Received: 16 December 2021 | Revised: 4 July 2022 | Accepted: 25 July 2022

DOI: 10.1111/1477-9552.12508

ORIGINAL ARTICLE

JAE Journal of Agricultural Economics

Farmers' participation in the Income Stabilisation Tool: Evidence from the apple sector in Italy

Ruggiero Rippo[1] | **Simone Cerroni**[1,2]

[1]Centre for Agriculture, Food and Environment, Università degli Studi di Trento, Trento, Italy

[2]Department of Economics and Management, Università degli Studi di Trento, Trento, Italy

Correspondence
Ruggiero Rippo, Center Agriculture Food and Environment, Università degli Studi di Trento, Trento, Italy.
Email: ruggiero.rippo@unitn.it

Abstract

The Income Stabilisation Tool (IST), which was recently added to the European Common Agricultural Policy's risk management toolkit, is a mutual fund that aims at stabilising farmers' income. We investigate the drivers of farmers' participation in an IST for the apple sector in the Autonomous Province of Trento in Italy, which is the only region that has operationalised the IST in the European Union. Our analysis is based on a theoretical framework based on the Unified Theory of Use and Acceptance of Technology. Using a three-year panel dataset of 3268 farm households, we estimated a logit model with the Mundlak–Chamberlain procedure. Our results show that higher crop production specialisation, associated with greater risk exposure, favours participation in the IST. Similarly, previous experience with mutual funds increases the acceptance of the IST. The analysis also provides evidence of how the new tool interacts with existing on-farm protection strategies, leading to a discussion of the presence of adverse and advantageous selection effects. Our paper sheds light on farmers' acceptance of newly implemented sector-specific ISTs and generates better knowledge and understanding of lock-ins and levers that influence participation in such schemes, which are relevant to other EU regions or member states that are considering the introduction of ISTs.

KEYWORDS
apple production, EU common agricultural policy, Income Stabilisation Tool, Italy, mutual fund, risk management, Trento Province, unified theory of acceptance and use of technology

JEL CLASSIFICATION
G22; Q18; D81

1 | INTRODUCTION

Farmers can adopt a wide range of risk management tools and strategies to cope with risk and uncertainties related to production, market and financial outcomes (Cordier & Santeramo, 2020; Finger et al., 2022; Meuwissen et al., 2018; Moschini & Hennessy, 2001). An instrument offered to European farmers under the Common Agricultural Policy (CAP) is the Income Stabilisation Tool (IST) that aims at stabilising farm income over time by providing compensation for severe falls in income due to any type of adverse event (e.g., production losses, market crisis or prices variations) (EC, 2011). The IST was introduced in the 2013 reform of the CAP and operates in compliance with Regulation (EU) No. 1305/2013 and subsequent Regulation (EU) No. 2393/2017 (EC, 2011, 2013). In the whole of the EU, only one region has operationalised the IST to date: the Autonomous Province of Trento (hereafter, PAT) in Italy. This paper represents the first attempt to investigate lock-ins and levers that influence farmers' participation in an operating IST by focusing on the scheme developed by the PAT for apple producers since 2019. Farmers' acceptance of the newly implemented scheme is investigated using a 3-year (2019–2021) dataset that comprises 3268 farm households and estimating a logit model via the Mundlak–Chamberlain procedure (Chamberlain, 1982; Mundlak, 1978).

In addition to the IST, more traditional tools are offered to European farmers under the CAP: (i) production insurance for crops, livestock and plants; and (ii) mutual funds for adverse climatic events and animal or plant diseases. These tools operate in a very different way. Insurance allows the farmer to transfer part of their risk to a third party (i.e., the insurance company) and covers production losses due to crop failure or environmental damages (e.g., hail, frost). Mutual funds represent a form of organised savings that can be withdrawn by members to compensate for production losses due to specific adverse hazards such as adverse climatic conditions or animal and plant diseases.

The IST is a particular form of mutual fund that differs from traditional tools for risk management. On the one hand, it compensates farmers for income losses rather than production losses. On the other hand, it provides farmers with financial support due to any type of adverse event that affects farm income, for example drops due to price volatility (Bardají & Garrido, 2016). The IST operates as follows. When the IST member's income drops by more than 30% of the average annual income, the IST is activated and provides compensations for up to 70% of the income lost. The average annual income is calculated over a 3-year period or a 5-year period excluding the highest and lowest year (Olympic average) that is antecedent to the IST enrolment. The Omnibus Regulation No. 2393/2017 introduced the possibility to set up a sector-specific IST with a lower threshold of 20% as it recognised that the economic risks do not affect all agricultural sectors equally (EC, 2017). The CAP Rural Development Policy allocates part of its budget to support the initial upfront costs of the IST in agreement with the World Trade Organisation green-box requirements (Bardají & Garrido, 2016). Public support is provided to cope with the administrative costs of setting up the mutual fund and with the amounts paid to the farmers as compensation.

Prior to the European experience, the USA and Canada have already developed risk management tools that focus on income stabilisation (EC, 2017). The Canadian Agricultural Income

Stabilisation (CAIS) programme, for example, was a whole farm insurance program, where farmers' private contributions are matched by public support. The CAIS, which expired in 2007 and was replaced by the AgriStability and AgriInvest programmes, was intended to help farmers who suffered large income drops with respect to a historical margin (Turvey, 2012). In the USA, the federal insurance programme witnessed a shift from yield to revenue-base, boosted by the 2008 Farm Bill with the Average Crop Revenue Election Program (ACRE) (Smith & Glauber, 2019). The 2014 Farm Bill simplified ACRE, creating a revenue based scheme for decoupled payments to farmers experiencing revenue reductions compared to a 5-year Olympic average (Severini et al., 2021).

Despite its potential and the EU financial support for the IST upfront costs, EU member states' interest regarding the IST has been very limited. Two member states (Italy, Hungary) and one region (Castilla y Lèon in Spain) had shown initial interest in implementing an IST (EPRS, 2016). In Spain and Hungary, the implementation was hindered by difficulties in the design of the instrument, like the measurement of the reference income that is used to determine the magnitudes of income drops (Cordier & Santeramo, 2020). In Italy, the Ministry of Agricultural, Food and Forestry Policy (MIPAAF) issued Decree No. 10158/2016 that regulates the implementation and the management of the IST. In 2019, the PAT created two sector specific ISTs: one for the apple sector and one for the dairy sector, which represent the first experience of operating ISTs in the whole EU to date. In this paper, we focus our analysis on the first scheme, which is the most developed.

In 2019, the PAT identified 3662 apple producers, of which 1995 (i.e., 55%) enrolled in the IST. The participation rate remained stable in the following 2 years (2020 and 2021). These numbers are encouraging but indicate that acceptability of new risk management tools should not be taken for granted, even in regions or sectors that are characterised by a robust system of cooperatives, a developed agricultural insurance market and the presence of other mutual funds related to specific fruit and plant diseases and adverse climatic events. The insurance market in the PAT is one of the most developed in Italy and the percentage of farmers protecting their production via multi-peril insurance, which covers damages from adverse environmental conditions (e.g., wind, frost, flood, hail, heatwaves), is approximately 90% (ISMEA, 2021). Considering that the financial viability of the IST depends on the number of farmers who voluntarily contribute to the fund, a better knowledge and understating of factors that facilitate or prevent the participation in the IST scheme is both timely and necessary.

Given the lack of available data on an operating IST scheme, previous studies focus on explorative ex-ante assessments of prospective IST schemes in different regions or countries using available data at farm level (for example, FADN) and simulation procedures (e.g., Capitanio et al., 2016; El Benni et al., 2016; Finger & El Benni, 2014; Severini, Biagini, et al., 2019; Trestini et al., 2018). These studies explore the economic feasibility of the tool and potential consequences that the IST might have on farmers' welfare. However, they do not provide any information regarding farmers' adoption of the IST-scheme and potential lock-ins and levers that influence farmers' participation in an operating IST. To the best of our knowledge, there are no studies investigating farmers' acceptance of the IST and factors affecting participation in the IST using available data on an operating scheme.

We fill this gap in the literature by profiling farmers and farm types and investigating drivers of participation in the scheme. To this end, we analyse a panel data set over the period 2019–2021, estimating a logit model applying the Mundlak–Chamberlain approach (Chamberlain, 1982; Mundlak, 1978). In our empirical analysis, we investigate the factors influencing farmers' participation in the apple-IST based on real farmer behaviour while using a modelling approach based on the Unified Theory of Use and Acceptance of Technology (UTAUT) (Venkatesh et al., 2003). The UTAUT was originally developed to explain acceptance and diffusion of information systems and technology but it is now more broadly used to study agents' intention and behaviour regarding the adoption of any type of technology or innovation such as: solar PV, electric vehicles, renewable energy adoption

by rural households, soil and water conservation measures, smartphone apps in crop protection and post-harvest practices among farmers (Faridi et al., 2020; Jain et al., 2022; Michels et al., 2020). Our study represents the first application of the UTAUT regarding an innovation in the field of agricultural risk management. The choice of using this specific behavioural framework stems from the fact that the UTAUT provides a unified theoretical framework that facilitates the analysis regarding the adoption and the diffusion of innovation, synthesising previous models of technology adoption, including, for example, the Innovation Diffusion Theory and the Technology Acceptance Model (Davis, 1989; Rogers, 1995). Moreover, the UTUAT incorporates behavioural factors (e.g., perceived risk, experience and perceived effort) that provide relevant insights on farmers' decisions to innovate and highlights the role of experience and learning as crucial factors in the innovation process (Chavas & Nauges, 2020; Santeramo, 2019). Understanding the role of behavioural factors behind innovation adoption should improve the efficacy and success of agricultural policy significantly (Cerroni, 2020; Colen, 2016; Streletskaya et al., 2020).

Although our analysis refers to a specific region in Italy and a sector specific IST, it contributes to the ongoing debate on agricultural risk management that is taking place at the EU level. An important topic within this debate, that is stimulated by the development of the new CAP 2023–2027, is the role of cooperation and mutual exchange of risk in coping with global and long-term challenges (Finger et al., 2022). First, our paper offers evidence on the acceptance of the only operating IST scheme in the whole of Europe. Information on the rate of participation in the PAT can be used as an indicator of farmers' attitudes towards this new scheme and can be interpreted as a first test of its acceptance. Sharing and disseminating results on the very first operative IST in the EU can be beneficial for other EU member states, supporting their efforts in planning and operationalising this new tool for risk management (Cordier & Santeramo, 2020). Secondly, we shed light on the factors driving participation in the IST. A better understanding of the profile of the farmers and farms joining the IST could help simulating more precisely the cost of indemnification as well as the national or the regional budgets needed to operationalise the new scheme in the future. Finally, our analysis of factors driving participation in the IST generates knowledge and understanding of lock-ins and levers that affect farmers' acceptability of the new risk management tool. This can help policy-makers to design more acceptable and sustainable formulations of the scheme as well as create informational campaigns to reach out to farmers who are more reluctant to accept the new risk management tool. The design of such strategies and campaigns can be further supported by theories of behavioural change and technology acceptance. Our findings should be particularly relevant for EU countries and regions that are planning to adopt this new risk management tool.

The paper is structured as follows. Section 2 provides a critical review of strengths and limitations of the IST, a review of studies performing ex-ante assessments of the IST and an overview of the literature on describing the famers' adoption of risk management tool. Section 3 describes the study setting and the apple-IST scheme in the PAT. We present our theoretical analytical framework in Section 4 and in Section 5 we lay out the methodology and the dataset. The modelling approach, the estimation strategy and the results of the econometric analysis are reported in Sections 6 and 7. Section 8 offers our conclusions and a discussion on the final policy implications of our study.

2 | BACKGROUND OF THE IST

2.1 | Strengths and limitations of the IST

Previous studies argue that the IST provides advantages with respect to more traditional risk management tools, in particular to purely commercial crop insurance. The IST has the objective

of stabilising farmers' income, probably the most informative indicator of farm household's well-being. In addition, the IST covers any type of adverse events, including risks that are not covered by the multi-perils crop insurance (e.g., market-, price- and trade-related risks). Hence, the IST protects farmers from systemic risks that are not covered by the commercial insurance (Meuwissen et al., 2003) and potentially reduces income inequalities among farmers (Finger & El Benni, 2014). Smallholder farmers, who may not have the skills and the knowledge to deal with market uncertainty and price fluctuations, could benefit the most from the IST. Finally, unlike classic crop insurance, the IST accounts for various correlations between prices, yields and profits of different farm activities (Severini et al., 2019).

The implementation of this new risk management tool also raises some concerns. The first is related to the acceptability of the tool as farmers may not entirely trust the financial robustness of the mutual fund that cover systemic risks (Meuwissen et al., 2003, 2013). In addition, Meuwissen et al. (2003) point out that the financial sustainability of the IST could be threatened by asymmetric information and related phenomena such as adverse selection and moral hazard. Asymmetric information occurs when the potential insured have more information about the insured risks than the insurer. The IST, as any other type of income insurance scheme, requires reliable data on all factors affecting farm income, including farm operating costs and inventories. This type of data is generally difficult to retrieve and is subject to manipulation by farmers (Meuwissen et al., 2003).

Asymmetric information could lead to adverse selection if farmers who are more exposed to risk join the IST as predicted by the classical insurance model (Rothschild & Stiglitz, 1976). Moral hazard would occur when farmers who participate in the IST take actions that increase the probability and magnitude of losses (Horowitz & Lichtenberg, 1993; Smith & Goodwin, 1996; Wu et al., 2020). However, it is important to note that more recent insurance models introduce the concept of advantageous selection under which the informational advantage of the insured is bi-dimensional and risk aversion increases the likelihood of purchasing additional coverage even when the probability of experiencing losses is small (de Meza & Webb, 2001; He et al., 2018). Advantageous selection mitigates issues related to adverse selection and moral hazard.

In addition, some recent studies argue that ad-hoc designs of the IST could minimise the risk of adverse selection and moral hazard. Pigeon et al. (2014) suggest a rule, inspired by the home windstorm insurance, that activates the IST if a reference group of farmers or a given percentage of farmers belonging to the same area experiences a loss larger than a pre-fixed threshold. Trestini and Giampietri (2018) argue that sector- and area-specific ISTs could reduce the asymmetric distribution of the information, thus reducing the risk of adverse selection and moral hazard. Finally, a high level of public support could minimise adverse selection by incentivising farmers with a low risk profile to join the IST, at a cost to the taxpayer.

2.2 | Empirical research on the IST

Previous empirical research focuses on *ex-ante* assessments of hypothetical IST schemes at regional or country level. These studies largely rely on simulations, given the lack of data on an operating scheme in the EU. Some studies simulate the setup costs of the IST and its economic viability in specific regions and countries. Capitanio et al. (2016) hypothesise the development of an IST at national level in Italy, estimating the potential public costs to set up and run the mutual fund based on a simulated farmers' demand for the tool. Trestini and Giampietri (2018), using data of farms specialised in viticulture, suggest the development of a national scheme alongside a number of different macro-regional funds with a heterogeneous contribution that depend on the geographical location of the farm. They argue this design could improve the financial stability of the IST.

Other studies have investigated whether the probability and the level of indemnification are a function of the farm profiles and the farmers' characteristics. Trestini et al. (2018), focusing on the potential implementation of IST schemes related to the dairy sector in two Italian regions (Veneto and Lombardy), find that younger farmers and farms located in upland areas would be more likely to experience a severe income reduction that triggers indemnification (i.e., variation greater than 30%). In contrast, farm size does not have a significant effect on the probability of indemnification. This study also examines whether the indemnification level depends on alternative designs of the reference income used to calculate income losses. Results indicate that, if the reference income is adjusted over the livestock herd (i.e., number of animals) or the utilised agricultural area (i.e., UAA), the number of farms eligible for indemnification increases compared to the situation where the reference income is calculated as the standard 3-year average. El Benni et al. (2016) conduct a similar analysis considering a set of sector-specific IST to be operationalised at a national scale in Switzerland. Results confirm that older farmers are less likely to face a severe income reduction but indicate that farms located in the valleys receive higher indemnities compared to the farms in upland areas.

Another stream of research examines the potential effects of the IST on income inequalities. Finger and El Benni (2014) show the IST can potentially reduce income inequalities, with a reduction in both Gini and Theil indices in Switzerland. The IST could generate an increase of the farms' income in the lower 25% quantile. The upward shifts would be explained by the fact that higher-income farms are less likely to receive indemnifications as they have a lower income risk profile. Similarly, by means of stochastic simulation procedures, Severini, Biagini, et al. (2019) and Severini, Di Tommaso, et al. (2019) find that a nationwide IST can reduce income inequalities, stabilise farm income and also enhance its level under different policy scenarios in Italy. According to these studies, the IST would be able to achieve the goal stabilising farm income, while enhancing the conditions of lower income farms.

Overall, farmers' acceptability of the IST scheme and drivers of participation have not been discussed and investigated within this literature. These studies often assumed that participation in the IST scheme would be mandatory.

2.3 | Farmers' adoption of risk management tools

The adoption of risk management tools such as insurance and mutual funds in agriculture is extensively investigated in the literature (e.g., Harrison & Ng, 2019). A large part of this literature focuses on the crop and revenue insurance market in the USA (e.g., Glauber, 2013; Mishra & Goodwin, 2006; Roznik et al., 2019; Velandia et al., 2009) and EU (e.g., Defrancesco et al., 2008; Enjolras & Sentis, 2011; Hynes & Garvey, 2009; Klimkowski, 2016; Lastra-Bravo et al., 2015; Liesivaara & Myyrä, 2017; Meuwissen et al., 2018; Santeramo, 2018; Santeramo et al., 2016; Vanslembrouck et al., 2002; Was & Kobus, 2018). There is also an increasing interest regarding the uptake of index-based insurance products, especially in developing countries (e.g., Bucheli et al., 2021; Jensen et al., 2018; King & Singh, 2020; Takahashi et al., 2020).

Although farm-related characteristics (e.g., farm size, crop type) as well as farmers' specific attributes (e.g., gender, age, education) are generally considered as factors explaining the demand for agricultural insurance and mutual funds in these empirical analyses, there is a scant but growing literature exploring the role of behavioural factors such as beliefs, risk, ambiguity and time preferences, and trust (Oca Munguia & Llewellyn, 2020; Streletskaya et al., 2020). A number of studies have stressed the importance of behavioural and psychological factors in influencing behavioural patterns of farmers' risk management strategies and technology adoption (Aziz et al., 2015; Bergevoet et al., 2004; Santeramo, 2019; Sok et al., 2020; Weersink & Fulton, 2020). A few recent adoption studies attempted to explain the insurance choices and participation in mutual funds using behavioural decision-making models that depart from

the standard expected utility theory (EUT) and incorporate some of the behavioural factors mentioned above (Cao et al., 2019; Dalhaus et al., 2020; Doherty & Eeckhoudt, 1995; Richter et al., 2014).

There is only one study exploring farmers' intentions and barriers towards the potential implementation of an IST scheme (Giampietri et al., 2020). This study explored farmers' intentions to participate in a hypothetical IST to be implemented in the Veneto region (Italy) using a stated preference survey and a sample of 127 farmers. However, behavioural economics and psychology indicate that economic agents' intentions are not necessarily good predictors of observed behaviour due to the attitude-action gap (Ariely & Wertenbroch, 2002; Cummings et al., 1995). Our study overcomes this limitation by examining farmers' acceptability of an existing IST scheme. Our study relies on a unique dataset which contains information on farmers' decision regarding voluntary participation in the apple-IST implemented by the PAT.

3 | THE APPLE-IST IN THE PAT

The PAT is located in the north-east of Italy. Apple production is an important source of income for Trentino's farmers and its value, representing 25% of the PAT gross marketable agricultural production, is over €200 million (ISPAT, 2020). In 2021, apple production in the PAT was 5,100,100 quintals of apples (23% of the total Italian production) (ISTAT, 2022), second only to the South Tyrol region (9,347,990 quintals and almost 50% of the total Italian production) (Rogna et al., 2021). The production system in the PAT is characterised by small producers with a farm size generally around 1 ha. In addition, the territory is characterised by high business fragmentation linked to the complex morphology with numerous Alpine valleys and mountainous areas (Laiti et al., 2016). To overcome these geomorphological challenges, the Trentino farmers have resorted to cooperatives (Fontanari & Sacchetti, 2020). The PAT has a long-standing cooperative tradition within the agricultural sector, and today, more than 75% of the agricultural gross product is associated with members of agricultural cooperatives (Fontanari, 2018). At the EU level, Scandinavian countries, Ireland, the Netherlands, France and Austria show patterns comparable with the PAT, with more than 50% of agricultural production coming from cooperatives (Bijman & Hanisch, 2012; Bijman & Iliopoulos, 2014).

The PAT is one of the most developed regions in terms of risk management. The insurance market in the PAT is one of the most developed in Italy. Farmers' participation rate in the multi-perils insurance programme that protects against environmental risks (i.e., hail, flood, heatwave, frost) is approximately 90% (Co.Di.Pr.A., 2020). This is a stark difference compared to the national situation where the average percentage of insured farmers is 15% despite the availability of large subsidies (Santeramo & Ford Ramsey, 2017). These figures suggest that the PAT is comparable to the USA and other EU countries such as Austria and Denmark (Diaz-Caneja et al., 2008, 2009). As mentioned before, in the PAT, farmers have the option to join different types of mutual funds in addition to the IST. In the EU, the Netherlands has similarities with the PAT, as agricultural mutual funds have been put in place to protect and support agricultural producers (Meuwissen et al., 2013).

The apple-IST scheme in the PAT was lunched in 2019. The Consortium for the Defence of Agricultural Produces (Co.Di.Pr.A.2019) is the main consortium in the area, accounting for 11,783 associates (i.e., 90% of the farmers in the PAT), and is the administrative body of the IST. Only farmers who are part of the consortium can join the apple-IST scheme. The consortium included 3662 apples producers in 2019 (30% of the total number of associates), of which 1995 enrolled in the apple-IST (i.e., 55% of the total apple growers) in the first year of application of the scheme (i.e., 2019). The total apple area involved in the IST was 5382.38 ha and the fund reached €8,730,863.62 in 2019. The IST can help farmers in the PAT to cope with market and price risk that are not covered by the multi-peril insurance and existing mutual funds. The

profit margin that the PAT's apple farmers can obtain also depends on the EU apple market, which in turn, is highly influenced by apple production in Poland, which is the largest apple producer in Europe (28.9% of total EU production) (Eurostat, 2022).

The apple-IST scheme works at whole farm level on a 3-year basis. The first triennium started in January 2019 and ended in December 2021. First, farmers pay an annual membership of €10 to join the scheme. Second, at the beginning of each year, farmers can decide whether to buy the apple-IST coverage (i.e., the income protection). Farmers decide on an annual basis to pay the fee for the income protection, where the income is the whole farm income from the apple sales. The cost of the coverage depends on three factors: (i) the hectares of apple production; (ii) the annual apple insured value (in €); and (iii) the annual premium of the multi-peril insurance[1] for apple production (in €). The coverage fee is the sum of the following items: (i) €150 for each hectare of apple plot owned by the farmer; (ii) 0.5% of the apple insured value; and (iii) 4% of the annual apple insurance premium value of the considered year. The farmers' contributions represent the 30% of the fund while public support (i.e., the EU) covers the remaining 70%. Farmers who want to participate in the IST must provide detailed information regarding their farming activities (e.g., revenues, operating costs, apple sales). Based on the documentation, the threshold income is calculated as the farmer's average income from apple production in the 3-year period prior to the annual coverage. Farmers who buy the annual IST coverage get compensation if their apple-income is at least 20% lower than the threshold income. The compensation is up to 70% of this loss.

In this paper, we use data related to 3 years of apple-IST campaign that were made available by Co.Di.Pr.A. Each panel comprises 3268 agricultural households. The final dataset is a balanced panel dataset of 9804 observations and contains information regarding: (i) whether each farmer buys the annual IST coverage and the relative costs for enrolling in the scheme; (ii) farmers' characteristics like gender, age and others; and (iii) plot characteristics such as the area where the plot is located, the adoption of other risk management strategies, and others. More details regarding the variables in the dataset are provided in Section 5.

4 | CONCEPTUAL FRAMEWORK

In our analysis, we model the famers' decision to adopt the apple-IST using the Unified Theory of Acceptance and Use of Technology (*UTAUT*) framework proposed by Venkatesh et al. (2003). The *UTAUT* is the synthesis of eight prominent models of individual acceptance and use: the theory of reasoned action (Fishbein & Ajzen, 1975); the technology acceptance model (Davis, 1989); the motivational model (Vallerand, 1997); the theory of planned behaviour (Ajzen, 1991); a model combining the technology acceptance model and the theory of planned behaviour (Taylor & Todd, 1995); the model of PC utilisation (Thompson et al., 1991); the innovation diffusion theory (Rogers, 1995); the social cognitive theory (Bandura, 1986). Venkatesh et al. (2003) validated the *UTAUT* model and showed empirically that it outperforms the other models in explaining an individual's intention and use of a new technology or of a new system. The *UTAUT* presumes that four major constructs determine an individual's behaviour: the performance expectancy, the effort expectancy, the social influence and the facilitating conditions. The core constructs can be thought of as latent variables. The original model was later updated to *UTAUT 2*, which incorporates additional constructs and introduces different moderating factors related to the user. The *UTAUT* model has been extended and adapted to different kinds of contexts,

[1]Multi-peril crop insurance is a safeguard against climatic risks like hails, frost and excessive rainfall. It covers production damages due to adverse climatic events and it is the standard crop insurance in the PAT.

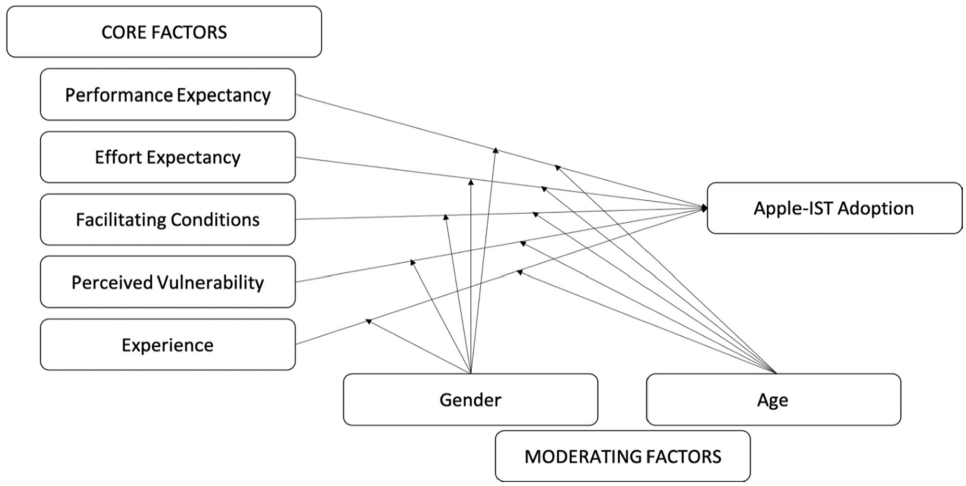

FIGURE 1 Adaptation of the *UTAUT* model used in the empirical application

such as education, food service, medical service and healthcare (for an extensive review see Williams et al., 2015).

More details regarding the constructs and the variables used to identify them are provided in the following section.

5 | METHODS

In this paper, we use a tailored version of the *UTAUT* model to investigate farmers' adoption of the IST, which is reflected by the farmer's choice to participate or not in the IST scheme (*IST*). We explain subjects' observed choices by mapping five key constructs (i.e., core factors): *performance expectancy*, *effort expectancy*, *facilitating condition*, *perceived vulnerability*, *experience*, and two modifying factors, *gender* and *age*. All these factors influence the farmers' adoption decision. A graphical representation of our model is shown in Figure 1.

The *performance expectancy* construct is usually considered the strongest predictor of adoption among the core constructs (Venkatesh et al., 2003). It refers to the farmer's belief about the tangible benefits of participating in IST. In our empirical application, this construct represents farmers' expectations regarding the capacity of the IST to stabilise their apple-related income (*performance expectancy*). As our dataset does not contain variables describing farmers' beliefs, we use as a proxy the variable *INDEM_HA* that measures the amount (in € per hectare) of indemnities paid to the farmers at time $t-1$ by the multi-peril crop insurance for damages occurred to the apple orchards in 2018, 2019 and 2020.[2] It is plausible to assume that farmers who experienced substantial damages and received large pay-outs may expect their income to fall below the threshold that triggers compensations under the IST scheme in the subsequent year. Therefore, they are more likely to perceive the benefits associated to the IST and its capacity to stabilise their income.[3]

[2]Indemnities of the crop-insurance are paid by the end of December each year.

[3]Other variables that could be used as indicators of *performance expectancy* or *perceived vulnerability* were the land devoted to apple production in the farm, apple production, the value of insured apples. However, these variables were highly correlated to the variable *IST_COST* and therefore these were not included in the model. Results related to an analysis of potential correlations are provided in the Appendix S1.

The second construct is *effort expectancy* that is related to the expected effort that is required to use a new system, including time and financial costs. The economic burden is expected to be a significant identifier of the farmers' decisions to join the IST scheme. We used the cost to buy the annual income coverage (*IST_COST*) as a proxy for the farmers' perceived effort. The fees to be paid by the farmers depend on farm size and the multi-perils insurance costs. We expect an inverse relationship between the subscription cost and farmer's decision to join the IST scheme. There are other costs that may have been used to identify the effort expectancy construct, such as transaction costs, cost of acquiring new information about the IST, paperwork time and administrative burdens. However, information on these variables is not available in our dataset.

Facilitating conditions refer to the existing organisational or technical structures that may support the use of the new system. Formal and informal structures can facilitate or hinder the implementation of the IST. We suggest that the ownership characteristics of the farm can remove or add barriers towards the new scheme. In our dataset, we have two typologies of farm status: enterprises and sole traders (*SOLE_TRADER*). Agricultural enterprises may have higher managerial abilities and lower individual liability than sole owners and therefore may be more willing to innovate and adopt new risk management instruments. Farm status is found to affect risk management decisions in other studies at European level, which found that sole farmers are less likely to purchase insurance compared to other types of farm ownership (Lefebvre et al., 2014). In addition, the location of the farm within the PAT (*AREA*) could identify the *facilitating condition* construct.[4] We have four macro areas denominated as follow: Val di Non – Val di Sole (*AREA_VNS*), Valsugana (*AREA_VAL*), Trento Sud – Rotaliana (*AREA_TSR*), and Bleggio – Valle dei Laghi (*AREA_BVL*). Apple production is the predominant activity in Val di Non – Val di Sole and this area represents 73% of the total insured apple value of our sample. Moreover, in 2018, 84% of the farms in Val di Non – Val di Sole were apple-oriented, whereas the agricultural production is more diversified in the other areas, where farmers cultivate apples along with other products (e.g., wine, other fruits and vegetable) (see Table B1 in Appendix S2). We expect that farmers who are more specialised in apple production may have a stronger incentive to use the apple-IST. In contrast, farmers with more complex crop portfolios may perceive the IST to be less beneficial because the apple activities marginally contribute to their final income. It follows that farmers who operate in Val di Non – Val di Sole *(AREA_VNS)* where the apple production is very intensive and more relevant to the whole farm production are expected to be more willing to participate in the IST schemes with respect to the farmers who operate in the other areas with a lower apple intensity.[5]

Perceived vulnerability is defined as the subjective judgement regarding the user's risk exposure (Johnston & Warkentin, 2010). This construct stems from protection motivation theory (PMT) (Rogers, 1975) and is found to have an effect on adoption of a new system, especially if the adoption reduces the subject's risk exposure (Rogers, 1975; Sun et al., 2013; Zhao et al., 2018). Different studies have demonstrated the substantial impact that subjective risk perception can have on farmers' attitude and behaviour. This construct is usually moderated by sociodemographic variables such as gender and age (Cerroni, 2020; Menapace et al., 2013). In our study, this construct is captured by a set of dummy variables providing information about the preventative measures (or risk management practices) that are

[4]*AREA* was not linked to the *perceived vulnerability* construct because the location of the farm does not provide information regarding its possible risk exposure. The PAT landscape is highly fragmented, presenting mixed geomorphic and microclimatic characteristics also within the same valley. Moreover, the location of the farm could inform us regarding the possible production risk, but it does not tell us anything regarding market or price risk, which is the IST main focus.

[5]A detailed map of the PAT and of the four macro areas is provided in Appendix S3.

implemented on-farm (i.e., nets and anti-frost systems). Although all farmers in our dataset insured their apple production against multiple environmental damages, the vast majority of apple-growers in our sample do not use any on-farm risk strategy (*RP_NO* = 72.28%). Approximately 20% of the farmers cover the apples only with nets (*RP_NETS*), preventing damage from hail, 4.90% use only anti-frost systems (*RP_FROST*) and almost 2% implement both nets and anti-frost (*RP_MIX)*. The farmers' use of active on-farm risk management tools—such as nets to protect from hailstorms or anti-frost systems—signal a higher level of perceived vulnerability to climate- and disease-related production risks. The impact of implementing on-farm preventative measures on participation in the IST schemes is difficult to predict as it is driven by many forces. On the one hand, adverse selection would predict that farmers who implemented on-farm preventative measures are less exposed to risk and less likely to join the IST as predicted by classical insurance models (Rothschild & Stiglitz, 1976). On the other hand, advantageous selection advocates that informational advantage of the insured is bi-dimensional and risk aversion increases the likelihood of purchasing additional coverage even when the probability of experiencing losses is small (de Meza & Webb, 2001; He et al., 2018). Finally, previous studies have shown that on-farm protection strategies are negatively correlated with the purchase of agricultural insurance (Di Falco et al., 2014; Enjolras & Sentis, 2011; Santeramo et al., 2016).

The last construct in our model is *experience*[6] defined as the extent to which people tend to repeat behaviours automatically as a result of a learning process and is driven by the familiarity of the economic agent with the innovation. *Experience* can be considered as a perceptual construct that reflects the results of prior knowledge and learning process of the individual (Venkatesh et al., 2012) and it affects how quickly and easily the novelty can be integrated into the organisational processes of the farm and into the farmer's existing behaviour. In our model, the participation in other mutual funds (*MF_PART*) is associated with the *experience* construct. In addition to the IST, Co.Di.Pr.A. offers to its associates other mutual funds that cover specific direct and indirect farm damages (Co.Di.Pr.A., 2020). The farmers involved in our study could belong to up to four mutual funds: (i) the mutual fund for damages due to fruit diseases (i.e., apple); (ii) the mutual fund for municipalities at high climatic risk[7]; (iii) the mutual fund '*per rischio sotto soglia*';[8] and (iv) the mutual fund for damages due to plant diseases (i.e., apple tree).[9] Farmers who already participate in other mutual fund schemes have certainly acquired more experience with mutual solutions for agricultural risks and may find it easier to add the IST to their risk management toolkit. Hence, we expect a positive effect of this variable on the IST acceptance rate. Farmers' experience with similar systems is expected to favour adoption because it is linked with improved individual knowledge, which in turn reduces the asymmetric information bias (Ghadim & Pannell, 1999; Rogna et al., 2021; Santeramo, 2019).[10]

[6]We prefer to name this construct *experience* instead of *habit*, which is the usual terminology used in the UTAUT. The term *habit* may be confounding and not linked to the learning process and familiarity of the farmers with similar risk management schemes. We thank an anonymous referee for this suggestion.

[7]The mutual fund provides indemnities to farmers in areas at high climatic risk, where the insurance deductible is generally higher than usual.

[8]The mutual fund provides indemnities for those damages below the insurance deductible threshold.

[9]For more information regarding the Co.Di.Pr.A. mutual funds see www.codipratn.it/fondi-mutualistici/

[10]The issue of reverse causality does not appear to be a problem in our study. There are no farmers who did not insure, participate in a mutual fund or use on-farm risk management strategies after having joined the IST scheme. A discussion on the topic and related data are presented in Appendix S4.

TABLE 1 Panel data description (no. of farms = 3268)

Variable	Description	Mean	SD
IST[a]	= 1 if the farmer participates in the IST 2019 (= 0 otherwise)	0.51	0.49
FEMALE[a]	= 1 if farmer female (= 0 if farmer male)	0.11	0.31
AGE	Farmer's age (years)	58.28	14.43
SOLE_TRADER[a]	= 1 if farm is run as a sole trader (= 0 if as a company)	0.04	0.21
MF_PART[a]	= 1 if participate to other mutual funds in 2019 (0 otherwise)	0.94	0.22
AREA_ VNS[a]	= 1 if the farm area is Val di Non – Val di Sole (= 0 otherwise)	0.72	0.44
AREA_VAL[a]	= 1 if the farm area is Valsugana (= 0 otherwise)	0.05	0.22
AREA_TSR[a]	= 1 if farm area is Trento Sud – Rotaliana (= 0 otherwise)	0.14	0.34
AREA_BVL[a]	= 1 if farm area is Bleggio – Valle dei Laghi (= 0 otherwise)	0.07	0.27
RP_NO[a]	= 1 if no on farm protection applied (= 0 otherwise)	0.72	0.44
RP_NETS[a]	= 1 if farm uses only net (= 0 otherwise)	0.20	0.40
RP_FROST[a]	= 1 if farm uses only anti-frost system (= 0 otherwise)	0.04	0.21
RP_MIX[a]	= 1 if farm use nets with anti-frost system (= 0 otherwise)	0.02	0.14
IST_COST	Annual cost of the apple-IST scheme coverage €	1215.84	1237.80
INDEM_HA	Indemnities received at *t*–1, €/ha	3196.22	12,853.28

[a]Variable is coded as dummy variable.

Regarding the moderating variables, we hypothesise that older farmers (*AGE*) are less likely to get involved in the IST than younger farmers because the former are generally wealthier (Mishra & Goodwin, 2003, 2006) and less willing to adopt innovations than the former (Frosch, 2011; Venkatesh et al., 2003). Female (*FEMALE*) farmers are also expected to have a lower propensity to adopt a new system as they are usually found to innovate less than men (Venkatesh et al., 2003). On the other hand, it could be argued that women who are generally more risk and ambiguity averse than men (Cerroni, 2020; Eckel & Grossman, 2002, 2008) may be more inclined to adopt the IST since the instrument could reduce their risk exposure. Barham et al. (2014) show that risk and uncertainty aversion can facilitate the adoption of a risk reducing technology. Other moderating factors could have been considered, such as farming experience and education level but were not available in our dataset. On the other hand, we purposely omitted from our analysis other variables such as the orchard size due to correlation issues. Indeed, farm size is intrinsically correlated to the cost to enrol in the IST scheme in our case (Table 1).

6 | MODELLING APPROACH AND ECONOMETRIC ANALYSES

We estimate a logit model to explore the effect of farm and farmers' characteristics on the decision to participate in the apple-IST scheme (*IST*). Our independent variables include a mix of time-variant and time-invariant variables. Therefore, we exploit the panel nature of our dataset using the Mundlak–Chamberlain approach (also known as the pseudo-fixed effects model). This allows us to estimate a logit model while controlling for unobserved heterogeneity (Chamberlain, 1982; Mundlak, 1978).

The Mundlak–Chamberlain approach includes the mean values of the time-varying independent variables among regressors and assumes that unobserved effects are linearly correlated with the independent variables. This estimation procedure alleviates the issues of selection and endogeneity bias arising from the invariant unobserved factors that cannot be included in a fixed-effect model (Wooldrige, 2002). The Mundlak–Chamberlain procedure has been used to investigate agricultural issues, for example to investigate the effects of crop biodiversity on farm income (Bozzola & Smale, 2020) and drivers behind the farmers' entry and exit decisions in the insurance programmes (Santeramo et al., 2016).

Our model, following Santeramo et al. (2016), is specified as in Equations (1–3):

$$P(\mathrm{IST}_{i,t}=1\left|X_i,Z_{i,t},\alpha_i\right.)=F\left(\beta X_i+\gamma Z_{i,t}+\alpha_i\right) \tag{1}$$

$$P_{\mathrm{IST}}(\mathrm{IST}_{i,t}=1\left|\ X_i,Z_{i,t},c_i\right.)=F\left(\beta X_i+\gamma Z_{i,t}+\theta\overline{Z}_i\right) \tag{2}$$

$$E\left[c_i|X_i\right]=\theta\overline{Z}_i \tag{3}$$

where $\mathrm{IST}_{i,t}$ is the dummy dependent variable ($\mathrm{IST}_{i,t}=1$ if the farmer i participates in the apple-IST at time $t=[2019,2020,2021]$), $F(\cdot)$ is the cumulative density function (cdf) of a logistic function, X_i is the set of time-invariant variables, $Z_{i,t}$ is the set of time-variant variables and α_i are the unobserved effects. Equation (2) adds as an additional explanatory variable $\overline{Z}_i$ that is the mean of the time-varying independent variables within each farm household, to capture the correlation between the unobserved heterogeneity c_i and the covariates. The set X_i consists of the following variables: *FEMALE, SOLE_TRADER, AREA, RP*. The set $Z_{i,t}$ consists of the following variables: *AGE, IST_COST, INDEM_HA, MF_PART*.

7 | RESULTS

Our results are reported in Table 2 and show that participation in the IST scheme is influenced by the *facilitating conditions* constructs. Farmers who operate in Valsugana ($AREA\_VAL=-1.21$, $p<0.01$), Trento Sud – Rotaliana ($AREA\_TSR=-1.31$, $p<0.001$) and in Bleggio – Valle dei Laghi ($AREA\_BVL=-1.16$, $p<0.01$) are less likely to subscribe the IST coverage than those operating in Val di Non – Val di Sole. The latter area is characterised by a very high apple production intensity, with the income of producers being heavily dependent on apple production. The production of farms located in other areas is more diversified and, as a consequence, the interest towards the apple-IST is lower (see Table B1 in Appendix S2). Previous research also indicated that specialised farms are more likely to adopt risk management tools as they cannot use crop diversification as a risk mitigation strategy (Di Falco et al., 2014; Finger & Lehmann, 2012; Santeramo et al., 2016; Sherrick et al., 2004).

Our results also show that *perceived vulnerability* influences farmers' participation in the IST—specifically, the use of other on-farm risk management strategies (i.e., nets and anti-frost systems) impacts farmers' decisions to join the IST scheme. Farmers who protect their orchard only against frost are less likely to join the IST scheme compared to other farmers who do not use any type of protection ($RP\_FROST=-1.15$, $p<0.05$). This behaviour appears to be consistent with phenomena such as adverse selection and moral hazard. In contrast, farmers who protect their production using anti-hail nets are more likely to participate in the IST than those who do not use any type of protection ($RP\_NETS=0.76$, $p<0.01$). This result could be driven by the fact that hailstorms are perceived to be highly damaging by farmers in the PAT. Hail causes an average loss of 12% of the aggregate crop

TABLE 2 IST uptake decision – Logit model

	Log-odds
Performance expectancy	
INDEM_HA (indemnities received at *t*–1, €/ha)	–1.610e–06
	(4.34e–06)
Effort expectancy	
IST_COST (annual cost to enrol the apple-IST, €)	−0.00
	(0.00)
Facilitating conditions	
SOLE_TRADER (=1 if farm is run as sole trader; otherwise = 0)	−0.11
	(0.48)
AREA_VAL (=1 if farm area Valsugana; otherwise = 0)	−1.21**
	(0.46)
AREA_VNS (=1 if farm area Trento Sud – Rotaliana; otherwise = 0)	−1.31***
	(0.36)
AREA_BVL (=1 if farm area Bleggio – Valle dei Laghi; otherwise = 0)	−1.16**
	(0.37)
Perceived vulnerability	
RP_NETS (=1 if farm uses only net; otherwise = 0)	0.76**
	(0.27)
RP_FROST (=1 if farm uses only anti-frost system; otherwise = 0)	−1.15*
	(0.50)
RP_MIX (=1 if farm uses net and with anti-frost system; otherwise = 0)	1.17
	(0.76)
Experience	
MF_PART (=1 if farmers participate in other mutual funds; otherwise = 0)	3.51***
	(0.41)
Moderating factors	
FEMALE (=1 if farmer is female; otherwise = 0)	−1.05**
	(0.34)
AGE	−0.40***
	(0.05)
CONSTANT	−2.74***
	(0.64)
Log-pseudolikelihood	4636.69
Wald Chi-squared	338.07
Observation	9804
Number of households	3268

Note: Robust standard errors in parentheses. Additional goodness of fit measures are provided in Appendix S7. ***$p < 0.001$, **$p < 0.05$, *$p < 0.01$.

value in the PAT, thus implying a higher susceptibility to hailstorm rather than to other climatic events such as frost (Menapace et al., 2016). Therefore, farmers who are particularly exposed to hailstorms may be attracted to farm income protection using the IST. This would be consistent with the notion of advantageous selection proposed by de Meza and

Webb (2001) and He et al. (2018) and it is supported by previous findings indicating that farmers who expect substantial yield losses are more likely to reduce their risk exposure (Menapace et al., 2016; Sherrick et al., 2004).

Our results show that *experience* has a positive influence on the likelihood of participating in the IST. Farmers adopting other mutual funds are more likely to participate in the IST ($MF\_PART = 3.51$, $p < 0.001$), reflecting the fact that mutual funds are commonly used in the PAT, generating a positive experience with such schemes. Generally a strong positive relationship between prior experience and demand for similar risk management tools has been reported in the literature (Cole et al., 2014; Santeramo, 2019; Sartwelle et al., 2000; Sherrick et al., 2004; Ye et al., 2017). The magnitude of the estimated coefficients suggests the *experience* construct is the strongest predictor of the farmers' decision-making.

Finally, our results indicate that women ($FEMALE = -1.05$, $p < 0.01$) and older farmers ($AGE = -0.40$, $p < 0.001$) are less likely to join in the IST relative to male and younger farmers.[11] Our results confirm the general evidence that *moderating factors* such as gender and age influence farmers' adoption of an innovative system. Specifically, we found that women (Venkatesh et al., 2012; Venkatesh & Morris, 2000) and older farmers are less attracted by insurance instruments, suggesting some resistance to innovation (Foudi & Erdlenbruch, 2012; Mishra & Goodwin, 2006; Santeramo, 2019; Smith & Goodwin, 1996).

8 | CONCLUSIONS

European farmers' exposure to risk is increasing and there is a need for well-designed risk management tools to hedge against multiple adverse events. The European CAP offers a broad range of options to reduce risk exposure (EC, 2017). The most recent and innovative risk management tool proposed under the CAP 2014–2020 is the Income Stabilisation Tool (IST). This scheme operates through a mutual fund to stabilise farm income over time and therefore increase farmers' resilience to income fluctuations due to any type of risk (e.g., climatic, environmental, market). Although classic crop insurance compensates farmers for short-term losses on production due to specific adverse events (e.g., hail, frost, floods, crop disease), the IST has the potential to increase farmers' ability to face global and long-term economic challenges, thus making the whole food production system more resilient in the longer term (Meuwissen et al., 2013; Spiegel et al., 2020). The IST is a form of whole farm protection, similar to revenue-based programmes in the USA and Canada, that is activated when farm income falls below a well-defined threshold (i.e., 20% of the previous 3-year average income) regardless of the specific source of the loss.

Despite the fact that public support accounts for 70% of the mutual fund initial upfront costs under the CAP, only the Autonomous Province of Trento in Italy, in the entire EU, has established and operationalised an IST. Specifically, the PAT has implemented two sector-specific ISTs in 2019, one concerning the apple sector, the other concerning the dairy sector. In this paper, using a 3-year panel dataset of 3268 farm households, we explore farm and farmers' characteristics that are associated with participation in the apple-IST, which is the largest and the most developed scheme. Our analysis identifies lock-ins and levers that influence farmers' decisions to join the only operating IST scheme in the EU and represents the first empirical study exploiting data from an existing and operating IST

[11]The variable *AGE* was modelled also as a discrete variable. Results for the estimation of this alternative modelling approach are very similar to those reported in Table 2. These results are presented in Table E1 in Appendix S5. In addition, we estimated additional models interacting the moderating variable *AGE* with the variable *MF_PART* (Experience construct) and the variable *IST_COST* (please see Appendix S6). We did not detect any significant effect of these interaction terms. Results are reported in Appendix S6.

scheme. Our empirical application builds on the Unified Theory of Acceptance and Use of Technology (*UTAUT*) theoretical framework and a logit estimation via the Mundlak–Chamberlain procedure.

On the one hand, our study provides a novel contribution to the scientific literature on the IST which, to date, focus on *ex-ante* assessments of the financial feasibility of prospective IST schemes that could be implemented at regional or national level for different agricultural sectors (e.g., El Benni et al., 2016). Another stream of the literature focuses on the impact that prospective IST schemes could generate on farmers' welfare and income inequalities. As the previous literature has no access to data on an existing and operating IST scheme, these analyses simulate the consequences of the introduction of different IST schemes on farmers' welfare (e.g., Finger & El Benni, 2014). As a consequence, previous research has not been able to address farmers' participation in the IST, which we deem to be very important, considering that the participation in the scheme relies on voluntary contributions and has an important impact on the economic sustainability of the scheme itself. Although previous research on risk management tools focuses on the study of lock-ins and levers of farmers' participation in the insurance market (e.g., Santeramo et al., 2016) we are not aware of any study exploring this topic in relation to the IST.

Our results are a first test of the acceptability of the tool among farmers. Approximately 55% farmers operating in the PAT enrolled in the IST programme and participation was stable in the period 2019–2021. These figures are encouraging, and demonstrate that this innovative risk management tool can be financially viable and sustainable over time, at least in the short run. Our results support the argument that small-scale IST schemes (regional and sector-specific) should be preferred to large ones, at least until we have more knowledge and better understanding of the functioning of these particular mutual funds. The experience acquired during the setup of a small-scale IST can minimise the risk of failure related to the development of national and multi-sector IST schemes that are more complex to design and operationalise (e.g., Trestini et al., 2018).

Our study provides interesting insights into the functioning of the IST scheme and contributes to the ongoing policy debate on agricultural risk management that is stimulated by the current development of the new Common Agricultural Policy 2023–2027. An in-depth knowledge and understanding of factors influencing farmers' decisions to participate to the IST can be instrumental at EU, national and regional level. Insights from our study could help policy-makers design an instrument that is accepted within the farming community and generates long-term benefits for the agri-food sector. More specifically, our study contributes to the policy debate in several ways. As proposed by Cordier and Santeramo (2020), the development of a public platform would help disseminate experience at both local and national level, with positive externalities for all the stakeholders involved. However, it must be noted that the instrument was not able to attract an increasing number of farmers over time, despite our results showing that the enrolment fees did not significantly affect farmers' participation in the scheme. This suggests that the current level of subsidies provided by the EU boost farmers' acceptability of the IST.

Our results must be interpreted in light of the area where the IST was introduced. In the PAT, the idea of cooperation in agriculture is widespread (90% of farmers belong to a cooperative) and the approximately 90% of the agricultural production is protected via multi-peril insurances. Considering this background, we can conclude that the acceptability of new risk management tools can encounter difficulties even in regions where protecting farms via insurances and mutual funds is common. These results highlight the necessity of gaining a better understanding of farmer and farm profiles that are more inclined to accept and subscribe to this new tool. This understanding can be beneficial for the design and development of future IST schemes at national or regional levels in two ways. First, it improves the precision of simulation exercises aiming at predicting indemnification costs and national or regional budgets needed to operationalise new IST schemes in the future. For example, we found that farmers

who are more specialised in apple production and have a larger income from apple-related activities are more likely to participate in the IST (*facilitating conditions* of the *UTAUT* model). These results could be used to re-parametrise the enrolment fees and improve the long-term financial sustainability of the IST scheme. Similarly, these results could identify suitable fees for future IST schemes developed elsewhere. Second, our results facilitate the identification of lock-ins and levers that affect farmers' participation in future IST schemes. This may help in designing education, communication and outreach strategies to engage farmers who are more reluctant to accept the IST tool. For example, our results show that female and older farmers should be targeted as they are less likely to join the scheme. Similarly, we found that experience is an important driver of farmer participation. Farmers who are not involved in other mutual funds are less likely to sign the IST coverage. These farmers should not be left behind, as they should be approached and informed regarding the potential benefits of using risk management tools proposed by the EU, especially the IST.

In addition, we provide some insights on the relationships between participation in the IST and the use of on-farm preventative risk management strategies. Our results suggest that farmers who use anti-frost systems are more reluctant to join the IST scheme, which may indicate some adverse selection and is consistent with previous findings in the risk management literature. For example, Santeramo et al. (2016) found that on-farm active protection tool (e.g., crop diversification and irrigation) may be used as an alternative to insurance products. However, we also found that farmers who use hail nets respond more favourably to the IST. This behaviour may be driven by the fact that damage from hail is more substantial than that from frost in the PAT (Menapace et al., 2016). Farmers who use hail-nets may be more concerned about damage related to adverse climatic events and thus more inclined to add the IST to their risk management portfolio. This would be consistent with the notion of advantageous, rather than adverse selection, as described by de Meza and Webb (2001) and He et al. (2018). Overall, our analysis does not fully disentangle the two effects, paving the way for future research regarding the possibility that an IST scheme could be designed to mitigate adverse selection while favouring advantageous selection.

However, our study suffers from some limitations. First, our dataset does not include information on behavioural factors, such as risk, uncertainty and time preferences, which are important drivers of farmers' decision-making processes (e.g., Cerroni, 2020; Moschini & Hennessy, 2001). Future research could overcome this limitation, integrating revealed preference data with information collected via economic surveys and experiments (Colen, 2016). Second, measures of goodness of fit are not high, suggesting that, while our model and results can help identify factors that affect farmers' participation in the IST, we are still not able to predict these farmers' decisions. Third, our empirical analysis is specific to an IST developed for a given crop (i.e., apple) in a specific production area (i.e., the PAT), so our results are not easily generalisable to other sectors or EU regions, though it is worth noting that apple represents the most harvested and exported food product in Europe (Eurostat, 2022). Countries and regions such Poland, France and South Tyrol in Italy, where apple production is substantial, could benefit from the implementation of a sector-specific IST. The tool could improve the resilience of the entire apple sector and minimise risks associated to global catastrophes of the likes of the Covid-19 pandemic (Tougeron & Hance, 2021). Similarly, it is important to note that the PAT has a long-standing tradition of agricultural cooperatives and a well-developed market for insurance products, which may have played a key role in making the IST more acceptable to the local farmers. Therefore, our results could be particularly beneficial to other European countries, characterised by the presence of well-developed cooperative systems and the use of mutual funds to cope with agricultural risks such as Ireland, Scandinavian countries, France, Austria and the Netherlands, or/and countries where the agricultural insurance market is well established and many farmers protect themselves using classic insurance products (e.g., Austria and Denmark).

Overall, our research contributes to the wide debate on cooperation and mutual exchange of risk that is currently taking place in the EU agricultural sector (Finger et al., 2022). In our globalised and interconnected economy, farmers' ability to share efforts and cooperate towards the achievement of long-term goals becomes crucial to tackle current and future global challenges related to climate change, public health emergencies and conflicts due to a high geo-political instability.

ACKNOWLEDGEMENTS

We thank Martina Bozzola, two anonymous referees and the editor for comments on an earlier draft of this paper. Open Access Funding provided by Universita degli Studi di Trento within the CRUI-CARE Agreement.

ORCID

Ruggiero Rippo https://orcid.org/0000-0002-3655-705X

REFERENCES

Ajzen, I. (1991) The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211.

Ariely, D. & Wertenbroch, K. (2002) Procrastination, Deadlines, and Performance: Self-Control by Precommitment. *Psychological Science*, 13(3), 219–224.

Aziz, N.A.B.A., Aziz, N.N.B.A., Aris, Y.B.W. & Aziz, N.A.B.A. (2015) Factors influencing the Paddy Farmers' intention to participate in agriculture takaful. *Procedia Economics and Finance*, 31, 237–242.

Bandura, A. (1986) *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

Bardají, I. & Garrido, A. (2016). *State of play of risk management tools implemented by member states during the period 2014–2020*. Brussel: National and European Frameworks: Research for AGRI Committee, European Parliament. Available from: https://www.europarl.europa.eu/RegData/etudes/STUD/2016/573415/IPOL_STU(2016)573415_EN.pdf [Accessed 27th October 2020].

Barham, B.L., Chavas, J.-P., Fitz, D., Salas, V.R. & Schechter, L. (2014) The roles of risk and ambiguity in technology adoption. *Journal of Economic Behavior & Organization*, 97, 204–218.

Bergevoet, R.H.M., Ondersteijn, C.J.M., Saatkamp, H.W., van Woerkum, C.M.J. & Huirne, R.B.M. (2004) Entrepreneurial behaviour of dutch dairy farmers under a milk quota system: goals, objectives and attitudes. *Agricultural Systems*, 80(1), 1–21.

Bijman, J. & Hanisch, M. (2012) *Support for Farmers' cooperatives; developing a typology of cooperatives and producer organisations in the EU*. Wageningen: Wageningen UR.

Bijman, J. & Iliopoulos, C. (2014) Farmers' cooperative in the EU: policies, strategies, and organization. *Annals of Public and Cooperative Economics*, 85(4), 497–508.

Bozzola, M. & Smale, M. (2020) The welfare effects of crop biodiversity as an adaptation to climate shocks in Kenya. *World Development*, 135, 105065.

Bucheli, J., Dalhaus, T. & Finger, R. (2021) The optimal drought index for designing weather index insurance. *European Review of Agricultural Economics*, 48(3), 573–597.

Cao, Y., Weersink, A. & Ferner, E. (2019) A risk management tool or an investment strategy? Understanding the unstable farm insurance demand via a gain-loss framework. *Agricultural and Resource Economics Review*, 49, 1–27.

Capitanio, F., Adinolfi, F. & Pasquale, J.D. (2016) The Income Stabilization Tool: assessing the hypothesis of a National Mutual Fund in Italy. *American Journal of Applied Sciences*, 13(4), 357–363.

Cerroni, S. (2020) Eliciting farmers' subjective probabilities, risk, and uncertainty preferences using contextualized field experiments. *Agricultural Economics*, 51(5), 707–724.

Chamberlain, G. (1982) Multivariate regression models for panel data. *Journal of Econometrics*, 18(1), 5–46.

Chavas, J. & Nauges, C. (2020) Uncertainty, learning, and technology adoption in agriculture. *Applied Economic Perspectives and Policy*, 42(1), 42–53.

Co.Di.Pr.A. (2020) "*Co.Di.Pr.A. Fondi Mutualistici*." Available from: https://www.codipratn.it/fondi-mutualistici/ [Accessed 30th January 2019].

Co.Di.Pr.A. (2019) "*Consorzio di Difesa dei Produttori Agricoli*." Available from: https://www.codipratn.it/fondi-mutualistici/ [Accessed 30th January 2019].

Cole, S., Stein, D. & Tobacman, J. (2014) Dynamics of demand for index insurance: evidence from a long-run field experiment. *American Economic Review*, 104(5), 284–290.

Colen, L., Gomez y Paloma, S., Latacz-Lohmann, U., Lefebvre, M., Préget, R. & Thoyer, S. (2016) Economic experiments as a tool for agricultural policy evaluation: insights from the European CAP. *Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie*, 64(4), 667–694.

Cordier, J. & Santeramo, F. (2020) Mutual funds and the income stabilisation tool in the EU: retrospect and prospects. *EuroChoices*, 19(1), 53–58.

Cummings, R.G., Harrison, G.W. & Rutstr, E.E. (1995) Homegrown Values and Hypothetical Surveys: Is the Dichotomous Choice Approach Incentive-Compatible? *American Economic Review*, 85(1), 260–266.

Dalhaus, T., Barnett, B.J. & Finger, R. (2020) Behavioral weather insurance: applying cumulative prospect theory to agricultural insurance design under narrow framing. *PLoS ONE*, 15(5), 1–25.

Davis, F.D. (1989) Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340.

de Meza, D. & Webb, D.C. (2001) Advantageous selection in insurance markets. *The Rand Journal of Economics*, 32(2), 249–262.

Defrancesco, E., Gatto, P., Runge, F. & Trestini, S. (2008) Factors affecting Farmers' participation in agri-environmental measures: A northern Italian perspective. *Journal of Agricultural Economics*, 59(1), 114–131.

Di Falco, S., Adinolfi, F., Bozzola, M. & Capitanio, F. (2014) Crop insurance as a strategy for adapting to climate change. *Journal of Agricultural Economics*, 65(2), 485–504.

Diaz-Caneja, B., Giulia, C., Javier, F., & Pinilla, G. (2008) *Agricultural insurance schemes*. JRC reference report, European Commission, pp. 302.

Diaz-Caneja, M.B., Conte, C.G. Pinilla, F.G. Stroblmair, J., Cantenaro, R., Dittmann, C. (2009) *Risk management and agricultural insurance schemes in Europe*. JRC reference report, European Commission. Available from: https://data.europa.eu/doi/10.2788/24307 [Accessed 1st March 2021].

Doherty, N.A. & Eeckhoudt, L. (1995) Optimal insurance without expected utility: the dual theory and the linearity of insurance contracts. *Journal of Risk and Uncertainty*, 10, 157–179.

EC. (2011) *Proposal for a regulation of the European Parliament and of the Council on Support for Rural Development by the European Agricultural Fund for Rural Development (EAFRD)*. Brussels: European Commission. COM(2011), 627/3.

EC. (2013) *Regulation (EU) no 1305/2013 of the European Parliament and of the Council of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (EC) no 1698/2005*. Brussels: European Commission. JEU.

EC. (2017) *Regulation (EU) No 2393/2017 of the European Parliament and of the Council of 13 December 2017 amending Regulations (EU) No 1305/2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), (EU) No 1306/2013 on the financing, management and monitoring of the common agricultural policy, (EU) No 1307/2013 establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy, (EU) No 1308/2013 establishing a common organisation of the markets in agricultural products and (EU) No 652/2014 laying down provisions for the management of expenditure relating to the food chain, animal health and animal welfare, and relating to plant health and plant reproductive material*. Brussels, JEU: Europeean Commission.

Eckel, C.C. & Grossman, P.J. (2002) Sex differences and statistical stereotyping in attitudes toward financial risk. *Evolution and Human Behavior*, 23(4), 281–295.

Eckel, C.C. & Grossman, P.J. (2008) Forecasting risk attitudes: an experimental study using actual and forecast gamble choices. *Journal of Economic Behavior & Organization*, 68(1), 1–17.

El Benni, N., Finger, R. & Meuwissen, M.P.M. (2016) Potential effects of the income stabilisation tool (IST) in swiss agriculture. *European Review of Agricultural Economics*, 43(3), 475–502.

Enjolras, G. & Sentis, P. (2011) Crop insurance policies and purchases in France. *Agricultural Economics*, 42(4), 475–486.

EPRS (European Parliamentary Research Service). (2016) *New income stabilisation tools and price volatility in agricultural markets*. Briefing 10/2016. Available from: https://www.europarl.europa.eu/RegData/etudes/BRIE/2016/593484/EPRS_BRI(2016)593484_EN.pdf [Accessed 13th August 2020].

European Commission, Directorate General for Agriculture and Rural Development, ECORYS & Wageningen Economic Research. (2017) *Study on risk management in EU agriculture: final report*. Luxembourg: Publications Office. Available from: https://data.europa.eu/doi/10.2762/387583 [Accessed 19th November 2021].

Eurostat. (2022). *Agriculture, forestry and fishery statistics*. Agricultural Production – Crops, Publications Office of the European Union. Available from: https://ec.europa.eu/eurostat/web/agriculture/data/database [Accessed May 2022].

Faridi, A.A., Kavoosi-Kalashami, M. & Bilali, H.E. (2020) Attitude components affecting adoption of soil and water conservation measures by paddy farmers in Rasht County, Northern Iran. *Land Use Policy*, 99, 104885.

Finger, R. & El Benni, N. (2014) A note on the effects of the income stabilisation tool on income inequality in agriculture. *Journal of Agricultural Economics*, 65(3), 739–745.

Finger, R. & Lehmann, N. (2012) The influence of direct payments on farmers' hail insurance decisions. *Agricultural Economics*, 43(3), 343–354.

Finger, R., Vroege, W., Spiegel, A., de Mey, Y., Slijper, T., Poortvliet, P.M. et al. (2022) In: Meuwissen, M.M.P., Feindt, P.H., Garrido, A., Mathijs, E., Soriano, B., Urquhart, J. et al. (Eds.) *The importance of improving and*

enlarging the scope of risk management to enhance resilience in European agriculture, 1st edition. Cambridge: Cambridge University Press. Available from: https://www.cambridge.org/core/product/identifier/9781009093569%23CN-bp-2/type/book_part [Accessed 5th May 2022].

Fishbein, M. & Ajzen, I. (1975) *Belief, attitude, intention and behavior: an introduction to theory and research*. Reading, MA: Addison-Wesley.

Fontanari, E. (2018) Cooperazione agricola e aree marginali: una riflessione sull'esperienza della Provincia di Trento. *Euricse Working Papers*, 102(18), 1–15.

Fontanari, E. & Sacchetti, S. (2020) The knowledge-based agricultural cooperative: A validation from the Trentino case. *The Journal of Entrepreneurial and Organizational Diversity*, 8(2), 46–70.

Foudi, S. & Erdlenbruch, K. (2012) The role of irrigation in farmers' risk management strategies in France. *European Review of Agricultural Economics*, 39(3), 439–457.

Frosch, K.H. (2011) Workforce age and innovation: A literature survey. *International Journal of Management Reviews*, 13(4), 414–430.

Ghadim, A.K.A. & Pannell, D.J. (1999) A conceptual framework of adoption of an agricultural innovation. *Agricultural Economics*, 21(2), 145–154.

Giampietri, E., Yu, X., & Trestini, S. (2020) The role of trust and perceived barriers on farmer's intention to adopt risk management tools. *Bio-based and Applied Economics*, 9(1), 1–24. https://doi.org/10.13128/bae-8416

Glauber, J.W. (2013) The growth of the Federal Crop Insurance Program, 1990–2011. *American Journal of Agricultural Economics*, 95(2), 482–488.

Harrison, G.W. & Ng, J.M. (2019) Behavioral insurance and economic theory: a literature review. *Risk Management and Insurance Review*, 22(2), 133–182.

He, J., Rejesus, R., Zheng, X. & Yorobe, J., Jr. (2018) Advantageous selection in crop insurance: theory and evidence. *Journal of Agricultural Economics*, 69(3), 646–668.

Horowitz, J.K. & Lichtenberg, E. (1993) Insurance, moral hazard, and chemical use in agriculture. *American Journal of Agricultural Economics*, 75(4), 926–935.

Hynes, S. & Garvey, E. (2009) Modelling farmers' participation in an agri-environmental scheme using panel data: an application to the rural environment protection scheme in Ireland. *Journal of Agricultural Economics*, 60(3), 546–562.

ISMEA. (2021) *Rapporto sulla gestione del rischio in agricoltura*. Availble from: https://www.ismea.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/11454 [Accessed May 2022].

ISPAT. (2020) *Istituto di statistica della provincia di Trento*. Available from: http://www.statistica.provincia.tn.it/ [Accessed May 2022].

ISTAT. (2022) *Istituto nazionale di Statistica*. Available from: https://www.istat.it/it/agricoltura?dati [Accessed May 2022].

Jain, N.K., Bhaskar, K. & Jain, S. (2022) What drives adoption intention of electric vehicles in India? An integrated UTAUT model with environmental concerns, perceived risk and government support. *Research in Transportation Business & Management*, 42, 100730.

Jensen, N.D., Mude, A.G. & Barrett, C.B. (2018) How basis risk and spatiotemporal adverse selection influence demand for index insurance: evidence from northern Kenya. *Food Policy*, 74, 172–198.

Johnston, A.C. & Warkentin, M. (2010) Fear appeals and information security behaviors: an empirical study. *MIS Quarterly*, 34(3), 549–566.

King, M. & Singh, A.P. (2020) Understanding farmers' valuation of agricultural insurance: evidence from Vietnam. *Food Policy*, 94, 101861.

Klimkowski, C. (2016) Farm income stabilization effectiveness and income stabilization tool. *Journal of Agribusiness and Rural Development*, 3(41), 309–318.

Laiti, I.L., Giovannini, I.L., & Zardi, D. (2016) *Progetto: 'Messa a punto di applicativi condivisi specifici per la spazializzazione e la mappatura delle principali variabili meteo-climatologiche sul territorio del Trentino'*.

Lastra-Bravo, X.B., Hubbard, C., Garrod, G. & Tolón-Becerra, A. (2015) What drives farmers' participation in EU agri-environmental schemes?: results from a qualitative meta-analysis. *Environmental Science & Policy*, 54, 1–9.

Lefebvre, M., Nikolov, D., Gomez-y-Paloma, S. & Chopeva, M. (2014) Determinants of insurance adoption among Bulgarian farmers. *Agricultural Finance Review*, 74(3), 326–347.

Liesivaara, P. & Myyrä, S. (2017) The demand for public–private crop insurance and government disaster relief. *Journal of Policy Modeling*, 39(1), 19–34.

Menapace, L., Colson, G. & Raffaelli, R. (2013) Risk aversion, subjective beliefs, and farmer risk management strategies. *American Journal of Agricultural Economics*, 95(2), 384–389.

Menapace, L., Colson, G. & Raffaelli, R. (2016) A comparison of hypothetical risk attitude elicitation instruments for explaining farmer crop insurance purchases. *European Review of Agricultural Economics*, 43(1), 113–135.

Meuwissen, M.P.M., Huirne, R.B.M. & Skees, J.R. (2003) Income insurance in European agriculture. *EuroChoices*, 2(1), 12–17.

Meuwissen, M.P.M., Assefa, T.T. & van Asseldonk, M.A.P.M. (2013) Supporting insurance in European Agriculture: experience of mutuals in the Netherlands. *EuroChoices*, 12(3), 10–16.
Meuwissen, M.P.M., de Mey, Y. & van Asseldonk, A.M. (2018) Prospects for agricultural insurance in Europe. *Agricultural Finance Review*, 78(2), 174–182.
Michels, M., Bonke, V. & Musshoff, O. (2020) Understanding the adoption of smartphone apps in crop protection. *Precision Agriculture*, 21(6), 1209–1226.
Mishra, A.K. & Goodwin, B.K. (2003) "Adoption of crop versus revenue insurance: a farm-level analysis." *Agricultural Finance Review*, 63(2), 143–155.
Mishra, A.K. & Goodwin, B.K. (2006) Revenue insurance purchase decisions of farmers. *Applied Economics*, 38(2), 149–159.
Moschini, G. & Hennessy, D.A. (2001) Uncertainty, risk aversion, and risk management for agricultural producers. In: *Handbook of agricultural economics* (vol. 1, pp. 87–153). Elsevier. https://doi.org/10.1016/S1574-0072(01)10005-8
Mundlak, Y. (1978) On the pooling of time series and cross section data. *Econometrica*, 46(1), 69–85.
Oca Munguia, O.M. & Llewellyn, R. (2020) The adopters versus the technology: which matters more when predicting or explaining adoption? *Applied Economic Perspectives and Policy*, 42(1), 80–91.
Pigeon, M., Henry de Frahan, B. & Denuit, M. (2014) Evaluation of the EU proposed farm income stabilisation tool by skew normal linear mixed models. *European Actuarial Journal*, 4(2), 383–409.
Richter, A., Schiller, J. & Schlesinger, H. (2014) Behavioral insurance: theory and experiments. *Journal of Risk and Uncertainty*, 48(2), 85–96.
Rogers, R.W. (1975) A protection motivation theory of fear appeals and attitude Change. *The Journal of Psychology*, 91(1), 93–114.
Rogers, E.M. (1995) *Diffusion of innovation*. New York: Free Press.
Rogna, M., Schamel, G. & Weissensteiner, A. (2021) The apple producers' choice between hail insurance and anti-hail nets. *Agricultural Finance Review*, 82(1), 20–48.
Rothschild, M. & Stiglitz, J. (1976) Equilibrium in competitive insurance markets: an essay on the economics of imperfect information. *The Quarterly Journal of Economics*, 90(4), 629–649.
Roznik, M., Boyd, M., Porth, L. & Porth, C.B. (2019) Factors affecting the use of forage index insurance: empirical evidence from Alberta and Saskatchewan, Canada. *Agricultural Finance Review*, 79(5), 565–581.
Santeramo, F.G. (2018) Imperfect information and participation in insurance markets: evidence from Italy. *Agricultural Finance Review*, 78(2), 183–194.
Santeramo, F.G. (2019) I learn, you learn, we gain experience in crop insurance markets. *Applied Economic Perspectives and Policy*, 41(2), 284–304.
Santeramo, F.G. & Ford Ramsey, A. (2017) Crop insurance in the EU: lessons and caution from the US. *EuroChoices*, 16(3), 34–39.
Santeramo, F.G., Goodwin, B.K., Adinolfi, F. & Capitanio, F. (2016) Farmer participation, entry and exit decisions in the Italian Crop Insurance Programme. *Journal of Agricultural Economics*, 67(3), 639–657.
Sartwelle, J., O'Brien, D., Tierney, W. & Eggers, T. (2000) The effect of personal and farm characteristics upon grain marketing practices. *Journal of Agricultural and Applied Economics*, 32(1), 95–111.
Severini, S., Biagini, L. & Finger, R. (2019) Modeling agricultural risk management policies – the implementation of the Income Stabilization Tool in Italy. *Journal of Policy Modeling*, 41(1), 140–155.
Severini, S., Di Tommaso, G. & Finger, R. (2019) Effects of the Income Stabilization Tool on farm income level, variability and concentration in Italian agriculture. *Agricultural and Food Economics*, 7(1), 23.
Severini, S., Zinnanti, C., Borsellino, V. & Schimmenti, E. (2021) EU income stabilization tool: potential impacts, financial sustainability and farmer's risk aversion. *Agricultural and Food Economics*, 9(34), 1–21.
Sherrick, B.J., Barry, P.J., Ellinger, P.N. & Schnitkey, G.D. (2004) Factors influencing Farmers' crop insurance decisions. *American Journal of Agricultural Economics*, 86(1), 103–114.
Smith, V.H. & Glauber, J.W. (2019) The future of US farm policy. *EuroChoices*, 18(1), 42–48.
Smith, V.H. & Goodwin, B.K. (1996) Crop insurance, moral Hazard, and agricultural chemical use. *American Journal of Agricultural Economics*, 78(2), 428–438.
Sok, J., Borges, J.R., Schmidt, P. & Ajzen, I. (2020) Farmer behaviour as reasoned action: A critical review of research with the theory of planned behaviour. *Journal of Agricultural Economics*, 72(2), 388–412. https://doi.org/10.1111/1477-9552.12408
Spiegel, A., Soriano, B., de Mey, Y., Slijper, T., Urquhart, J., Bardají, I. et al. (2020) Risk management and its role in enhancing perceived resilience capacities of farms and farming Systems in Europe. *EuroChoices*, 19(2), 45–53.
Streletskaya, N.A., Bell, S.D., Kecinski, M., Li, T., Banerjee, S., Palm-Forster, L.H. et al. (2020) Agricultural adoption and behavioral economics: bridging the gap. *Applied Economic Perspectives and Policy*, 42(1), 54–66.
Sun, Y., Wang, N., Guo, X. & Peng, Z. (2013) Understanding the acceptance of mobile health services: a comparison and integration of alternative models. *Journal of Electronic Commerce Research*, 14(2), 183–200.
Takahashi, K., Noritomo, Y., Ikegami, M. & Jensen, N.D. (2020) Understanding pastoralists' dynamic insurance uptake decisions: evidence from four-year panel data in Ethiopia. *Food Policy*, 95, 101910.
Taylor, S. & Todd, P. (1995) Assessing IT usage: the role of prior experience. *MIS Quarterly*, 19(4), 561–570.

Thompson, R.L., Higgins, C.A. & Howell, J.M. (1991) Personal computing: toward a conceptual model of utilization. *MIS Quarterly*, 15(1), 125–143.
Tougeron, K. & Hance, T. (2021) Impact of the COVID-19 pandemic on apple orchards in Europe. *Agricultural Systems*, 190, 103097.
Trestini, S. & Giampietri, E. (2018) Re-adjusting risk management within the CAP: evidences on implementation of the income stabilisation tool in Italy. In: Wigier, M. & Kowalski, A. (Eds.) *The common agricultural policy of the European union—the present and the future, EU member states point of view, no 73.1*. Warsaw: IAFE-NRI. Available from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3202690 [Accessed 21st April 2022].
Trestini, S., Szathvary, S., Pomarici, E. & Boatto, V. (2018) Assessing the risk profile of dairy farms: application of the Income Stabilisation Tool in Italy. *Agricultural Finance Review*, 78(2), 195–208.
Turvey, C.G. (2012) Whole farm income insurance. *Journal of Risk and Insurance*, 79(2), 515–540.
Vallerand, R.J. (1997) Toward a hierarical model of intrinsic and extrinsic motivation. *Academic Press*, 29, 271–360.
Vanslembrouck, I., Van Huylenbroeck, G. & Verbeke, W. (2002) Determinants of the willingness of Belgian farmers to participate in Agri-environmental measures. *Journal of Agricultural Economics*, 53(3), 489–511.
Velandia, M., Rejesus, R.M., Knight, T.O. & Sherrick, B.J. (2009) Factors affecting Farmers' utilization of agricultural risk management tools: the case of crop insurance, forward contracting, and spreading sales. *Journal of Agricultural and Applied Economics*, 41, 107–123.
Venkatesh, V. & Morris, M.G. (2000) Why Don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior. *MIS Quarterly*, 24(1), 115–139.
Venkatesh, V., Morris, M.G., Davis, G.B. & Davis, F.D. (2003) User acceptance of information technology: toward a unified view. *MIS Quarterly*, 27(3), 425–478.
Venkatesh, V., Thong, J.Y.L. & Xu, X. (2012) Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS Quarterly*, 36(1), 157–178.
Was, A. & Kobus, P. (2018) Factors differentiating the level of crop insurance at Polish farms. *Agricultural Finance Review*, 78(2), 209–222.
Weersink, A. & Fulton, M. (2020) Limits to profit maximization as a guide to behavior change. *Applied Economic Perspectives and Policy*, 42(1), 67–79.
Williams, M.D., Rana, N.P. & Dwivedi, Y.K. (2015) The unified theory of acceptance and use of technology (UTAUT): a literature review. *Journal of Enterprise Information Management*, 28(3), 443–488.
Wooldrige, J.M. (2002) *Econometric analysis of cross section and panel data*. Cambridge, MA: MIT Press.
Wu, S., Goodwin, B.K. & Coble, K. (2020) Moral hazard and subsidized crop insurance. *Agricultural Economics*, 51(1), 131–142.
Ye, T., Liu, Y., Wang, J., Wang, M. & Shi, P. (2017) Farmers' crop insurance perception and participation decisions: empirical evidence from Hunan, China. *Journal of Risk Research*, 20(5), 664–677.
Zhao, Y., Ni, Q. & Zhou, R. (2018) What factors influence the mobile health service adoption? A meta-analysis and the moderating role of age. *International Journal of Information Management*, 43, 342–350.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Rippo, R. & Cerroni, S. (2022) Farmers' participation in the Income Stabilisation Tool: Evidence from the apple sector in Italy. *Journal of Agricultural Economics*, 00, 1–22. Available from: https://doi.org/10.1111/1477-9552.12508