Uncertain and irreversible benefits and costs of the adoption of Bt maize.

Results from the MISTICs model

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Background

- The EU has laid out the basic decision on coexistence
  - Freedom of choice for farmers, processors and consumers
  - Actual measures decided at country level

- Coexistence starts at the farm level

- Coexistence measures at farm level should minimize mixing
  - Main worry for maize: outcrossing
  - Different coexistence measures possible
  - Different measures = different (perceived) costs

The PRICE project

- EU FP-7 Research project: PRactical Implementation of Coexistence in Europe

A part of the project:

- Choice experiment with farmers in three countries
  - Tease out aversion against certain coexistence measures
  - Likelihood of Bt maize adoption under different scenarios

Scaling up to welfare analysis

- Introduction of new technology has irreversible benefits & costs
  - Cannot be recouped or returned on disinvestment
  - Irreversible Costs: speculative and unknown
  - Irreversible Benefits: reductions in pesticide use

- There is also uncertainty about benefits and costs
  - Maize price may go up or down

- Decision on when technology is introduced is flexible
  - Opportunity to learn about price developments

Welfare analysis with irreversibilities, uncertainty and flexibility

- Three important factors:

1. Irreversibility
2. Uncertainty
3. Flexibility
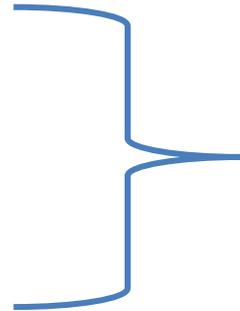
Standard cost-benefit analysis = biased

- Because it does not account for flexibility and learning

- Unbiased alternative: Real Options Method

Cost-benefit versus real options

CBA says:

Introduce technology when total benefits > total costs

Real-option frame work says:
Introduce when:

$$W \geq H * (I - B)$$

With
W: reversible net benefits
I: Irreversible costs
B: Irreversible benefits
H: Hurdle rate (accounts for uncertainy, larger than 1)

MISTICs

Problem: irreversible costs = unknown

We can get estimates for the others -> turn formula upside down

$$I^* \leq \frac{W}{H} + B$$

I = MISTIC, maximum incremental social tollerable irreversible costs

Estimate of how high we think the irreversible costs are when we choose not to introduce the crop.

Estimating (ir)reversible net benefits and uncertainty factor

- Reversible net benefits: gains in "consumer" and producer surplus
  - Estimated through shift of supply curve
  - Shift depends on:
    - Estimated gross margin change
    - Estimated adoption curves (from choice experiments)

- Irreversible benefits:
  - Valuation of pesticide reduction
  - Amount of reduction from adoption curves

- Uncertainty factor: movement of maize prices

Scenarios examples: Germany

Attribute	Scenarios Germany	
	Scenario 1	
Minimum distance (0, 50, 100 meters)	100	
Sowing difference (0, 2, 4 weeks)	0	
Only liable when coexistence rules were not followed(0=no,1=yes)	0	
Liable even when coexistence rules were followed (0=no,1=yes)	1	
Informing the neighbours (0=no,1=yes)	1	
Informing the public (0=no,1=yes)	1	
Potential adoption (θ_{max})	**30.218**	

Resulting MISTICs

Germany				
	Scenario 1	Scenario 4	Scenario 5	Unit
Hurdle rate	1.09	1.09	1.09	
MISTIC	42.63	10.78	51.95	Mil. € per annum

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Examples: UK & Spain

Attribute		
Minimum distance (0, 50, 100 meters)		
Sowing difference (0, 2, 4 weeks)		
Only liable when coexistence rules were not followed(0=no,1=yes)		
Liable even when coexistence rules were followed (0=no,1=yes)		
Informing the neighbours (0=no,1=yes)		
Informing the public (0=no,1=yes)		
Potential adoption (θ_{max})		

Resulting MISTICs

	Spain		UK		
	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Unit
					Mil. € per annum
					Mil. € per annum
					Mil. € per annum
MISTIC	6.02	8.44	18.17	8.47	Mil. € per annum
					€/per capita per annum
					€/per household per annum
					€/per farmer per annum

Conclusion

- We estimated MISTICs of Bt maize introduction for three countries

- The MISTICs for Germany are relatively low (due to low adoption)

- Tougher coexistence measures = less adoption = less benefits BUT also lower MISTICs

- On a per farm level MISTICs are roughly similar in Germany and Spain: 200-400€/annum. UK is more

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