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An impact assessment of EU's CAP income stabilisation payments

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AN IMPACT ASSESSMENT OF EU'S CAP INCOME STABILIZATION PAYMENTS[1]

Abstract

To help farmers cope with increased income volatility, the EU may be introducing a farm income stabilisation payment in the post-2013 CAP. This payment would generally cover dramatic risk exceptionally leading to more than 30 per cent of income losses. This paper applies a model for a risk-averse farm producer facing output price, yield and policy uncertainty, to examine the impacts of the potential implementation of such payments in French crop specialist farms. The proposed scheme reduces farm income volatility, after 5 and 10 years, respectively by 0.79% and 0.72%.

Keywords: Income Stabilization Payment, EU, farm producer model, policy uncertainty

JEL codes: Q12, Q18

Introduction

Agricultural policy reforms in the EU have seen structural changes over the last two decades. Originally, these reforms focused on the reduction in price support and coupled payments. It later led to the introduction of Single Farm Payments. While such reforms have allowed the EU to comply with WTO regulations and internal budgetary pressures, they have also increasingly exposed farmers to greater market fluctuations, who now have to face increased income volatility. Among many negative consequences, farm income volatility jams the economic market signals, fosters uncertainty and risk aversion and may hinder the optimal decision-making by farmers, especially in terms of farm investment. While most farmers today believe that farm income volatility has become inevitable, EU policymakers aim at addressing the situation by providing European farmers with additional subsidies. Thus, the post-2013 CAP will incorporate farm payments whose objective is to "*maintain income support and to reinforce instruments to better manage risk in a context of ever increasing pressures on farm incomes*" (European Commission, 2011). In the legal proposal on the future CAP, Income Stabilization Payments (ISP) are designed according to WTO regulations, ensuring that these new payments will be classified into the Green Box, which regroups subsidies with no (or, at most, minimally) trade distorting effects.

From an analytical perspective, while this policy scheme is likely to affect farmers' decisions, its design[2] makes it extremely difficult to predict the final impacts of its implementation on farm decisions. Indeed, ISP are direct payments and may affect farmers through several transmission channels, such as uncertainty, risk aversion or bankruptcy risks (Hennessy, 1998; Vercammen, 2007). The timing of the payments matters too. As information on farm incomes is not instantaneously available, ISP will be given to farmers with some delay (one

[1] The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission or Louisiana State University Agricultural Center. The authors thank Jacques Delincé and Fabien Santini for fruitful discussions on an earlier version of the paper, and Javier Alba (and the JRC-IPTS IT department) for technical assistance on virtualisation.

[2] If the farmer experiences a drop of income of more than 30 per cent with respect to an average of the last three years, he will receive compensation up to 70 per cent of the income loss. The legal proposal (article 40) refers to the average annual income of the individual farmer in the preceding three-year period or a three-year average based on the preceding five-year period excluding the highest and lowest entry (Olympic average).

year or two years later) and may well be pro-cyclical, potentially generating adverse effects, partially preventing the fulfilment of their objectives (OECD, 2011). Last, but not least, payments will be given to farmers in exceptional situations of income losses that are mainly determined by prices and yields, which are ex-ante unknown. Indeed, when planning their future operations, farmers cannot observe future prices and yields and have to make forecasts about the future environment in which they will make decisions. As a direct result, there is also some degree of uncertainty surrounding the farm income stabilization programme with regard to: i) whether farmers will receive the payment or not; ii) if they do, on the monetary value provided to the farmer via the income stabilization programme. This additional layer of uncertainty (policy uncertainty) may also play a key role on farm behaviour (e.g. Bhaskar and Beghin, 2010; Mary, 2013a).

In the existing literature, there are a few studies which show that income stabilization programmes may have unexpected and counter-productive effects. For instance, Anton and Kimura (2011) find that farm income stabilization payments in Canada may allow farmers to engage in riskier activities, partially jeopardizing the income stabilization nature of the programme. In another application to Canada, Bhakshi and Gray (2012) highlight that income safety net programmes could significantly distort production and trade through wealth and insurance effects. Yet, there has not been any evaluation of EU's income stabilization payments as the above-mentioned studies mainly focus on North America. The need for EU-specific research is reinforced by the clearly different nature of ISP in the European Commission's proposal. Indeed, unlike the Canadian programme that covers frequent normal risk (i.e. between 15 and 30 per cent income losses), the payment proposed by the EC would cover only dramatic risk, i.e. more than 30 per cent income losses. Further, the farming landscape is quite different in the EU (with small scale farms and diversified enterprise composition) compared to farms in North America, where farms are large and tend to specialize in the production of one or two commodities. This paper fills the gap in the agricultural economics literature and assesses the ex-ante implementation of income stabilization payments on farm input and output decisions in the French crops sector, the largest cereal producer in Europe.

Model

We consider a stylised model of a risk-averse farm producer using farm labour, i.e. its fixed labour ($\overline{N}$) and hired labour (N_t^H), machinery (*K*), and farm land (owned $\overline{L}^o$ and rented L_t^R) to produce an aggregate good *F*, in the face of output price ($\tilde{P}$) and yield ($\tilde{\xi}$) uncertainty. The inputs are combined in the production technology, which is of Cobb-Douglas form and assumes constant returns to scale. While it may appear a somewhat restrictive representation, recent studies have found that both assumptions may be reasonable for French cereal farmers (Mary, 2013a; Mary, 2013b). The function is also econometrically estimated using system GMM estimation and tested against a Translog form via a log-likelihood ratio test. The farmer receives income from the sale of its output and from subsidies. The total amount of subsidies (*TS*) includes the provision of Single Farm Payments (*E*), investment subsidies (*IS*), crop-area payments (*COP*) and an aggregate of other subsidies (*A*). Single Farm Payments are direct decoupled payments. Crop-area payments are paid on a fixed-hectare basis. Additional to these payments, he may receive an income stabilisation payment ($\tilde{G}$) in the case of exceptional income losses. If the farmer experiences a drop of income of more than

30 per cent with respect to an average of the last three years, he will receive compensation up to 70 per cent of the income loss. Note that the farmer is also subject to set aside restrictions (*s*).

Three main types of costs are considered in the farmer's total costs (*TC*). First, he has to pay the farming overheads (*O*), in which we consider machinery and building current costs and costs related to contract work and other direct inputs (e.g. water, insurance, telephone charges). Depreciation (δ) and energy costs (*e*) are also included, proportionally to the level of farm machinery. Second, we consider the cost of external factors, by including wages paid to hired labour (*w*, the hourly wage), rents paid for land (η, the rental rate of land), the repayment of existing long-term loans ($\bar{c}$) and farm taxes (*T*). Third, other variables costs, specific to land use (μ) are included in the model (e.g. seeds, fertilisers, crop protection). Additional to this cost structure, we also model the existence of quadratic capital (Φ) and land rental (Ψ) adjustment costs. Capital adjustment costs allow for more realistic production behaviour. Land rental adjustment costs represent the administrative and regulatory constraints in French land markets.

The farm producer's decision problem is defined as follows:

(1) $$\max_{K_{t+1},N_t^H,L_{t+1}^R} E\sum_t^{\infty}\beta^t U(W_0,\pi_t)$$

$$\pi_t = \tilde{P}_t\tilde{\xi}_t F(K_t,L_t,N_t) + TS_t - TC_t - I_t$$
$$F_t = N_t^{\alpha^N} K_t^{\alpha^K} (sL_t)^{\alpha^L}$$
$$TS_t = E + IS(K_t) + COP(L_t) + A + \tilde{G}_t$$
$$TC_t = O(F_t) + (\delta + e)K_t + wN_t^H + \mu L_t + \eta L_t^R + \bar{c} + T + \Phi(K_t,K_{t+1}) + \Psi(L_t,L_{t+1})$$

Where U is a constant relative risk aversion utility function of the following form $U(W_0,\pi) = \frac{(W_0+\pi)^{1-\gamma}}{1-\gamma}$ with W_0 the initial net worth of the farm and γ the coefficient of relative risk aversion; β is the discount factor and *E* is the expectation operator over price, yield and income stabilisation payment; π is the per-period net profit (or farm net income) of the farmer; *I* is net investment.

While the provision of most government payments is known with certainty, the farmer faces policy uncertainty in that there is some degree of uncertainty on both the provision and the value of the income stabilisation payment, because ISP will depend on the farmer's income situation that is directly affected by current and future prices and yields. In other words, the farmer makes decisions based on current yields, prices, and ISP, but also on his expectations in the evolution of future prices, yields, and ISP.

Numerical calibration and solution

The model is calibrated to the representative French crop specialist farm, using standard reports from the Farm Accountancy Database Network (FADN) public database. The FADN data is at farm level with the samples of farms chosen so as to be representative of French agriculture. The representative farms provide detailed data on farm output, on farm labour supply, farm investment, assets and debts, etc. The public database provides aggregated results as an average of a sample of crop specialist farms in France. We use information for the latest available year, 2009. Information on subsidies, costs, net worth, rented land, hired labour, set aside restrictions is also used in our analysis. We complete the calibration by extracting a few estimates from the literature. In particular, production parameters are taken from Mary (2013b) and the correlation coefficient between price and yield is taken from Mary, Boulanger and Santini (2013). The coefficient of relative risk aversion is set to 2 as is commonly done in the literature (e.g. Bhaskar and Beghin, 2010). The depreciation rate is set within a range of reasonable estimates (e.g. Sckokai and Moro, 2009). Model parameters are shown in Table 1.

Table 1. Model and policy parameters

Model parameters		
Discount factor	β	0.947
Capital elasticity	α^K	0.141
Labour elasticity	α^N	0.305
Land elasticity	α^L	0.554
Coefficient of relative risk aversion	γ	2
Depreciation	δ	0.1
Correlation coefficient between price and yield	ρ	-0.34
Coefficient for capital adjustment	ϕ	300
Coefficient for land rental adjustment	ψ	700
Net worth (in euros)	W_0	163,593
Policy parameters		
Set aside (in ha)	s	5.21
Single Farm Payments (in euros)	E	27,533
Investment subsidies (in euros)	IS	298
Crop-area payments (in euros)	COP	7,632
Other subsidies (in euros)	A	2,472
Costs		
Specific crop costs per ha (in euros)	μ	458
Energy cost parameter	e	0.081
Farming Overheads (in euros)	O	27,790
Farm taxes (in euros)	T	2,145
Hourly wage (in euros)	w	7.6
Rental rate of land	η	123
Debt repayments	$\bar{c}$	3,782

We use a value function iteration method with a binary search acceleration algorithm to solve the farmer's problem. We assume the yields to follow a beta distribution, and the output price to follow a log normal distribution. As prices and yields are negatively correlated, we use a copula approach (Frank), to calculate the joint distribution of output prices and yields.

Simulations

The baseline scenario represents the situation of the average French crop specialist farm in 2009, in which no income stabilisation policy is implemented, but includes all other subsidies. The alternative scenario aims at representing the potential introduction of income stabilisation payments following the EC's proposal for the post-2013 CAP. This payment is granted where the drop in farm income exceeds 30 per cent of the average annual income of the farmer in the preceding three year period (or a five-year Olympic average). The ISP compensates for no more than 70 per cent of the income lost. The definition of income in the legal proposal is somewhat ambiguous in that input costs are not thoroughly defined or that there is no direct reference to off-farm income. In this paper, income is defined as gross farm income (GFI) and computed as the sum of farm revenues from the sale of output and public support (including all subsidies), deducting total intermediate consumptions (this includes farming overheads, external factors, other variable costs) and farm taxes. The issue of off-farm income is also particularly delicate; while income from off-farm work is excluded from the definition of income, the EU's interpretation of the term income derived from agriculture may include sources of income that are derived from the fact of being engaged in agriculture, but are not associated with any particular agricultural production. The main problem with modelling such incomes is that there is no information in the FADN database and therefore prevents studying the role of additional income.

Furthermore, while we measure the accurate value of the income stabilization payments, the payment is given to the farmer one year after the fall in farm income, in order to explicitly model delays in paying farmers. We do not model the possibility to give early partial payments. For sensitivity analyses, we also model two alternative policy scenarios which are variants of the scheme as defined in the Commission's proposal. The first variant includes the provision of an ISP when the drop in gross farm income exceeds 15 per cent of the average annual income. The second variant of the programme models the ISP of up to 70 per cent of the income loss when the drop in gross farm income exceeds 30 per cent of the average annual income. Table 2 summarises the policy scenarios.

Table 2. Policy scenarios

Scenario	Income stabilisation	Risk cover	Compensation
Baseline	No	n.a.	n.a.
ISP-EC	Yes	Dramatic risk (>30%)	70%
ISP-V1	Yes	Normal and dramatic risk (>15%)	70%
ISP-V2	Yes	Dramatic risk (>30%)	85%

Results

Table 3 presents the average impacts of an ISP (as proposed by the EC), on farm input and output allocation decisions, over a period of 5 and 10 years. We consider the 5-year and 10-

year time horizons to be reasonable benchmarks, for the medium-term and long-term, respectively. The main message is that, despite potentially significant impacts on input and output decisions, the ISP scheme described in the Commission's proposal reduces gross farm income volatility in French crop farms.

The average impact on farm output remains small in the longer run (-0.35). This result might seem to confirm that such a tool may not be distortive on production and tends to validate *ex post* the Green Box criteria established in Annex 2 of WTO Agreement on Agriculture[3]. However, the average final impact on production masks some significant differences in how the ISP affects input decisions. While there is no impact on farm hired labour, an ISP substantially affects both capital and land in the farm decision-making. In our medium-term simulations (5 years), we find that rented land increases by approximately 0.3 per cent and that farm capital decreases by 3.66 per cent. The impact on farm capital results from a significant increase in investment volatility (+41.52%).

Table 3. Average impact of income stabilisation payments, in %

	Baseline	ISP-EC	
		T = 5	T = 10
Gross farm income (in euros)	60,766	-0.29	-0.34
		(0.000)	(0.001)
GFI volatility (in euros)	5,653	-0.79	-0.72
		(0.047)	(0.005)
Output(in euros)	106,854	-0.38	-0.35
		(0.001)	(0.003)
Rented land (in ha)	87.15	0.31	0.57
		(0.003)	(0.007)
Machinery (in euros)	69,208	-3.66	-4.32
		(0.007)	(0.012)
Machinery volatility(in euros)	3,395	41.52	10.05
		(0.113)	(0.073)

Note: standard deviations in brackets. Results over 20,000 correlated simulations of prices and yields.

[3] The Green Box is defined as "support measures for which exemption from the reduction commitments is claimed shall meet the fundamental requirement that they have no, or at most minimal, trade-distorting effects or effects on production".

More fundamentally, the calculation of income volatility shows that an ISP plays a key role in reducing farm income fluctuations as average income variability is reduced by almost 0.8 per cent in our simulations after 5 years (Table 3). This effect remains in the longer run (10 years) as the volatility of gross farm income is reduced by 0.72 per cent. In other words, in contrast with Anton and Kimura (2011), we find that income stabilisation payments are efficiently reducing the farmer's exposure to income fluctuations (relative to the situation without ISP). The difference in results may be due to the different types of income stabilisation payments studied and the type of risk covered, i.e. frequent normal risk – between 15 per cent and 30 per cent income losses – and dramatic risk, i.e. more than 30 per cent).

Table 4 (appendix) provides some evidence that confirms our original conjecture. In the alternative scenario ISP-V1, the programme covers frequent normal risk as well as dramatic risk. We find in this case that the programme implies more volatile gross farm incomes as the volatility of NFI would increase by 0.10 per cent after 5 years. It is also noteworthy that this variant of the ISP would have much lesser impacts on machinery and output. For example, under this scenario, farm machinery would decrease by more than 1.79 per cent, in the long run, contributing to a slight increase in farm output in the longer run (0.25), although the amount of rented land would increase by 1.1 per cent during the same time period.

On the contrary, the last variant of the ISP scheme (Table 4), implying a higher compensation in the case of large income losses, would have relatively larger impacts on farm output. This is mainly because farm rented land would be much less affected in comparison with results displayed in Table 3. Also, the scheme would induce a decrease in the volatility of GFI, especially in the medium-term. Results in table 4 show that the volatility in gross farm income would decrease by about 1 per cent in the short run and by 0.87 per cent in the long run.

Finally, we also implement some sensitivity analyses with respect to the coefficient of risk aversion (Table 5 in appendix). While the main patterns of results remain the same, the role of risk aversion becomes clear in the effects that ISP have on farm decisions. When the farm producer is less (more) risk-averse, the income-stabilising effect of the programme reduces (increases). For example, when $\gamma = 1.2$, income volatility is only reduced by 0.4 per cent after 5 years against 0.8 per cent when $\gamma = 2$, or 0.94 per cent when $\gamma = 2.8$. Similarly, the impacts of the programme on farm output seem to vary with the level risk aversion. With a relatively high coefficient of relative risk aversion, farm output would decrease by almost 0.7 after 10 years.

Conclusions

The EC is likely to introduce ISP in the post-2013 CAP. The specific structure of the policy scheme proposed by the EC calls upon the need for empirical research. We develop a stylised model of a risk-averse farm producer to examine the impact of the implementation of ISP for a representative French crop specialist calibrated on information publicly available through the public FADN database, for the year 2009.

Results from this ex-ante evaluation confirm that on average ISP can be effective in fulfilling their objective of income stabilization. This is in contrast with Anton and Kimura (2011). However, sensitivity analyses also suggest that if some degree of subsidiarity was to be given to Member States in the application of the programme, for the level of compensation or the threshold at which the payment is triggered, this policy programme could potentially have adverse effects, which ultimately lead to more volatile incomes. This result is particularly of interest to European policymakers and requires more research to understand better the mechanisms of farm income stabilization scheme.

We also find that such payments may have important effects on farm input decisions, but those do not seem to manifest into sizeable effects on farm output. In other words, our results may suggest the absence of potential output distortions. In terms of the WTO, this would confirm the Green Box nature of income stabilization payments, as designed by the EU. This result is not consistent with the findings of Bhakshi and Gray (2012) though they are obtained in a different context. However, sensitivity analyses with respect to the policy design and to the role of risk aversion suggest the possibility of significantly higher output distortions. On the regulatory level, these results obtained from sensitivity analyses would call for the redefining of Green Box subsidies and confirm the difficulty in designing support instruments which fulfil their objectives without unwanted side-effects.

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Appendix

Table 4. Average impact of variants of income stabilisation payments, in %

	ISP-V1		ISP-V2	
	T = 5	T = 10	T = 5	T = 10
Gross farm income (in euros)	-0.06	-0.08	-0.31	-0.36
	(0.000)	(0.001)	(0.000)	(0.001)
GFI volatility (in euros)	0.10	0.16	-1.06	-0.87
	(0.021)	(0.004)	(0.039)	(0.005)
Output(in euros)	0.13	0.25	-0.58	-0.51
	(0.001)	(0.004)	(0.002)	(0.004)
Rented land (in ha)	0.65	1.10	-0.14	0.20
	(0.004)	(0.008)	(0.003)	(0.008)
Machinery (in euros)	-1.23	-1.79	-3.58	-4.22
	(0.005)	(0.010)	(0.006)	(0.010)
Machinery volatility(in euros)	15.86	7.08	39.94	9.74
	(0.111)	(0.066)	(0.110)	(0.066)

Note: standard deviations in brackets. Results over 20,000 correlated simulations of prices and yields.

Table 5. Average impact of income stabilisation payments with different CRRA coefficients, in %

	ISP $\gamma = 1.2$		ISP $\gamma = 2.8$	
	T = 5	T = 10	T = 5	T = 10
Gross farm income (in euros)	-0.20	-0.24	-0.29	-0.34
	(0.000)	(0.001)	(0.000)	(0.001)
GFI volatility (in euros)	-0.40	-0.29	-0.94	-1.02
	(0.022)	(0.005)	(0.054)	(0.004)
Output(in euros)	-0.14	-0.10	-0.62	-0.69
	(0.002)	(0.003)	(0.001)	(0.003)
Rented land (in ha)	0.52	0.81	-0.38	-0.34
	(0.004)	(0.008)	(0.003)	(0.007)
Machinery (in euros)	-2.71	-3.31	-3.08	-3.68
	(0.006)	(0.010)	(0.006)	(0.011)
Machinery volatility(in euros)	29.31	9.45	35.48	9.86
	(0.095)	(0.063)	(0.096)	(0.076)

Note: standard deviations in brackets. Results over 20,000 correlated simulations of prices and yields.