'il existe des variations importantes d'une année sur l'autre, et que les principaux aléas dévastateurs fluctuent également.

L'efficacité et la résilience de l'assurance récolte dans son état actuel semblent être remises en cause. Pourtant, l'assurance récolte est un outil promu et soutenu par la majorité des pays, et est également identifié comme un outil essentiel pour l'adaptation au changement climatique dans les pays développés et en développement (IPCC, 2020)<sup>24</sup>.

En outre, le changement climatique va certainement aggraver les conditions météorologiques et donc remettre en question l'assurabilité de ces risques météorologiques, ou du moins avoir un impact sur le coût de l'assurance. En France métropolitaine, les simulations utilisées par la Banque Mondiale indiquent des augmentations de température entraînant davantage de vagues de chaleur, d'épisodes de pluies intenses et de risques d'inondations. Dans un contexte agricole, ces variations météorologiques sont d'autant plus perturbantes. Outre le risque de voir leurs récoltes détruites par des épisodes dévastateurs, les agriculteurs devront faire face à des périodes de croissance perturbées, à une modification des intervalles d'exposition au risque de gel pour la vigne ou les fruits, par exemple, et à des contraintes inédites en termes d'accès à l'eau.

## Thèse : objectifs et cadre d'analyse

L'objectif de cette thèse est de mieux comprendre le rapport des agriculteurs à l'assurance récolte et d'évaluer la place de cet instrument dans leur stratégie de gestion des risques aujourd'hui et à l'avenir. Au cours des 4 chapitres de cette thèse, nous tentons de retracer l'histoire du développement de cet outil assurantiel, tant d'un point de vue institutionnel, en examinant les différentes réformes et leur impact, que du point de vue des agriculteurs en s'intéressant à la manière dont ils perçoivent l'assurance. Avec cet objectif en tête, nous poursuivons une double approche complémentaire.

La première approche concerne le cadre institutionnel et législatif du régime français d'assurance récolte. En France, l'assurance récolte est particulièrement réglementée et supervisée par l'Etat. Gérant des taux de subvention importants et essayant, tant bien que mal, d'établir une synergie entre les différents soutiens apportés aux agriculteurs, l'Etat est le principal acteur de l'évolution du marché et en particulier de l'offre. En dialogue constant avec les assureurs et autres représentants agricoles, il définit ce qui est subventionné et ce qui ne l'est pas, et surtout, il définit précisément les caractéristiques des contrats subventionnables. Pour mener des réflexions pertinentes et dans l'espoir de mener à bien de futures

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<sup>24</sup>Intergovernmental Panel on Climate Change (2022). *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.*

réformes nécessaires, il convient de regarder ce que font d'autres pays en plus du cas français. Une analyse comparative est utilisée dans les premier et troisième chapitres. Un accent particulier est mis sur les systèmes d'assurance récolte en place en Espagne et en Italie afin d'établir des analogies et des différences avec le cas français sur les forces et les faiblesses de chacun qui peuvent être mutuellement avantageuses.

La deuxième approche se concentre sur l'adoption de l'assurance récolte. Il s'agit à la fois de comprendre la relation que les agriculteurs entretiennent avec l'outil assurantiel aujourd'hui, mais aussi de se demander si les agriculteurs souscriront davantage à une assurance à l'avenir, lorsque les conditions météorologiques se détérioreront encore plus en raison du changement climatique.

En réalité, chercher à savoir "pourquoi" les agriculteurs s'assurent si peu implique une multitude de facettes à explorer. Afin de savoir par où commencer, le premier chapitre propose notamment une revue de la littérature sur les déterminants de l'adoption de l'assurance récolte qui conduit à une liste d'hypothèses que le second chapitre testera empiriquement. Ces multiples facettes renvoient à des mécanismes en action impliquant des déterminants et des freins liés aux caractéristiques des contrats, aux caractéristiques objectives de l'exploitation et de l'exploitant, mais aussi à des éléments de gouvernance du dispositif d'assurance récolte. De plus, il convient de considérer les besoins des agriculteurs et comment ils perçoivent les solutions proposées par l'assurance, élément subjectif à chaque agriculteur. Ces mêmes facteurs entrent en jeu lorsqu'il s'agit d'anticiper le rôle de l'assurance récolte dans les stratégies d'adaptation des agriculteurs au changement climatique. Sur ce point, d'autres paramètres sont également à considérer tel que la perception qu'ont les agriculteurs du changement climatique et des impacts auxquels ils s'attendent. C'est notamment ce que le quatrième chapitre propose d'étudier.

## **Premier chapitre - L'assurance récolte en France : spécificités du régime et déterminants potentiels**

Ce premier chapitre établit le cadre analytique de l'ensemble de la thèse. Son objectif est d'établir des orientations pour l'identification des facteurs qui expliquent la faible adhésion des agriculteurs français à l'assurance récolte. En partant de la mise en place du régime des calamités agricoles en 1964, nous retraçons l'évolution du régime français, en revenant sur les réformes successives et l'évolution des contrats proposés aux agriculteurs, pour finalement expliquer précisément l'état de l'offre aujourd'hui (le régime d'avant réforme de 2023) et la problématique de sa faible adoption. Ensuite, nous comparons cette offre d'assurance et le mode de gouvernance du régime avec les régimes en place en Espagne et en Italie. La première comparaison permet d'observer un pays où l'assurance est beaucoup plus répandue et mieux implantée. La seconde comparaison offre l'opportunité d'identifier certaines similitudes et différences avec un pays confronté aux mêmes problématiques que la France.

Dans un second temps, nous effectuons une revue de la littérature sur les obstacles et les déterminants de l'adoption de l'assurance récolte. Sur la base de cet ensemble d'articles et de leurs résultats théoriques

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ou empiriques, nous listons les impacts identifiés des caractéristiques du marché, de l'offre et de la demande sur l'assurance récolte. Ces deux parties conduisent à une discussion sur les éléments qu'il serait intéressant de tester auprès des agriculteurs français afin de comprendre plus précisément leur comportement d'assurance et d'identifier certaines lacunes dans la littérature sur l'adoption de l'assurance récolte, notamment en ce qui concerne l'analyse des variables comportementales.

Ce chapitre est le seul de cette thèse rédigé en français, puisqu'il est publié en français dans la revue *Economie Rurale*<sup>25</sup>.

## **Deuxième chapitre - Barrières subjectives et déterminants de l'adoption de l'assurance récolte**

Le deuxième chapitre de cette thèse analyse une partie des données de notre enquête, réalisée en ligne durant la thèse auprès d'agriculteurs français, dans l'objectif de tester les hypothèses énoncées à la fin du chapitre précédent.

Si la question de recherche est relativement simple : quels sont les principaux déterminants et barrières à l'adoption de l'assurance récolte ? L'approche est originale. Grâce à la nature des données collectées, nous avons pu tester certains déterminants relativement classiques dans la littérature (taille de l'exploitation, type de culture, âge et niveau d'éducation de l'agriculteur, degré d'aversion pour le risque...) mais aussi des éléments qui, à notre connaissance, n'ont jamais été étudiés. En particulier, nous examinons le processus de décision de souscrire ou non une assurance du point de vue des freins à l'adoption. Dans notre analyse, ces freins ne sont pas des déterminants avec un signe négatif mais des éléments intrinsèques au fonctionnement du marché ou aux caractéristiques des contrats.

En utilisant les différentes méthodologies employées dans l'enquête (questions, mécanismes de classification, auto-évaluation, échelles de Likert, tests expérimentaux) et grâce à un échantillon bien équilibré entre agriculteurs assurés (49,31%) et non assurés (50,69%), nous réalisons une analyse empirique au travers de régressions probit sur données en coupe et dynamique. En complément de cette analyse économétrique, nous analysons les résultats des différentes classifications des barrières réalisés par les répondants. Nous mettons en évidence divers effets et différences concernant les barrières entre les adoptants et les non-adoptants de contrat d'assurance récolte. Alors que les non-assurés soulignent des problèmes de confiance et de gestion administrative des contrats, ainsi que la faible probabilité qu'ils perçoivent d'être sinistrés, les assurés sont très critiques à l'égard des caractéristiques intrinsèques des contrats. Cependant, les deux populations s'accordent à dire que l'assurance est perçue comme trop chère (même si les assureurs sont structurellement déficitaires dans cette politique). Nous soulignons également plusieurs effets tels qu'une forte dynamique d'inertie pour les assurés en ce qui concerne l'adoption de l'assurance; une occurrence de pertes récentes qui encourage fortement le recours à l'assurance dans les années qui suivent et une perception erronée du rôle de la subvention puisqu'une augmentation de son

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<sup>25</sup>Koenig, R., Brunette, M., Delacote, P., and Tevenart, C. (2022). Assurance récolte en France : spécificité du régime et déterminants potentiels. *Economie Rurale*, 380:7-25.

niveau ne semble pas être substituable à une réduction du niveau de la prime.

Nous regroupons nos résultats en résumant le processus de réflexion d'un agriculteur sur l'adoption ou non d'un contrat d'assurance récolte comme un processus en trois étapes : une première phase d'auto-évaluation de son risque et de la probabilité de recevoir une indemnisation, suivie d'une deuxième phase d'évaluation de la qualité de la couverture offerte et d'une dernière phase concernant sa perception du coût de l'assurance et de sa capacité à la payer.

### **Troisième chapitre - Les trajectoires de réforme des régimes européens d'assurance récolte : réflexions à partir du cas français**

Ce troisième chapitre consiste en un *policy paper* sur l'influence des orientations de la PAC sur les réformes mises en oeuvre au niveau national. Dans le contexte de cette thèse, ce chapitre souligne ma collaboration avec le professeur Fabio Gaetano Santeramo de l'Université de Foggia, qui a beaucoup publié ces dernières années sur l'assurance récolte en Italie. Comme mentionné dans le premier chapitre, l'Italie fait également face à un très faible niveau d'adhésion à l'assurance récolte, avec des disparités géographiques importantes. Confrontés à un problème commun, nous avons décidé de travailler ensemble et j'ai donc passé trois mois au département des sciences agricoles de l'Université de Foggia, de septembre à novembre 2021. Dans la revue *EuroChoices*, Santeramo et Ramsey (2017)<sup>26</sup> examinent certaines des caractéristiques spécifiques du modèle américain d'assurance récolte et conclut en ouvrant l'idée d'un modèle d'assurance à l'échelle européenne. Si cela peut potentiellement contribuer à résoudre le problème de l'échelle de mutualisation, les auteurs soulignent l'ampleur des difficultés et des obstacles à une telle démarche en insistant sur l'importance de développer au préalable les marchés nationaux. Quelques années plus tard, nous proposons de revenir sur cette question en nous demandant si les systèmes mis en place au niveau national ne pourraient pas être progressivement en train de s'harmoniser sous l'influence de la politique agricole commune. En nous concentrant sur le cas français, nous établissons un parallèle entre les réformes nationales et l'émergence d'un volet "gestion des risques" dans la PAC. Nous établissons ensuite un parallèle avec l'impact potentiel de la PAC dans les deux mêmes études de cas que dans le premier chapitre : Espagne et Italie. Nous montrons que, sous l'influence d'une même politique supranationale, les trajectoires entre les pays tendent à diverger. Nos études de cas sont progressivement passées d'un soutien public aux contrats monorisque aux contrats multirisques. Cependant, les tendances actuelles diffèrent. En particulier, deux stratégies de développement du marché de l'assurance s'opposent : une offre subventionnée unique et simple pour tous (France) contre une offre subventionnée diversifiée, complexe et mieux adaptée aux différents besoins des agriculteurs (Espagne, Italie). Nous discutons ces différences au regard des modifications importantes apportées au système français par la réforme de 2023.

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<sup>26</sup>Santeramo, F. and Ramsey, A. (2017). Crop insurance in the eu: Lessons and caution from the US. *EuroChoices*, 16(3):34-39.

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## Quatrième chapitre - Perception, impact et adaptation au changement climatique : implications pour l'assurance récolte

Ce quatrième chapitre examine si l'assurance récolte est considérée par les agriculteurs comme un outil d'adaptation. D'une manière générale, nous étudions dans ce chapitre la perception du changement climatique par les agriculteurs, les effets en termes de variations des risques météorologiques auxquels ils s'attendent et les stratégies qu'ils mettent en oeuvre ou qu'ils comptent mettre en oeuvre. Ce chapitre est également basé sur les données de l'enquête. En utilisant notamment une section non exploitée dans le second chapitre, nous étudions les perceptions du changement climatique par les agriculteurs en trois étapes.

Après avoir montré l'importance du risque météorologique dans l'ensemble des risques auxquels sont exposés les agriculteurs, nous nous intéressons dans un premier temps à leur perception ou prise de conscience du changement climatique. Cette première étape nous permet d'exclure de la suite de l'analyse 8 agriculteurs sur les 288 qui ne croient pas au changement climatique et pour lesquels les questions relatives aux effets attendus et à l'adaptation ne sont pas applicables. Deuxièmement, ayant interrogé les agriculteurs sur les variations météorologiques attendues (augmentation, diminution, pas de changement) en termes de fréquence et d'intensité pour six risques (sécheresse, tempêtes, inondations, grêle, gel et ravageurs et maladies), nous utilisons ces réponses pour construire un indicateur synthétique des effets attendus du changement climatique. Nous montrons, à l'aide de matrices de corrélation, que certains risques sont considérés comme significativement corrélés avec les autres (sécheresse ou ravageurs et maladies) et que d'autres ne le sont pas (gel). Troisièmement, au travers d'une analyse économétrique, nous étudions les déterminants de la perception du changement climatique et les déterminants de l'adoption de quatre stratégies d'adaptation génériques (changement de pratiques, diversification des cultures, recours accru à l'assurance et diversification des revenus). Nous mettons en évidence deux profils d'agriculteurs distincts. D'une part, des agriculteurs qui se sentent aujourd'hui relativement moins exposés aux aléas climatiques, avec une forte inertie sur leur exploitation (labellisés ou avec salariés), et qui sont plus enclins à adapter leurs pratiques agricoles. D'autre part, des agriculteurs qui se sentent relativement plus exposés aujourd'hui et qui entendent découpler leurs revenus des aléas climatiques en adoptant une stratégie de diversification de leurs sources de revenus. Dans ce contexte, l'assurance peine à trouver sa place. Nous discutons des résultats à la lumière des évolutions possibles que l'assurance récolte pourrait prendre à l'avenir.



*Gérer, c'est anticiper.*

# CROP INSURANCE: FROM PERCEPTION AND ADOPTION ISSUES TO ADAPTATION CHALLENGES

This thesis examines the role of crop insurance in the risk management and adaptation strategies of French farmers. Weather hazards are a major concern for farmers, and managing these risks is essential to securing their income. To encourage farmers to insure their crops, public authorities in France provide subsidies for insurance premiums. However, despite a 65% subsidy, the adoption of crop insurance remains low, with around 33% of the agricultural area insured in 2020. The thesis consists of four chapters. The first chapter reviews the history and development of the French crop insurance scheme and compares it with schemes in Italy and Spain. It also reviews the literature to identify possible reasons for its low adoption in France. The second chapter presents survey data on farmers' perceptions of insurance and identifies determinants and barriers to its adoption. It highlights differences in self-assessment of exposure to weather risks and the influence of factors such as recent losses and diversification. The third chapter is a policy paper examining the impact of the introduction of a weather risk management component in the Common Agricultural Policy on national crop insurance schemes. It shows differences in policies between Member States. The final chapter analyses farmers' perceptions of climate change, its expected impact on hazards and adaptation strategies. We identify two main trends in farmers' adaptation strategies: on-farm changes for some and income diversification for others. Crop insurance struggles to find its place in this context. Finally, this thesis examines the challenges and opportunities for crop insurance in French agriculture in the adaptation to climate change.

## L'ASSURANCE RÉCOLTE : DE SA PERCEPTION ET DES PROBLÈMES D'ADOPTION AUX ENJEUX D'ADAPTATION

Cette thèse examine le rôle de l'assurance récolte dans les stratégies de gestion des risques et d'adaptation des agriculteurs français. Les aléas climatiques sont une préoccupation majeure pour les agriculteurs, et la gestion de ces risques est essentielle pour sécuriser leurs revenus. Afin d'encourager les agriculteurs à assurer leurs récoltes, les pouvoirs publics français accordent des subventions pour les primes d'assurance. Cependant, malgré une subvention de 65%, l'adoption de l'assurance récolte reste faible, avec environ 33% de la surface agricole assurée en 2020. La thèse est composée de quatre chapitres. Le premier chapitre retrace l'histoire et l'évolution du régime français d'assurance récolte et le compare aux régimes italien et espagnol. Il passe également en revue la littérature afin d'identifier les raisons possibles de sa faible adoption en France. Le deuxième chapitre présente des données d'enquête sur la perception de l'assurance par les agriculteurs et identifie les déterminants et les barrières à son adoption. Il met en évidence les différences d'auto-évaluation de l'exposition aux risques météorologiques et l'influence de facteurs tels que les pertes récentes et la diversification. Le troisième chapitre est un *policy paper* qui examine l'impact de l'introduction d'une composante de gestion des risques météorologiques dans la politique agricole commune sur les régimes nationaux d'assurance récolte. Il montre les différences de stratégies entre les États membres. Le dernier chapitre analyse la perception qu'ont les agriculteurs du changement climatique, des impacts auxquels ils s'attendent et des stratégies d'adaptation qu'ils comptent instaurer. Nous identifions deux tendances principales dans les stratégies d'adaptation des agriculteurs : des changements sur l'exploitation et la manière de cultiver pour certains et la diversification des revenus pour d'autres. L'assurance récolte peine à trouver sa place dans ce contexte. Finalement, cette thèse examine les défis et les opportunités de l'assurance récolte en France dans le contexte de l'adaptation au changement climatique.