Linking marketing choices with farming practices of grain producers: a farm level modeling approach applied to the south-west of France

A. Ricome, C. Képhaliacos, F. Carpy-Goulard, A. Ridier, K. Chaïb

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Introduction

- CAP changes
- Increasing world commodity price volatility

} Increasing ex ante price risk/uncertainty

- A few tools can help farmers to cope with this rising price risk:
  - revenue insurance
  - Marketing contracts
  - Farm level adjustments (on-farm strategies)
- Marketing contracts are playing an increasingly important role for EU farmers
- There is a need to understand how EU farmers will « react » to this new context

Introduction

- Theory of the firm under price uncertainty shows that risk averse farmers modify their production decision (Sandmo, 1971; Batra and Ullah, 1974)
- Holthausen (1979), Feder et al. (1980) proposed a « generalized » theory of production under price uncertainty (incorporate a forward market)…
- …The production decision is not anymore subject to risk considerations. Production level is:
  - determined by the forward price
  - independant of the degree of risk aversion and subjective probability distribution of the uncertain price
- …then, risk averse farmers should benefit from hedging instruments

objectives

- Based on this theroretical framework, we propose an applied study to investigate how price risk and risk aversion affect:
  - Production choices
  - Marketing choices
  - Links between production and marketing choices
- More precisely: could marketing alternatives help farmers, confronted to uncertainty, to use risky but environnementaly-friendly practices ?

Method

- We develop a multiperiodic mathematical programming model that incorporates the possibility of using marketing alternatives under price and output uncertainty

The farm model

- Multiperiodic: planning horizon of 2 years
- 12 periods per year
- 6 crop activities
- 3 land types
  - 2 dry land types (clay muddy soil and sandy-clay soil)
  - 1 irrigated land
- 2 farming practices
- 4 pricing arrangements
- Specific states of nature for yield and price

The farm model

- Constraints on:
  - Crop rotation
  - Land resource
  - Stock constraints
  - Liquidity constraints (with an opportunity of short-term credit)

The farm model

- The farmer's decision problem:
  - Production decisions:
    - crop mix
    - farming practices
  - Marketing decision: set of marketing contacts to select, conditional to states of nature of yield
  - Short-term financing decision

The farm model

- Objective function: discounted expected utility of the net profit
  - Risk preference: DARA-CRRA (power functional form of the utility function)
  - Time preference : (related to storage)

Empirical analysis and Data (Farming practices)

- Intensive crop management system (conventional)
- Crop management system inspired from Integrated Pest Management (IPM) (intergrated):
    - Pesticide and fertilizer reduction techniques
    - Lower prodution costs
    - Almost equal yields…
    - …But higher yield risk

Empirical analysis and Data (marketing contracts)

- For each crop, there are different pricing arrangements:
  - K1: average sale price per quarter
  - K2: cash at harvest
  - K3: forward contracts
  - K4: post-harvest marketing contract (storage)

Empirical analysis and Data

- 3 farm types derived from a typology of large arable farm of the studied area (data from FADN)
- we selected the intermediate one (in terms of land size and irrigation density)
- Cost, return data and yield have been estimated according to the regional experts'references database and direct interviews of expert
- Contract specific crop prices: deflated national time-series observations of national monthly commodity prices (1993-2008)

Risk assessment

- Procedure adapted from Richardson et al. (2000):
  - Normal distribution assumed (yield and price)
  - Historical intra-temporal correlations
  - Historical inter-temporal correlations
- Monte-carlo sampling to generate 20 states for each set of states of nature

(Preliminary) Results

- Case 1: a unique contract: cash at harvest contract (K2) = only production choices allow to mitigate risk
- Case 2: all contracts are available = the farmer is able to choose between marketing and technical choices to mitigate risk

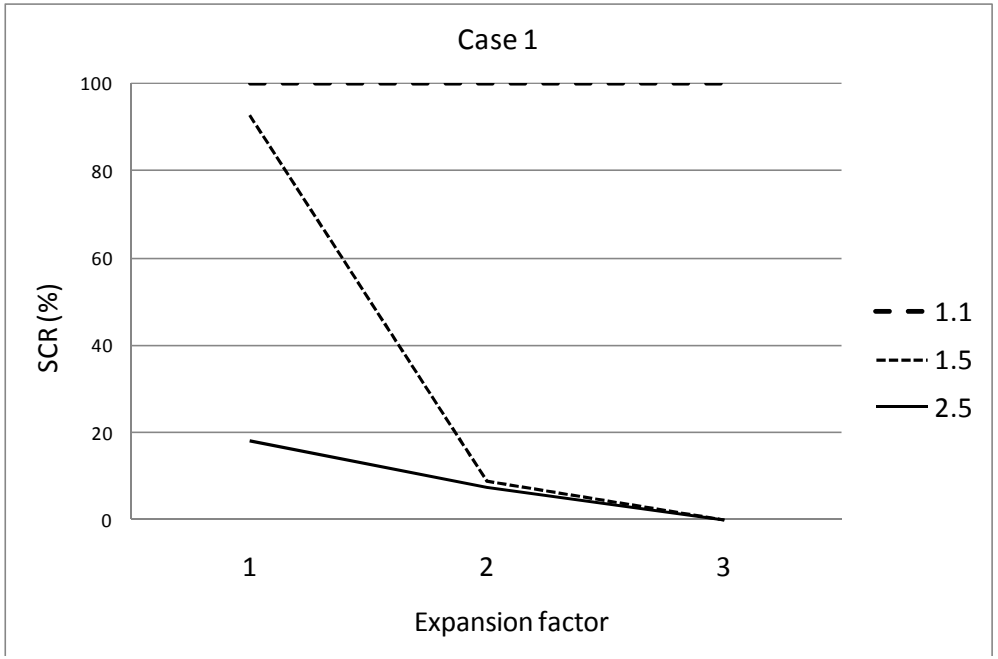
(Preliminary) Results

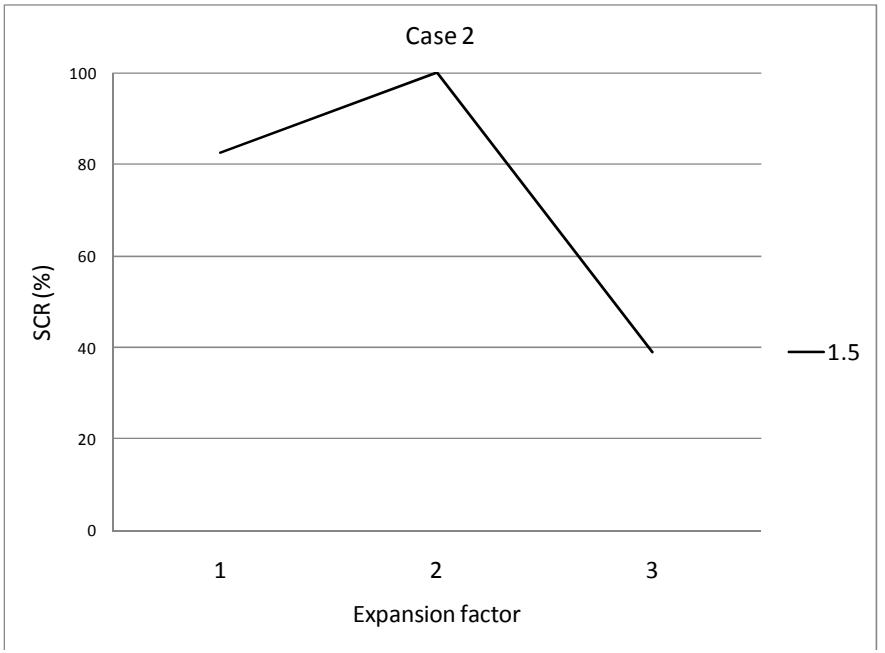
- Simulation 1: increase in the coefficient of the relative risk aversion (r)
- Simulation 2: raise of the volatility of crop price: multiplication of the SD of each contract specific crop price by an expansion factor (E)

	Simulation 1	Simulation 2
Case 1	✖	✖
Case 2		✖

Effect of risk aversion and price risk on farming practices (comparison case 1 and 2)

- Case 1:
  - The higher the risk aversion of the farmer, the lower the Simulated Conversion Rate (SCR)
  - When price volatility increases, there is a decrease in the SCR for risk averse farmers (r ≥ 1.5)
- Case 2: The drop in the SCR is less dramatic (go down to 40%)





Effect of risk aversion and price risk on crop mix (case 1)

- The higher the risk aversion of the farmer, the higher the crop diversification
- When price volatility increases, risk averse farmers diversify crop activities

coefficient of relative risk aversion	0			0.9			1.1			1.5			2.5		
Expansion factor	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
simulated conversion rate (SCR)	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**92.7**	**8.9**	**0**	**18**	**7.4**	**0**
optimal cropping plan:															
conventional:															
Durum wheat										7.3	45.6	52.4	3.9	26.9	49.2
Soft wheat													38.1	18.7	
Irrigated corn											15.1	24	24	24	24
Dry corn											28	14	7.2	11	15
Sunflower											2.4	9.6	9.3		10.5
Rapeseed														12	1.3
integrated:															
Durum wheat	57	57	57	57	57	57	57	57	57	39.1					
Soft wheat													3.6		
Irrigated corn	24	24	24	24	24	24	24	24	24	24	8.9				
Dry corn										28					
Sunflower					1.4	9.1		1.8	9.2					7.4	
Rapeseed	19	19	19	19	17.6	9.9	19	17.2	9.8	1.6			13.9		

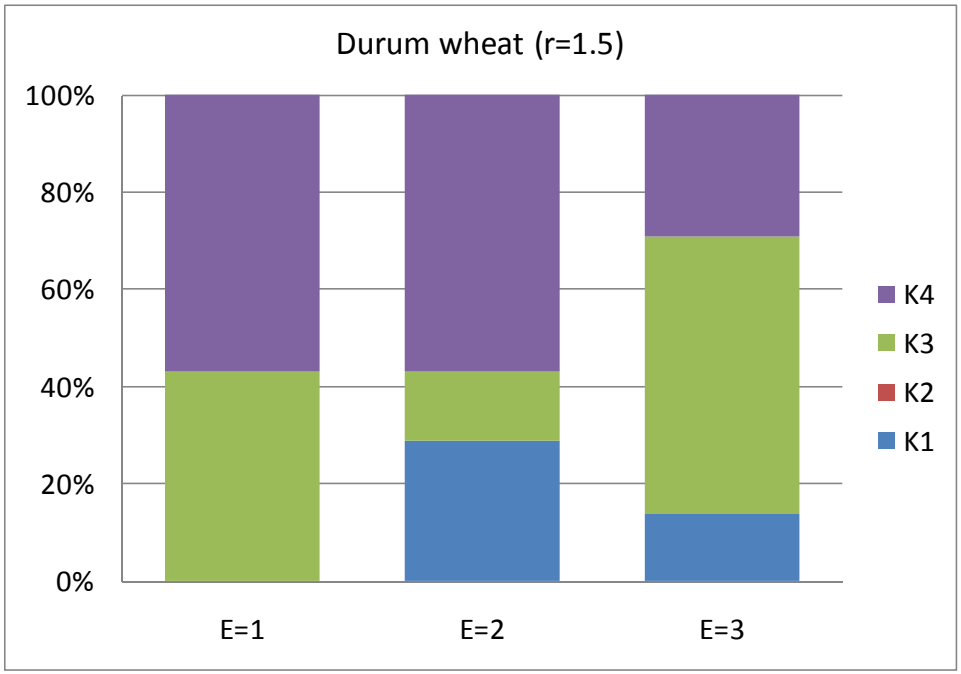
Effect of risk aversion and price risk on crop mix (comparison case 1 and 2)

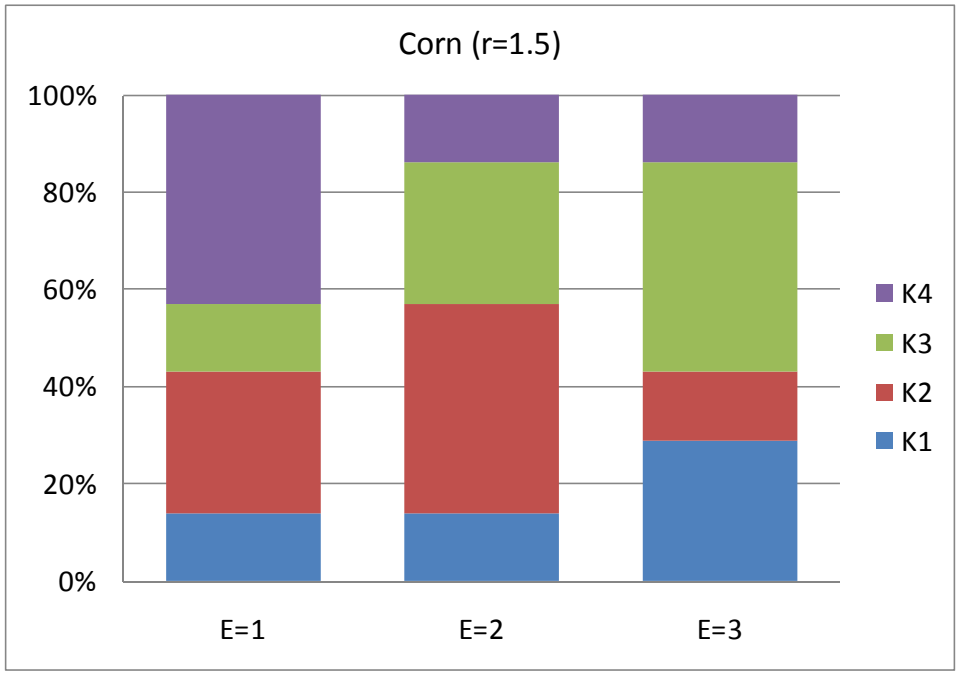
- Crop mix chosen by a risk averse farmer (r=1.5) in case 2 is similar to the crop mix of a risk neutral farmer:

	case 1 (r=0)			case 2 (r=1.5)		
expansion factor (E)	1 (baseline)	2	3	1 (baseline)	2	3
optimal cropping plan (ha):						
conventional:						
durum wheat						
soft wheat						30.6
irrigated corn						
dry corn						
sunflower				17.5		
rapeseed						30.4
integrated:						
durum wheat	57	57	57	57	57	15
soft wheat						
irrigated corn	24	24	24	24	24	24
dry corn						
sunflower				1.5	19	
rapeseed	19	19	19			

Marketing choices (case 2)

- When price risk becomes severe, quantities stored decrease while the hedge ratio increases
- e.g: marketing choices for the 2 main crops in year 1





Conclusion

- Sensibility analysis presented here shows how the model reacts to different values of the main parameters…
- No marketing tools to manage price risk (case 1):
  - Increasing risk aversion or price risk lead to:
    - A large switch towards risk-decreasing conventional farming practices
    - An increase in the crop diversification
    - Hardly risk averse farmers can manage partially price risk without any change to farming practices (but there is still change to production choices)
- Marketing contracts are available (case 2):
  - Increasing risk aversion or price risk lead to:
    - A decrease in the storage and an increase in the hedge ratio
    - A weaker decrease in the SCR

Conclusion

- In the study area, price risk level and risk aversion could actually play a role in the low adoption rate of environmentally-friendly farming practices…
- But marketing strategies could help to maintain the use of innovative techniques
- Production risk and marketing alternatives need to be jointly analysed to study the relevance of environmentally friendly technologies for farmers

Conclusion

- Labour constraints are not taken into account (favourable to the integrated practices)
- Further analysis is needed. Role of the other factors included in the model :
  - Liquidity and credit constraints
  - CAP change (SFP…)
  - Natural hedging (farmer's expectations…)
- …it could affect the adoption rate of hedging strategies obtained…and the production choices