Integrated Climate Risk Assessment in Agriculture & Food - Trade M

Parallel Session
Modelling improvements through integrated approaches
Chair: Franz Sinabell

The role of CAP direct payments in the support and stabilisation of farm income:
empirical evidences from a constant sample of Italian farms

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Outline of the presentation

- Background

- Research questions

- Data and methodology

- Empirical results

- Discussion and policy considerations

- Future developments

Background (1)

- A large share of the support provided to EU farmers by the Common Agricultural Policy (CAP) is delivered by means of Direct Payments (DP). These have been aimed at increasing and stabilising farm income as well as supporting farmers to deliver a multiplicity of goods and services.

- Stabilising income is an important problem faced by farmers so that there has been a growing attention to cope with it.

Background (2)

- Empirical results regarding this topic are not abundant apart Vrolijk and Poppe (2008) and Vrolijk et al. (2009).

- An important knowledge gap provided that a set of policy tools have been introduced within the CAP to support farmers to cope with risk and MSs have to decide whether and how to implement them (Matthews, 2010; Meuwissen et al., 2011; Tangermann, 2010).

Research questions

- What is the amount of the support provided by DP? How the income of Italian farms will be affected by reductions of DP levels?

- What is the extent of farm income variability over time? Is it the same in all types of farms?

- Where is this variability coming from?

- Do CAP direct payments reduce farm income variability? How do DP affect it? Are DP targeted to stabilise the income of those farms facing larger income variability?

Data and methodology (1)

- The analysis has been developed on the individual farms belonging to the whole Italian sample of the EU Farm Accounting Data Network (FADN) farms during all years of the period 2003-2012 (i.e. constant sample of 2402 farms for 10 years)

- Whole sample and farms grouped according to: a) 7 types of farming b) 3 classes of economic size c) relative importance of DP (NO DP and 4 quartiles)

- Focus on Farm Income, defined as: $FI = REV - EC + DP = MI + DP$ where REV is revenues, EC is costs for external (i.e. non-family owned) factors, MI is market income (i.e. $FI - DP$).

Data and methodology (2)

- The relative importance of DP is assessed by two indicators:
   a) PSE=DP/(REV+DP)
   b) DP/FI (Share of DP on FI)

- The impact of the reduction of DP on farm income is assessed considering both the relative reductions of FI and the relative number of farms having a negative FI (reduction of 20%, 40%, 60%, 80% from the base line levels and the complete elimination of DP). This analysis is performed on the 10 year average values of each single farm.

- The variability of farm income is assessed by calculating variance and Coefficient of Variation (CV) over the 10 year period in each single farm for each relevant income component. Differences between groups have been statistically tested by means of both Kruskal-Wallis and Wilcoxon rank-sum tests (Kruskal and Wallis 1952; Mann and Whitney 1947)

Data and Methodology (3): variance decomposition

- The role of the three components on income variability is assessed by applying the variance decomposition by income sources (Burt and Finley 1968; El Benni and Finger 2013; Mishra et al. 2002).
- We applied the variance decomposition of additive components (i.e. the variance of a sum), as follows:

$$Var(FI) = Var(REV) + Var(DP) + Var(EC)$$
$$+ 2Cov(REV, DP) - 2Cov(REV, EC) - 2Cov(DP, EC)$$

$$\frac{Var(REV) + ar(DP) + Var(EC) + 2Cov(REV, DP) - 2Cov(REV, EC) - 2Cov(DP, EC)}{Var(REV) + Var(DP) + Var(EC)} = p1 + p2 + p3 + p12 - p13 - p23$$

where p1, p2, and p3 are the direct effects while p12, p13 and p23 are the covariance effects

Empirical Results (1)

- The level of support provided by DP is relevant: on average DP account for around 13,2% of total farm receipts (PSE) and 42,6% of farm income (DP/FI). However, there are relevant differences within the farm sample.

		Sample size	Importance of DP:			
			PSE		DP/FI	
		Number	Mean		Mean	
Types of Farming (TF)^:	**TF**					
Specialist field crops	1	571	22.9%		80.9%	
Specialist horticulture	2	276	0.8%		2.0%	
Specialist permanent crops	3	715	8.3%	b	25.5%	a
Specialist grazing livestock	4	492	16.3%	a	45.5%	b
Specialist granivore	5	84	5.7%	b	18.6%	a
Mixed cropping	6	161	13.6%	a	44.7%	b
Mixed livestock and Mixed crops-livestock	7	103	17.6%	a	60.6%	
Economic size (ESU)^:						
Small (Classes 1, 2, 3)		697	14.6%		56.1%	
Medium (Classes 4, 5, 6)		1595	12.9%		37.5%	a
Large (Classes 7, 8)		110	9.3%		31.1%	a
PSE level:						
No DP	0	247	0.0%		0.0%	
Low	1st	540	2.0%		6.5%	
Low-Medium	2nd	539	8.1%		27.6%	
Medium-High	3rd	537	16.4%		55.6%	
High	4th	539	32.4%		100.4%	
Total sample		2402	13.2%		42.6%	

Empirical results (2)

- On average, the income of farms would be affected very negatively by reductions of DP levels. In the whole sample, the reduction is 42.6% for the complete elimination of DP

- The impact of reducing DP is definitely more relevant in small than in large size farms: in the former eliminating DP could cause income to decline by around 56%. The impact is clearly increasing as long as the relative importance of DP increases

| | | FI reduction from baseline level (%) | | | Share of farms with FI < 0 (%) | | | | |
| | | Relative level of DP (Baseline = 100%) | | | Relative level of DP (Baseline = 100%) | | | | |
		80%	40%	0%	80%	60%	40%	20%	0%
Types of Farming (TF):	**TF**								
Specialist field crops	1	-16.2%	-48.5%	-80.9%	0.7%	3.3%	7.2%	14.0%	22.4%
Specialist horticulture	2	-0.4%	-1.2%	-2.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Specialist permanent crops	3	-5.1%	-15.3%	-25.5%	0.1%	0.6%	1.0%	1.8%	3.6%
Specialist grazing livestock	4	-9.1%	-27.3%	-45.5%	0.4%	1.2%	2.0%	3.7%	5.1%
Specialist granivore	5	-3.7%	-11.2%	-18.6%	0.0%	1.2%	1.2%	1.2%	2.4%
Mixed cropping	6	-8.9%	-26.8%	-44.7%	0.6%	0.6%	1.9%	5.0%	8.7%
Mixed livestock and Mixed crops-livestock	7	-12.1%	-36.4%	-60.6%	0.0%	1.0%	3.9%	8.7%	15.5%
Economic size (ESU):									
Small (Classes 1, 2, 3)		-11.2%	-33.7%	-56.1%	0.6%	2.2%	4.4%	8.5%	13.5%
Medium (Classes 4, 5, 6)		-7.5%	-22.5%	-37.5%	0.2%	1.0%	2.1%	4.2%	7.0%
Large (Classes 7, 8)		-6.2%	-18.7%	-31.1%	0.9%	0.9%	0.9%	2.7%	5.5%
PSE level:									
No DP	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Low	1st	-1.3%	-3.9%	-6.5%	0.0%	0.2%	0.2%	0.2%	0.4%
Low-Medium	2nd	-5.5%	-16.5%	-27.6%	0.2%	0.4%	1.3%	1.9%	3.0%
Medium-High	3rd	-11.1%	-33.3%	-55.6%	0.7%	1.7%	2.2%	4.5%	6.9%
High	4th	-20.1%	-60.2%	-100.4%	0.6%	3.7%	8.5%	17.4%	28.9%
Total sample		-8.5%	-25.6%	-42.6%	0.3%	1.3%	2.7%	5.4%	8.8%

Empirical Results (3)

- Variability of farm income over time is high. On the whole sample, the median coefficient of variation of farm income is 0.64 and there are limited but significant differences between farm groups

		CV(FI)	
		Median ^	
Types of Farming (TF):	**TF**		
Specialist field crops	1	0.666	a b
Specialist horticulture	2	0.604	b c d
Specialist permanent crops	3	0.659	a b
Specialist grazing livestock	4	0.576	c d
Specialist granivore	5	0.725	a b
Mixed cropping	6	0.710	a b
Mixed livestock and Mixed crops-livestock	7	0.658	a b c
Economic size (ESU):			
Small (Classes 1, 2, 3)		0.734	a
Medium (Classes 4, 5, 6)		0.606	b
Large (Classes 7, 8)		0.619	b
PSE level:			
No DP	0	0.599	b c
Low	1st	0.667	a b
Low-Medium	2nd	0.629	a b c
Medium-High	3rd	0.661	a b
High	4th	0.617	a b c
Total sample		0.636	

^ Differences between groups statistically significant at 5% confidence interval according to Wilcoxon rank-sum test.

Empirical Results (4)

- Variance decomposition results show that most of the variance is due to revenues (65%) and external costs (around 30%). DP account only for 5% of the sum of direct effects. Indirect effects have a low contribution to total variability.

- The relative contribution of DP to total variability is way higher than the mean in specialist field crops farms, in which DP account for around 80% of FI.

Types of Farming (TF):	TF	p_1	p_2	p_3	p_{12}	p_{13}	p_{23}	REV/FI	DP/FI	EC/FI
			Mean						Mean	
Specialist field crops	1	0.617	0.082	0.301	-0.026	0.294	0.028	2.84	0.81	2.65
Specialist horticulture	2	0.699	0.006	0.296	-0.005	0.321	0.004	2.81	0.02	1.83
Specialist permanent crops	3	0.688	0.045	0.267	-0.016	0.250	0.011	2.68	0.25	1.94
Specialist grazing livestock	4	0.601	0.062	0.337	-0.035	0.263	0.005	2.29	0.46	1.74
Specialist granivore	5	0.599	0.010	0.392	-0.006	0.562	0.008	4.07	0.19	3.26
Mixed cropping	6	0.640	0.056	0.304	-0.027	0.293	0.028	3.08	0.45	2.52
Mixed livestock and Mixed crops-livestock	7	0.605	0.055	0.340	-0.039	0.302	0.022	3.11	0.61	2.71
Economic size (ESU):										
Small (Classes 1, 2, 3)		0.648	0.047	0.305	-0.022	0.269	0.019	3.04	0.56	2.61
Medium (Classes 4, 5, 6)		0.647	0.057	0.296	-0.024	0.282	0.014	2.58	0.38	1.96
Large (Classes 7, 8)		0.583	0.038	0.379	0.009	0.486	-0.003	3.32	0.31	2.63
PSE level:										
No DP	0	0.698	0.000	0.302	0.000	0.328	0.000	2.83	-	1.83
Low	1st	0.718	0.007	0.275	-0.002	0.289	0.004	2.97	0.07	2.04
Low-Medium	2nd	0.664	0.034	0.302	-0.025	0.270	0.006	2.99	0.28	2.27
Medium-High	3rd	0.625	0.055	0.319	-0.014	0.321	0.015	2.81	0.56	2.36
High	4th	0.546	0.139	0.315	-0.059	0.251	0.040	2.19	1.00	2.19
Total sample		0.645	0.053	0.303	-0.022	0.288	0.015	2.75	0.43	2.18

Variance decomposition^ — Direct effects (p_1, p_2, p_3); Indirect effects (p_{12}, p_{13}, p_{23}). Relative importance of income sources (REV/FI, DP/FI, EC/FI).

^ Subscripts 1, 2 and 3 refer to revenues, direct payments and external costs, respectively.

Empirical Results (5)

- The variability of DP seems to decrease as DP become more relevant in generating farm receipts (PSE) (i.e. DP play an income stabilising role).

- Indeed, the presence of DP allows for a reduction of the variability of farm income because the variability of FI is around 30% lower than the variability of MI on average.

- The variability of DP declines moving from farms with low to farms with high relative levels of DP while the variability of MI does the opposite. So, the income stabilisation role of DP is very relevant for those farms in the third and last quartile of PSE

		Sample size	Importance of DP: PSE^	DP/FI	Coefficient of Variation of FI	MI	DP	Difference between CV(MI) and CV(FI)	
		Number	Mean		Median			Var.^^	
Types of Farming (TF):	**TF**								
Specialist field crops	1	443	19.9%	49.4%	0.608	1.287	0.304	-52.8%	***
Specialist horticulture	2	276	0.8%	2.0%	0.604	0.612	1.823	-1.3%	
Specialist permanent crops	3	689	7.7%	19.7%	0.646	0.774	0.699	-16.5%	***
Specialist grazing livestock	4	467	15.1%	35.5%	0.567	0.861	0.361	-34.2%	***
Specialist granivore	5	82	5.7%	13.2%	0.715	0.900	0.352	-20.6%	***
Mixed cropping	6	147	12.2%	31.9%	0.690	0.952	0.474	-27.5%	***
Mixed livestock and Mixed crops-livestock	7	87	16.2%	44.0%	0.583	1.207	0.281	-51.7%	***
Economic size (ESU):									
Small (Classes 1, 2, 3)		603	12.5%	33.3%	0.690	1.046	0.422	-34.1%	***
Medium (Classes 4, 5, 6)		1484	11.2%	26.9%	0.592	0.819	0.445	-27.7%	***
Large (Classes 7, 8)		104	8.2%	20.4%	0.612	0.790	0.412	-22.5%	**
PSE level:									
No DP	0	247	0.0%	0.0%	0.599	0.599	0.000	0.0%	
Low	1st	538	2.0%	5.6%	0.665	0.687	1.068	-3.2%	
Low-Medium	2nd	523	8.0%	22.1%	0.615	0.756	0.444	-18.6%	***
Medium-High	3rd	500	16.3%	44.0%	0.632	1.107	0.334	-43.0%	***
High	4th	383	30.4%	66.7%	0.546	1.506	0.296	-63.8%	***
Total sample		2191	11.4%	28.4%	0.615	0.871	0.438	-29.4%	***

^PSE = DP/(REV+DP). ^^ Calculated as: (CV(MI) - CV(FI))/CV(FI)

Empirical Results (6)

- The stabilising effect of DP is not due to the fact that DP play a countervailing role against market income. This is because only a very small (even if negative) correlation between MI and DP is found.

- DP are not specifically targeted to stabilise the income of those farms facing large income variability levels, because the correlation between the variability of MI and the relative level of DP (PSE) is very low on average and in many of the considered groups.

		Sample size	Correlation^ between:		CV(MI) and PSE^^ (mean)
		Number	MI and DP (mean)		
Types of Farming (TF):	**TF**				
Specialist field crops	1	443	-0.094	***	0.016
Specialist horticulture	2	276	-0.024		0.264
Specialist permanent Crops	3	689	-0.033	*	0.180
Specialist grazing livestock	4	467	-0.036	*	0.109
Specialist granivore	5	82	-0.043		0.254
Mixed cropping	6	147	-0.086	**	0.296
Mixed livestock and Mixed crops-livestock	7	87	-0.048		0.023
Economic size (ESU):					
Small (Classes 1, 2, 3)		603	-0.086	***	0.036
Medium (Classes 4, 5, 6)		1484	-0.045	***	0.052
Large (Classes 7, 8)		104	0.062		0.356
PSE level:					
No DP	0	247	/	/	/
Low	1st	538	0.002		0.057
Low-Medium	2nd	523	-0.059	***	0.017
Medium-High	3rd	500	-0.061	***	0.061
High	4th	383	-0.104	***	0.064
Total sample		2191	-0.051	***	0.045

^ Significantly different from zero at 1% (***), 5% (**) and 10% (*). ^^ PSE = DP/(REV+DP)

Conclusions and policy considerations

- DP play a crucial role in sustaining and stabilising farm income. A large share of the farms could face income level problems in the case of a reduction of DP. However, the impact will be strong only on those farms currently receiving sizeable amounts of DP.

- DP stabilise farm income even if the extent of such effect strongly depends on the relative share of DP in farm income.

- A cut in DP level negatively affects farm economic results in two ways: reducing the average income level and increasing its variability over time.

- As the stabilising role of DP only depends from the fact that DP are less variable than MI, a more effective DP policy should be taken into account in order to stabilise income.

Future developments

- The new DP policy drastically changes the distribution and the nature of DP.

- Thus, when data will become available, it could be interesting to investigate whether the new DP policy will be more effective than the previous one in pursuing income support and stabilisation goals.

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