The Design of the Income Stabilization Tool in Italy: Balancing Risk Pooling, Risk Reduction and Distribution of Policy Benefits

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Abstract

The potential impact of the income stabilisation tool (IST) is analysed on a panel of Italian farms. The paper extends the existing literature by investigating two implementation issues: level of aggregation of mutual funds (MF); definition of farmers contribution to MF. Enlarging the MF to cover more sectors/regions allows to better pool the risk making the indemnifications less variable over time. Regarding the second issue, a flat contribution is compared with a contribution proportional to the expected income of each farm. The latter approach generates a less unequal distribution of benefits among farms and more effectively reduces income variability.

Keywords: income stabilisation tool, policy design, mutual funds, risk-pooling.

JEL classification: D8, G22, Q12, Q18

1. Introduction

Several instruments have been proposed to support farmers in coping with (increasing) income risks (see, e.g. Bielza Diaz-Caneja et al., 2008; Meuwissen et al., 2013; for examples and overviews). Recently, especially whole-farm income insurance schemes have attracted the recent interest of agricultural policy-makers in Europe.

European Union has provided the possibility for member states (MS) to introduce within their Rural Development Policies the income stabilisation tool (IST). This tool provides compensation to farmers who experience a severe income drop, i.e. income decreases larger than 30% from the expected income[1].

IST has attracted the interest of policy-makers because of different reasons. First, farmers protection under the IST focuses on the key variable of interest, i.e. income that represents the

[1] 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) (OJ L 347, 20.12.2013, p.487).

economic wellbeing of a farm household much better than revenues of a single commodity, and implicitly accounts for various correlations between prices and yields and across profits of different farm activities (Meuwissen et al., 2003; Severini et al., 2016). Second, IST is in agreement with WTO green-box requirements (e.g. Mary et al., 2013). Third, it is expected that IST has the potential to cover also systemic risks (specifically price risk) that are not covered by purely commercial insurances hampering the principles of risk pooling (Meuwissen et al., 2003).

There is now a large amount of explorative research on the farm-, sector- and country-level effects of IST. This literature focuses on actuarial evaluations of a potential income insurance, its governmental costs, potential beneficiaries within the farm population as well as conceptual studies on problems of adverse selection and moral hazard with such whole-farm income insurance tools (dell'Aquila and Cimino, 2012; Liesivaara et al., 2012; Liesivaara and Myyrä, 2016; Pigeon et al., 2014; Mary et al., 2013; El Benni et al. 2016; Finger and El Benni, 2014a and 2014b).

This research has shown that the introduction of such tool: i) might indeed stabilize farm-incomes (Finger and El Benni, 2014a), ii) affects the income inequality within the farm population (Finger and El Benni, 2014a), iii) the benefits from such tool might be highly heterogeneous across farm types (El Benni et al. 2016), iv) cause highly volatile levels of indemnification payments, requiring large buffers (Pigeon et al. 2014), v) might cause large transaction costs (Liesivaara et al., 2012), vi) indemnification patterns are highly dependent on the calculation of the reference income (Finger and El Benni, 2014b), vii) might cause moral hazard problems along value chains (Liesivaara and Myyrae, 2016).

The conducted research, however, remained on conceptual levels, without an explicit focus on implementation issues. Now, first countries and regions declared interest in establishing IST: Italy, Hungary and the Spanish region Castilla y León (Bardají and Garrido, 2016). Hence, it is now important to investigate relevant implementations issues such as: specification of aspects concerning the structure of mutual funds (MF) across sectors and space; calculation of relevant incomes; specification of farmers' contribution to MF. This is because these decisions could affect income stabilizing properties, viability of mutual funds, income inequality in the agricultural sector and the distribution of benefits across space and farm types. These questions have, for instance in Italy, led to a postponement of an implementation (Trestini and Boatto, 2015; ISMEA, 2015).

This paper focuses on two implementation issues: level of aggregation of mutual funds (MF); definition of farmers' contribution to MF. Regarding the first issue, MF focused on specific sectors and/or regions could be attractive provided that this could increase the likelihood of an agreement among farmers. This is because: there exist already institutions (e.g. Producers Organizations) that can support the development of MF; MF, having a more detailed knowledge about the participating farmers, could better manage moral hazard problems; finally, there is a limited redistribution of benefits (as well as costs) of the policy among different sectors and regions. Hence, a low level of aggregation is expected to substantially lower transaction costs. However, when MF work on a specific sector and specific regions, these may not be able to effectively pool risks because the underlying risks are systemic (e.g. when a small region is concern, systemic weather risks can be present). Large indemnification events within a MF might require large buffers and this increases costs.

The second issue investigated by this paper is how farmers should pay the contributions to the MF. Previous analyses have assessed the impact of the IST by assuming that each farm pay exactly the same contribution, regardless the size of the farm and its income risk (Finger and El Benni, 2016). However, we also consider the case in which contribution levels are proportional to the average farm income: in this way larger farms pay relatively larger contributions than small farms. This allows to assess whether this latter approach yields a more equitable distribution of the net benefits of the IST among the farm population.

We use Italian agriculture as case study and present an empirical analysis that contributes to ongoing policy debates in Italy. This is important provided that, despite the fact that Italy has decided to introduce the IST, it has not yet been implemented. This is also due to the fact that that many design issues addressed in this paper are still not solved. Shedding light into these implementation aspects thus constitutes an important basis for policy decisions in Italy but also in other countries. More specifically, this paper assesses extent, distribution and variability of the indemnities paid by MF to farmers, how much the IST could reduce the variability of farm income and how policy benefits could be distributed among the farm population under different configurations of the policy.

The remainder of this paper is organized as follows. Next section describes methodology and data. Section 3 presents the results of the analysis. The final section summarises the results and draws some policy implications and proposes possible directions for further research.

2. Data and methodology

2.1 Methodology

The existing studies investigating potential effects of IST employed two approaches: farm-level optimisation models and bookkeeping data. While the former approach can reveal insights in farm-level decision-making, bookkeeping data across a large set of farms and years are used to set up simulation models and investigate income risks of farms to specify potential indemnification within the IST (or other stabilisation mechanisms). This latter approach allows drawing conclusions for the farm population at large and thus the investigation of a large set of farm and farmers' characteristics as well as their interactions that may influence effects of the IST. Along these lines, Finger and El Benni (2014a) recently investigated the potential effects of the IST on income inequality using a balanced panel data set of bookkeeping data. We follow this latter stream of literature to develop the following analyses.

Calculating indemnification through the IST. As in previous analyses, we assume participation to be mandatory (EC, 2009; Liesivaara et al., 2012; Finger and El Benni, 2014a and 2014b; El Benni et al., 2016). Following the EU regulation, we assume that a farmer is indemnified if his/her income drops more than 30 per cent compared with the expected income level. For each individual farm:

I_t is the realised income of the i-th farm (index omitted for simplification) at the t-th year

E_t is the expected income at the t-th year and is assumed to be the average of the realised I_i of the previous three years (see Finger and El Benni 2014b for discussions) as: $E_t = \frac{1}{3}\sum_{t-4}^{t-1} I_t$

I_{Rt} is the reference income at the t-th year and is calculated as: $I_{Rt} = \alpha \cdot E_t$ where α is set by the Regulation as 0.7.

The indemnity paid in year t for a generic farm is:

$$Ind_t = \begin{pmatrix} 0 & if & I_i \geq I_{Rt} \\ \beta \cdot (E_t - I_i) & if & I_i < I_{Rt} \end{pmatrix} \qquad (1)$$

where the regulation sets also β = 0.7. This partial compensation is supposed to reduce moral hazard effects of the IST.

Total indemnification paid by the MF ($TInd_t$) is calculated by means of a weighted sum of farm level indemnities:

$$TInd_t = \sum_{i=1}^{n} Ind_{it} \cdot w_i \qquad (2)$$

where w_i refers to the frequency weights obtained from the FADN data. These weights indicate how many similar farms are included in the total population (EC, 2010). Criteria that define similarity include region, type of farm and economic size class (EC, 2010). The weights have been used to extrapolating the results to the entire country and groups of farms. The relative frequency of indemnification can be assessed by mean of indemnification rates given by the ratio of farms receiving indemnification over the total number of farms.

Calculating contribution of farmers to the MF. The impact of the IST is assessed under two different assumptions:

a) IST is fully subsidised by government (i.e. farmers do not pay neither indemnities, nor management costs of the MF)

b) Farmers pay contributions (i.e. premiums) that are set to fully cover the indemnities paid by the MF[2].

Farm level contributions are calculated in two alternative ways. As in Finger and El Benni (2014a), we simply divide the total indemnification paid by the MF in each of the years ($TInd_t$) by the sum of the weights of the sampled farms:

$$ContF_t = TInd_t / \sum_{i=1}^{n} w_i \qquad (3)$$

Where $ContF_t$ is the per farm contribution to be paid in order to fully cover the indemnities paid by the MF. In this way, each farm pays a flat rate contribution per farm. This is exactly the same for all farms in a specific year regardless the size of the farms or the probability to receive an indemnification.

However, we also calculate the farm-based contribution by distributing the total indemnification paid by the MF in each of the years according to the expected income of each farm:

$$ContE_{it} = (TInd_t / TE_t) \cdot E_{it} \qquad (4)$$

$ContE_{it}$ stands for the contribution paid by each farmer in each year, while TE_t is the weighted sum of the expected income of all farms of the sample. In this case, the contribution differs among farms being larger in those with relatively larger expected income. The term within brackets is the whole amount of indemnifications paid expressed as share of the total expected income of the whole represented farm population.

Variability of farm income over time. The analysis relies on 4 different income indicators (for each farm and year, indexes are omitted):

[2] The EU regulation allows to cover up to 65% of the paid indemnities by public funds. However, farmers will also be charged for other costs incurred by the MF (e.g. management costs) so that it is not possible to exactly know the cost that will be charged to farmers. The considered assumptions represent two extremes within which it is possible to place the real contribution rate.

I observed income (i.e. without IST)

$$I_I = I + Ind \tag{5}$$

$$I_{IF} = I_I - ContF \tag{6}$$

$$I_{IE} = I_I - ContE \tag{7}$$

I_I includes the received indemnification but does not subtract farmers' contribution to the MF. This is as an hypothetical situation in which the policy covers all costs of the IST. On the contrary, indicators I_{IF} and I_{IE} include the received indemnifications (as I_I) but are net of the farmers' contribution to the MF. This latter is paid according to the two considered criteria (Index *F* refers to *ContF* while index *E* refers to *ContE*). These are set to levels that allow the full recovery of the amount of the indemnities paid within the considered groups.

Income variability has been assessed by calculating standard deviation (SD), Median Absolute Deviation (MAD) and Coefficient of Variation (CV) over the years 2011-2014 for each farm. Comparing the income variability of the 4 considered income indicators allows to assess the potential income stabilizing effect of the IST under different implementation rules.

Distribution of the net benefits of the IST among farms. The distribution of the cost and benefits of the IST has been assessed only under the assumption that farmers pay contributions. This has been done by using the ratio between average indemnities received and the average contribution paid (over the considered four-year period) for each farm:

$$\mathrm{DCB}_i = \frac{Avg(Ind)_i}{Avg(Cont)_i} \tag{8}$$

This ratio, that is zero for farms that have not received any indemnity, represents the benefit/cost related to the IST. Analysing the distribution of this indicator within the considered farms allows to assess the extent of the redistribution of the net benefits of the policy. An uneven distribution of this indicator suggests that a relatively large number of farms do not benefit from this policy while other farms enjoy a relatively high level of net benefits. This piece of information is perceived as important in the design of the policy because it is perceived that an uneven distribution of the benefits could increase the opposition to the introduction of the policy.

2.2. Data

The analysis relies on a constant sample of 3421 farms belonging to the Italian FADN consecutively in the year from 2008 to 2014 and not having negative average income[3]. This rich dataset allowed us to consider different articulation of the MF: a) a unique national MF; b) MFs working on the 3 altimetry regions of Italy; c) MFs working on 5 macro-regions of Italy; d) MFs working on 7 specific sectors (i.e. types of farming) (Table 1).

The focus is on the Farm Net Value Added that measures the amount available for remuneration of the fixed production factors (work, land and capital) (EC, 2007). This indicator has been adopted by the European Commission and several analyses related to IST because it is the most comparable indicator between Member States and because it does not vary according to the relative importance of family own production factors (EC, 2009; El Benni et al., 2016; Pigeon et al., 2014). Income is measured on a per farm basis. All figures are deflated to allow comparability among data from different years by means of the Harmonised Indices of Consumer Prices (HICP) (Eurostat).

3. Results

3.1 Frequency and expected level of indemnification

In the case a unique national MF manages the IST, i.e. all Italian farms are included, indemnification rates range from 24% to 18% of the represented farms. Around 55% of the represented farms receive at least one indemnification within the four considered years (Table 2).

Most of those farms receive one indemnification only but a not negligible share of these receive two indemnifications. On the contrary, a very limited number of farms receive indemnifications in more than two years.

Under the hypothesis of one national MF, the overall amount of indemnities paid in the years 2011 – 2014 are around 9% of the expected income (i.e. indemnity rate).

This level differs among the considered regions and types of farming (Table 3). For example, indemnity rate is relatively high in the hill regions and in the islands of Italy. Differences are also found among TF: farms specialised in horticulture have a relative level of indemnification higher than the average, while the opposite is true for specialised grazing livestock farms (Table 3).

[3] As in previous analyses, the exclusion of farms with negative average income (i.e. 84 farms over 3505 that is 2.4%) is motivated by the fact that in these cases it is not clear how such farmers should be handled and, in particular, how they should pay the contribution to the MF (Finger and El Benni, 2014a).

The variability over time of the relative level of indemnifications sharply increases when farms are grouped according to the considered dimensions. In two of the three altimetry regions, CV are clearly higher than the one calculated for the national MF case (Table 3). This is even more true when farms are grouped by macro-regions and TF. Relevant is the case of the center of Italy where, despite the low expected indemnity rate, this has a very large variability. Within the TFs, the variability is way higher in granivore livestock farms, mixed farms and horticulture farms. In those cases, the variability is very high.

These results suggest that MF defined at a low level of aggregation (i.e. not at national level) can be less viable (or require substantially larger stocks or reinsurance, increasing costs) than a national MF in pooling the risk of all members. This depends on the fact that similar/contiguous farms face the same risks and that, in these cases, MF aggregate a lower number of farms.

However, under this configuration, MF could better define the contribution of the farms making it more tailored to the peculiar extent of the income risk each group is facing. Hence, this reduces the distribution of policy benefits among farms. However, this latter result crucially depends also on how the contribution is calculated.

3.2 Farm contributions to the IST

The flat rate contributions (i.e. each farm of a group pays the same amount in a given year) are around 4000 Euro/farm under the assumption of the national MF (Table 4).

However, when MF are articulated by altimetry regions or macro-regions, each group pays a different contribution (Table 4). This clearly depends on both the expected relative level of indemnification and the size of the sampled farms. Regarding the altimetry regions, the highest value is found in the plain. Large differences can also be found among macro-regions with high contributions found in Islands and North-West of Italy. Even larger differences are found among TF with the highest levels in specialised granivore livestock farms.

When contribution is defined according to the average income level, there are large differences in the contribution paid by the farmers (Table 5). This is true not just for the national MF, but also when the MFs are developed within the considered groups (Data not reported here).

Comparing results from tables 4 and 5 clearly suggests that the two considered approaches to calculate the contributions differs in terms of distribution of the cost of the IST among farms.

3.3 Impact on income variability

The application of the IST allows a reduction of income variability. Providing indemnifications without asking farmers to contribute to the full recovery of the paid indemnifications (I_I) allows a relevant reduction of the absolute level of income variability. This results in a reduction of both SD and MAD of farm income (Table 6). However, the relative reduction of the CV is even more relevant because the (free) indemnifications provided by the policy increase the mean (and median) income level.

Under both scenarios that account for farmers contributions (IIF and IIE), the absolute variability declines in comparison with the observed condition (i.e. without IST). Introducing the IST under the IIF and IIE configurations generates a relevant reduction of income variability provided that median SD and MAD decline by more than 60% of the observed median values. However, when the contribution is proportional to the expected income (IIE), the variability declines more than in the case in which the contribution is paid uniformly (IIF) (Table 6). Hence, the way the contribution system is designed have implications on the income stabilising effect of the IST even considering exactly the same design of the indemnification mechanism.

The income stabilizing role of the IST also changes according to how the MF are designed (Table 7). When contributions are calculated on a flat rate basis, MF at a lower level of aggregation are always more effective in reducing income variability. The median CV of the whole sample is higher when the MF is designed at the national level than under the other three configurations. However, this is not the case when the contributions are defined according to the expected income (Table 7).

3.4 Distribution of the net benefits of the IST

In all three scenarios, 1577 farms of the whole sample (3421) do not receive any indemnity in the four considered years. These farms clearly do not benefit at all from the IST. However, Graph 1 shows the very different distribution of the net benefits of the IST under the two considered approaches used to calculate farmers' contributions to MF: flat rate and proportional to the expected income of each farm (I_{IF} and I_{IE}).

In particular, when contributions are paid according to expected income, the distribution of the ratio Ind/Cont is less unevenly distributed than under the flat rate contribution. In this latter case, fewer farms benefit of an extraordinary high benefit/cost ratio while, in a larger share of the remaining farms (around 300), contributions exceed received indemnities (i.e. Ind/Cont < 1). Hence, the way contribution is calculated, strongly affects the distribution of the net benefit of the policy. This have important policy implications, as this strongly affects the potential support by stakeholders such as farmers.

4. Conclusions

This paper has confirmed that IST stabilizes farm-incomes (Finger and El Benni, 2014a). However, it is the first attempt to explore two main implementation aspects of the IST, finding that these affect the impact of the application of this tool. The first is the level of aggregation, both across regions and sectors of the MF. The second is how farmers pay the contributions to the MF.

Regarding the first issue, the paper has shown that moving from a national to a regional/sectorial MF increases the variability over time of the total indemnities paid by the MF. Hence, MF focusing on specific regions and sectors could face highly volatile levels of indemnification payments, requiring large buffers (Pigeon et al. 2014) and/or reinsurance. This could result in an increase of the costs incurred by the MF and, consequently, charged to farmers. On the contrary, MF at the national scale seems to face a limited variability of the total amount of indemnifications over time. This implies that the public expenses for this tool could be also less variable over time under this configuration of the MF.

When farmers are asked to pay contributions to the MF, the design of MF affect the income stabilising role of IST. In the flat rate case, regional/sector specific MF seem to be more effective than a national MF in terms of income risk reduction. However, this is not the case when contributions are paid according to their expected farm income.

The level of the contributions farmers pay affects the income stabilising effect of the IST. As already shown in previous research (El Benni et al. 2016), increasing the contribution reduces the income stabilising effect of the IST. However, the paper has shown that also the way farmers pay can be important in this regards: using a flat rate contribution seems less effective than using a contribution proportional to the average farm income level in terms of income stabilisation.

The way contributions are designed has been found to have relevant implications on how the benefit of the policy are distributed among the farm population. The analysis has found that the IST could generate a very uneven distribution of the benefits generated by this tool. In particular, a large share of the farmers will not benefit from it because not receiving indemnities. In this regard, the paper has shown that a flat rate contribution generates a very uneven distribution of the net benefits of such tool across farms (El Benni et al., 2016). However, this phenomenon is strongly reduced when contribution levels are proportional to expected farm income.

Those results support some policy implications. First, developing MF with a high level of aggregation may be desirable to avoid highly volatile levels of the total indemnification payments. This will not have relevant implication in terms of reduction of the effectiveness of the IST. Of course, this kind of design of the IST might cause large transaction costs as suggested by Liesivaara et al. (2012). Second, the very uneven distribution of the benefits could strongly constrain the policy support toward the IST. This is of paramount importance whenever it could be decided to make farmers' participation compulsory or, in the other case, there is the need to have a large enough degree of participation. In this regard, the analysis supports the idea that it is more appropriate to modulate farmers contributions to the MF according to farm size avoiding simpler approaches such as flat rate contributions.

Finally, the analysis has not considered some other aspects that should be explored in future analyses on the IST. These include, among others, the potential implications of the application of the IST on the income inequality within the farm population (Finger and El Benni, 2014a) and the factors affecting the distribution of the benefits derived by this tool (El Benni et al. 2016).

References

Bardají, I. and Garrido, A. (2016). *State of play of risk management tools implemented by Member States during the period 2004 - 2020: national and European frameworks*. Study requested by the European Parliament's Committee on Agriculture and Rural Development. Bruxelles.

Bielza Diaz-Caneja, M., Conte, C. G., Dittmann, C., Gallego Pinilla, J. and Stroblmair, J. (2008). *Agricultural Insurance Schemes*. Italy: Joint Research Center of the European Commission, Institute for the Protection and Security of Citizens JRC (Ispra).

dell'Aquila, C. and Cimino, O. (2012). *Stabilization of farm income in the new risk management policy of the EU: a preliminary assessment for Italy through FADN data*. In Paper presented at the 126th EAAE

Seminar: *"New challenges for EU agricultural sector and rural areas. Which role for public policy?"* Capri, Italy.

European Commission (EC) (2009). *Income variability and potential cost of income insurance for EU.* Brussels, Belgium: Directorate-General for Agriculture and Rural Development, European Commission.

European Commission (EC) (2010). *Farm Accountancy Data Network. An A to Z of methodology.* Available at: http://ec.europa.eu/agriculture/rica/pdf/site_en.pdf. Accessed on: June 2016.

El Benni, N., Finger, R. and Mann, S. (2012). Effects of agricultural policy reforms on income risks in Swiss agriculture. *Agricultural Finance Review,* 72(3): 301–324.

El Benni, N. and Lehmann, B. (2010). *Swiss agricultural policy reform: landscape changes in consequence of national agricultural policy and international competition pressure*. In: J. Primdahl and S. Swaffield (ed.), Globalisation and Agricultural Landscapes – Change Patterns and Policy trends in Developed Countries. Cambridge, UK: Cambridge University Press, 73–94.

El Benni, N., Finger, R., and M., Meuwissen (2016). Potential effects of the income stabilisation tool (IST) in Swiss agriculture. *European Review of Agricultural Economics,* 43 (3): 475-502. DOI: https://doi.org/10.1093/erae/jbv023.

Finger, R. and El Benni, N. (2014a). A note on the effects of the Income Stabilisation Tool on income inequality in agriculture. *Journal of Agricultural Economics,* 65(3): 739–745. doi: 10.1111/1477-9552.12069

Finger, R. and El Benni, N. (2014b). *Alternative specifications of reference income levels in the income stabilization tool*. In: C. Zopounidis, N. Kalogeras, K. Mattas, G. Dijk and G. Baourakis (eds), Agricultural Cooperative Management and Policy. Springer, 65–85.

ISMEA (2015). *Sviluppo Rurale 2014-2020. Studio per l'attuazione in Italia dello strumento di stabilizzazione del reddito delle imprese agricole*. ISMEA, Rome (Italy). Available at: http://www.reterurale.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/15269. Accessed on: 23-01-2017.

Liesivaara, P. and Myyrä, S. (2016). *Income stabilisation tool and the pig gross margin index for the Finnish pig sector*. In 90th Annual Conference, April 4-6, 2016, Warwick University, Coventry, UK (No. 236360). Agricultural Economics Society.

Liesivaara, P., Myyräae, S. and Jaakkola, A. (2012). *Feasibility of the Income Stabilisation Tool in Finland*. Paper prepared for the 123rd EAAE Seminar Price Volatility and Farm Income Stabilisation, 23–24 February. Dublin, Ireland.

Mary, S., Santini, F. and Boulanger, P. (2013). *An ex-ante assessment of CAP Income Stabilisation Payments using a farm household model*. Paper presented at the 87th Annual Conference of the Agricultural Economics Society, 8–10 April 2013. University of Warwick, United Kingdom.

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

Pigeon, M., de Frahan, B. H. and 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.

R Core Team. (2016). *R: A Language and Environment for Statistical Computing*. Vienna, Austria. Retrieved from https://www.r-project.org/ (Accessed December 2016).

Severini S., Tantari A. and Di Tommaso G. (2016). The instability of farm income. Empirical evidences on aggregation bias and heterogeneity among farm groups. *Bio-based and Applied Economics*, 5(1): 63-81. DOI: 10.13128/BAE-16367

Trestini, S. and Boatto, V. (2015). *Understanding the probability of farm income reduction: contribution to the discussion about the implementation of the Income Stabilisation Tool under the new CAP*. Paper presented at the 52nd SIDEA Conference: "The value of food. Internationalization, competition and local development in agro-food systems". Rome and Viterbo, September 17th – 19th.

Table 1. Sampled and represented farms. Number of observations and frequency (%).

	Sampled farms		Represented farms	
	N. of obs.s	Freq.	N. of obs.s	Freq.
All observations	3421	100.0%	186191	100.0%
Altimetry regions:				
Mountain	709	20.7%	30806	16.5%
Hill	1458	42.6%	78154	42.0%
Plain	1254	36.7%	77231	41.5%
Macro-regions (MR):				
Center	383	11.2%	14612	7.8%
Islands	194	5.7%	18583	10.0%
South	760	22.2%	50020	26.9%
North-West	1251	36.6%	49647	26.7%
North-East	833	24.3%	53329	28.6%
Types of farming (TF)				
Specialised fieldcrops	844	24.7%	47142	25.3%
Specialised horticulture	305	8.9%	12392	6.7%
Specialised permanent crops	1012	29.6%	75824	40.7%
Specialised grazing livestock	770	22.5%	30975	16.6%
Specialised granivore livestock	98	2.9%	1848	1.0%
Mixed crops	201	5.9%	9529	5.1%
Mixed livestock, crops and livestock	191	5.6%	8481	4.6%

Source: Own elaboration on the Italian FADN sample.

Table 2. Beneficiaries of indemnities over the four considered years (2011 – 2014) in the whole sample of farms. Shares of represented farms (%).

Not indemnified	**Indemnified**				
	At least in one year	of which:			
		1 year	2 years	3 years	4 years
44.8%	55.2%	31.8%	16.6%	6.1%	0.7%

Source: Own elaboration on a constant sample of farms of the Italian FADN.

Table 3. Indemnity rates (Total indemnities paid over expected income) (%). (Weighted values).

	2011	2012	2013	2014	Mean	Standard Deviation (SD)	Coefficient of Variation (SD/Mean)
National MF	9.5%	8.3%	9.1%	10.4%	9.3%	0.9%	0.096
MF by altimetry regions:							
Mountain	7.6%	7.4%	7.5%	10.5%	8.2%	1.5%	0.182
Hill	9.9%	10.5%	11.4%	10.8%	10.7%	0.6%	0.059
Plain	9.7%	7.0%	8.1%	10.2%	8.7%	1.4%	0.164
MF by macro-regions (MR):							
Center	6.3%	5.2%	5.4%	14.3%	7.8%	4.3%	0.555
Islands	9.2%	15.8%	18.5%	14.1%	14.4%	3.9%	0.272
South	9.6%	7.7%	7.7%	9.4%	8.6%	1.0%	0.121
North-West	11.3%	7.9%	9.5%	10.1%	9.7%	1.4%	0.144
North-East	7.8%	7.2%	7.4%	9.7%	8.0%	1.1%	0.141
MF by types of farming (TF)							
Specialised fieldcrops	12.8%	8.3%	7.8%	10.2%	9.8%	2.2%	0.228
Specialised horticulture	14.0%	18.7%	15.9%	5.1%	13.4%	5.9%	0.439
Specialised permanent crops	9.5%	8.9%	10.1%	11.6%	10.0%	1.2%	0.118
Specialised grazing livestock	4.7%	5.2%	7.4%	8.0%	6.3%	1.6%	0.253
Specialised granivore livestock	20.4%	11.1%	6.3%	10.5%	12.1%	5.9%	0.492
Mixed crops	5.9%	3.9%	6.0%	10.4%	6.5%	2.7%	0.419
Mixed livestock, crops and livestock	7.6%	3.6%	10.2%	14.4%	9.0%	4.5%	0.506

Source: Own elaboration on a constant sample of farms of the Italian FADN.

Table 4. Contribution per farm with cost equally distributed for each farm (Euro/farm).

	2011	2012	2013	2014	Mean
National MF	4320	3752	4257	4861	4297
MF by altimetry regions:					
Mountain	2845	2724	2758	3847	3043
Hill	3652	3833	4238	3950	3919
Plain	5584	4079	4873	6188	5181
MF by macro-regions:					
Center	2112	1703	1858	4922	2649
Islands	4056	6875	7787	5449	6042
South	3045	2375	2370	2876	2667
North-West	6991	4851	6040	6418	6075
North-East	3726	3492	3793	5052	4016
MF by types of farming (TF)					
Specialised fieldcrops	4094	2597	3169	3755	3404
Specialised horticulture	9983	11644	9758	7128	9628
Specialised permanent crops	3442	3221	3802	4441	3726
Specialised grazing livestock	3313	3706	5405	6033	4614
Specialised granivore livestock	29749	13666	8133	12186	15933
Mixed crops	4447	2415	1611	3791	3066
Mixed livestock, crops and livestock	3143	2892	4265	6781	4270

Source: Own elaboration on a constant sample of farms of the Italian FADN.

Table 5. Level and heterogeneity of the farm contribution to the MF when this is proportional to the expected farm income.

	Mean (Euro/farm)				*Standard Deviation (Euro/farm)*			
	2011	**2012**	**2013**	**2014**	**2011**	**2012**	**2013**	**2014**
National MF	7162	6207	7060	8012	17001	14059	15826	16979

Source: Own elaboration on a constant sample of farms of the Italian FADN.

Table 6. Variability of farm income under different IST scenarios. Application of the IST at the national level (i.e. Only one MF).

	Central values		Absolute variability		
	Mean	Median	Standard Deviation (SD)	Median Absolute Deviation (MAD)	Coefficient of Variation (SD/Mean)
Observed income (without IST) (I)					
Mean	2490082	2446726	772794	572399	0.372
Median	1373449	1349493	353663	252313	0.271
Income with indemnities paid by the IST:					
- without any farmers contribution (I_I)					
Mean	2723972	2654713	637747	465346	0.239
Median	1489122	1459957	295312	200447	0.204
- with a flat rate contribution per farm (I_{IF})					
Mean	2490082	2423478	641366	470188	0.384
Median	1256617	1222355	296825	208184	0.249
- with contributions proportional to expected income (I_{IE})					
Mean	2490082	2419010	634992	462592	0.259
Median	1365861	1327135	295890	203783	0.225

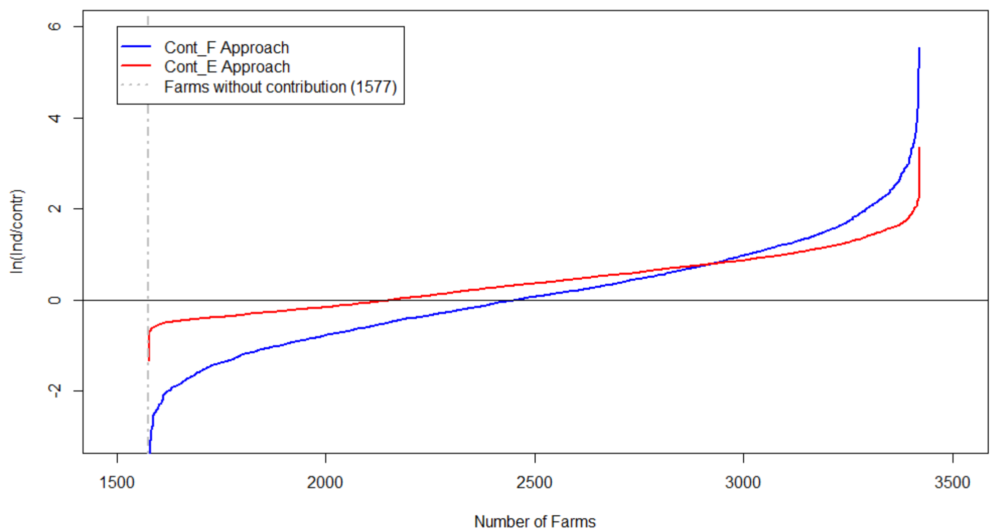
Source: Own elaboration on a constant sample of farms of the Italian FADN.

Table 7. Median of the CV of the income over time of the sampled farms under different designs of the MF.

	Observed	**With IST:**		
		No contribution	**With contribution:**	
			Flat	Based on income
	I	I_I	I_{IF}	I_{IE}
National MF	0.271	0.204	0.249	0.225
MF by altimetry regions:			***0.171***	***0.272***
Mountain	0.268	0.194	0.175	0.202
Hill	0.259	0.205	0.063	0.250
Plain	0.281	0.209	0.175	0.341
MF by macro-regions (MR):			***0.149***	***0.225***
Center	0.257	0.192	0.565	0.232
Islands	0.291	0.204	0.266	0.225
South	0.256	0.205	0.129	0.220
North-West	0.286	0.209	0.148	0.220
North-East	0.266	0.200	0.173	0.237
MF by types of farming (TF):			***0.193***	***0.224***
Specialised fieldcrops	0.267	0.206	0.192	0.223
Specialised horticulture	0.268	0.202	0.193	0.237
Specialised permanent crops	0.287	0.212	0.142	0.234
Specialised grazing livestock	0.264	0.192	0.281	0.206
Specialised granivore livestock	0.307	0.228	0.576	0.257
Mixed crops	0.289	0.203	0.410	0.219
Mixed livestock, crops and livestock	0.241	0.192	0.403	0.226

Source: Own elaboration on a constant sample of farms of the Italian FADN.

Graph 1. Distribution of the net benefits of the IST among farms. Ratio indemnities over contribution in the whole sample of farms (Ind/Cont). Contributions paid according to flat rate (Cont_F) and proportional to expected income (Cont_E). National MF. (Logaritmic scale).



Source: Own elaboration on a constant sample of farms of the Italian FADN.