Extended Abstract
Please do not add your name or affiliation

Paper/Poster Title	**Risky business: engaging farmers in innovative risk management tools through ICT. Evidence from a randomized control trial**

Abstract prepared for presentation at the 98th Annual Conference of The Agricultural Economics Society will be held at The University of Edinburgh, UK, 18th - 20th March 2024.

Abstract	***200 words max***
This study explores the impact of information communication technology (ICT) on farmers' adoption of the Income Stabilization Tool (IST) through a randomized control trial in the Autonomous Province of Trento, Italy. Comparing traditional communication channels (SMS and paper) with email, the research reveals that email significantly increases farmers' likelihood of engaging with IST information, indicating its effectiveness in promoting tool acceptability. Using a two-stage estimation approach with instrumental variables, the study contributes to the literature on ICT's role in innovation adoption among farmers and assesses the acceptability of innovative risk management tools. The findings underscore the importance of targeted email communication in enhancing farmers' participation in risk management schemes, shedding light on effective communication strategies for agricultural extension services. This research also emphasizes the potential of randomized control trials in predicting and investigating EU farmers' behavior, offering insights into optimizing communication for the successful adoption of agricultural innovations.	

Keywords	Risk management, Information communication technology, Randomized control trial, Innovation adoption, Agricultural extension, Income Stabilization Tool.
JEL Code	G22; Q18; D81; C93 see: www.aeaweb.org/jel/guide/jel.php?class=Q)

Introduction	***100 – 250 words***

Risk management is vital in farming due to challenges like climate change, soil erosion, and labor shortages. Farmers need awareness and understanding of available risk management tools. Effective communication, including interpersonal methods, digital means, and ICT technologies, is crucial for this. Extension services play a role in introducing these tools, but they often face challenges in reaching and influencing farmers effectively. Factors influencing the adoption of innovations include farm characteristics and the nature of the innovation itself, along with the information type and communication channels used (Aker, 2011). Cost-effective communication methods like SMS, emails, and online newsletters can reach farmers in both developed and developing nations (Fu and Akter, 2016). This study focuses on assessing how various information communication technologies influence farmers' adoption of an innovative risk management tool called the income stabilization tool. Conducted as a

randomized control trial (RCT) among apple producers in the Autonomous Province of Trento (PAT) in Italy, this research aims to enhance understanding in three areas: 1) the impact of ICT on farmers' innovation adoption, 2) the acceptability of new risk management tools from the EU CAP toolkit, and 3) the potential of RCTs to predict and study EU farmers' behavior, contributing to the literature on these topics (Behaghel, Macours, and Subervie, 2019; Colen et al., 2016).

Methodology

100 – 250 words

Our RCT was implemented in the PAT in the North-East of Italy. The local defense consortium (Co.Di.Pr.A.) represents almost 90% of the agricultural producers and manage the Income Stabilization Tool developed for the apple-sector (Rippo and Cerroni, 2023). The consortium usually advises farmers (for example about the beginning of the new insurance campaign) through SMS and a quarterly printed news-magazine. This has also been the case for spreading information and gathering participation in the apple-IST during its first three-years period of operation (i.e. 2019-2020-2021). In our RCT, we involved 3.355 apple producers randomly allocated in two sample (see Table 1 for summary statistic): sample A, consisting of 1.493 apple producers that was informed about the beginning of the new three-years periods through the usual communication channels (SMS and paper communication); sample B, consisting of 1.862 apple producers who, in addition, received information through an official email from the defense consortium (see Table 2 for between group comparison). The email contained a short 100 words text informing the farmers about the possibility to join the IST scheme and a link to a video posted on the official channel of the consortium explaining the functioning of the IST scheme.

We adopted a two-stage estimation approach with instrumental variable (IV) to identify the impact of the type of communication strategy. It is particularly useful when the relationship between the dependent and independent variables is complicated by the possible presence of endogeneity (i.e., when the independent variable is correlated with the error term in the regression equation). This method provides more accurate estimates than standard regression models, which assume that the independent variable is exogenous, and can help to identify the causal relationships between variables that are necessary for making policy decisions. The 2SLS are reported in Equation 1 and Equation 2.

$$x_i = \beta_0 + \beta_1 z_i + \beta_2 X_i + \varepsilon_i \quad \text{(Eq. 1)}$$

$$y_i = \alpha_0 + \alpha_1 \hat{x_i} + \eta_i \quad \text{(Eq. 2)}$$

Where x_i is a dichotomous independent variable telling whether or not the farmer has opened the link embodied in the email (*Open_Link = 0.50*), which is treated as endogenous variable in Equation 2; z_i is our treatment variable (*Mail= 0.55)* informing if the subjects belongs to the control (Group A) or the treatment (Group B); X_i is a set of independents covariates like: gender *(Female),*age *(Age)*, location of the farm within the PAT *(Area)*, type of active risk protection strategies used on-farm *(Rp)*, farm area (in hectares) *(Sup_ha),* a variable informing if the farmer has enrolled in the Income Stabilization Tool in 2021 *(IST_21).*It is important to notice

that the error term ε_i has zero correlation with x_i and z_i does not affect y_i directly but only through x_i. In the second stage y_i describe the farmers' choice to enroll in the apple-IST in 2022 *(IST_22);* $\hat{x}_i$ is the estimated value of the variable in stage one, and η_i is an error term with zero mean.

Table 1. Summary statistic of sample (n= 3.355)

Variable	Description	Mean	SD
IST_21	Farmers participating in the apple IST scheme in 2021 (= 1; =0 otherwise)	48%	0.49
IST_22	Farmers participating in the apple IST scheme in 2022 (= 1; =0 otherwise)	48%	0.49
Mail	Farmers who received the mail (i.e. the treatment)	55%	0.49
Age	Farmers' average age	56	14.76
Female	Farmers is female	4%	0.31444
Sup_ha	Farm size in ha	2.56	2.55
Rp_No	Farm using no on-farm protection (= 1; =0 otherwise)	68%	1.32
Rp_Nets	Farm using only anti-hails nets (= 1; =0 otherwise)	22.62%	0.16
Rp_Frost	Farm using only anti-frost system (= 1; =0 otherwise)	6.83%	0.03
Rp_Mix	Farm using nets with anti-frost system (= 1; =0 otherwise)	2%	0.26
Area_VSN	Farm located in Val di Non (= 1; =0 otherwise)	72.65%	0.99
Area_VAL	Farm located in Valsugana (= 1; =0 otherwise)	5.33%	0.05
Area_TSR	Farm located in Trento Sud – Rotaliana (= 1; =0 otherwise)	14.45%	0.14
Area_BVL	Farm located in Bleggio – Valle dei Laghi (= 1; =0 otherwise)	7.57%	0.07

Source: Co.Di.Pr.A. (2023)

Table 1. Summary statistic of Group A (control) and Group B (treatment)

Variable	Description	Group A	Group B
IST_21	Farmers participating in the apple IST scheme in 2021 (= 1; =0 otherwise)	47%	49%
IST_22	Farmers participating in the apple IST scheme in 2022 (= 1; =0 otherwise)	47%	50%
Open_Link	Farmers in treatment group B who received the mail and open the link to the video (= 1; =0 otherwise	0%	50%
Age	Farmers' age	60	53
Female	Farmers is female	10%	11%
Sup_ha	Farm size in ha	2.30	2.76
Rp_No	Farm using no on-farm protection (= 1; =0 otherwise)	71,73%	66%
Rp_Nets	Farm using only anti-hails nets (= 1; =0 otherwise)	20,96%	23,95%
Rp_Frost	Farm using only anti-frost system (= 1; =0 otherwise)	5,89%	7,57%
Rp_Mix	Farm using nets with anti-frost system (= 1; =0 otherwise)	1,41%	2,47%
Area_VSN	Farm located in Val di Non (= 1; =0 otherwise)	79%	67%
Area_VAL	Farm located in Valsugana (= 1; =0 otherwise)	4,29%	6,12%
Area_TSR	Farm located in Trento Sud – Rotaliana (= 1; =0 otherwise)	10,58%	17,56%
Area_BVL	Farm located in Bleggio – Valle dei Laghi (= 1; =0 otherwise)	5,96%	8,86%

Source: Co.Di.Pr.A. (2023)

Results

100 – 250 words

The results of the model are reported in Table 3. As it is shown by the variable *Open_Link (2.99, p-value< 0.001)* opening the link to the Youtube video contained in the email increases the likelihood of participating in the Income Stabilization Tool. This should signal that the informing the farmers with a targeted personal email with visual explanation regarding the functioning of the innovative risk management tool help increasing the acceptability of such tool. The control variables have heterogenous effects. The bigger the farm area (*Sup_ha = 0.06 , p-value < 0.001)* the more the farmer adhere to the Income Stabilization Tool scheme. This is similar to what found previously in other study regarding adoption and use of the income stabilization tool (e.g., Rippo and Cerroni, 2023). Also, older farmers (*Age=-0.01, p-value<0.01)* are less inclined in participating to the income stabilization, suggesting some resistance to innovation, (Santeramo, 2019).

Variable	Description	Estimates
Open_Link	Farmers in treatment group B who received the mail and open the link to the video (= 1; =0 otherwise)	2.99*** (0.61)
Sup_ha	Farm size in ha	0.061*** (0.16)
Rp_Nets	Farm using only anti-hails nets (= 1; =0 otherwise)	0.07 (0.13)
Rp_Frost	Farm using only anti-frost system (= 1; =0 otherwise)	0.27 (0.22)
Rp_Mix	Farm using nets with anti-frost system (= 1; =0 otherwise)	0.46 (0.32)
Area_VAL	Farm located in Valsugana (= 1; =0 otherwise)	-0.37 (0.25)
Area_TSR	Farm located in Trento Sud – Rotaliana (= 1; =0 otherwise)	-0.47* (0.20)
Area_BVL	Farm located in Bleggio – Valle dei Laghi (= 1; =0 otherwise)	-0.36 (0.23)
Age	Farmers' age	-0.01* (0.00)
Female	Farmers is female(= 1; =0 otherwise)	-0.39 (0.25)
Constant		-2.88*** (0.34)
N° obs		**3.355**
Wald chi2		**69.52**

Notes*:* Standard errors in parenthesis. ***p<0.001, ** p<0.05, *p<0.01

Discussion and Conclusion

100 – 250 words

This paper investigates the impact of different forms of information communication technology (ICT) on the adoption of innovative risk management tools by farmers. Specifically, the study tests how different communication strategies (interpersonal communication, digital communication, and ICT technologies) can effectively engage farmers in participation in an innovative risk management tool: the Income Stabilization Tool. The research was conducted through a randomized control trial (RCT) in the Autonomous Province of Trento (PAT), Italy, involving apple producers. The study compares the impact of two different communication campaigns on farmers' enrollment in an income stabilization tool (IST) developed for the apple sector. One group was informed through usual communication channels (SMS and paper

communication), while the other group received information through an official email in addition to the usual communication channels. The study employed a two-stage estimation approach with instrumental variable (IV) to identify the impact of the type of communication strategy. The findings suggest that email communication is more effective in engaging farmers to enroll in the IST scheme than the traditional communication channels of SMS and paper communication. The paper contributes to the literature on the role of ICT on the adoption of innovation among farmers and the acceptability of newly and innovative proposed risk management tools from the EU CAP risk management toolkit. Furthermore, the study highlights the potential of RCT as a tool to predict and investigate EU farmers' behavior.