Multiple Adoption of Pest Management Technologies in UK Cereal Farming

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Opener I (Strauss)

- We consider the adoption of pest management technologies by farmers in UK cereal crop systems
- Chemical control of pest outbreaks is still popular.
- But, there are a range of non-chemical approaches and management practices.
- Consider determinants of adoption of different combinations of individual pest management technologies.
- Objective – try & understand which technologies and pest management practices likely to be used and in which combination by UK cereal farmers.

Opener II (Cook)

- Briefly Review Policy Domain & Antecedent Literature
- Explain how we generate technology choice sets
- Describe the data
- Present key results
  - PCA
  - Multinomial Regression results
- Summary/Conclusions

Policy Domain (Trott)

- Chemical pesticides very important in ag productivity
- Number of drivers changing feasible set of technologies
- Voluntary Initiative (VI), Agri-Environmental Policy (AEP), EU legislation
- DEFRA (2004) listed 12 pest management activities used as part of integrated pest management (IPM) plan
- Eg, conservation headlands, beetle banks, grassy field margins and strips of pollen and nectar mixture, crop rotation, crop varieties, alternative forms of cropping.

Multiple Technology Adoption (Pietersen)

- Reasonably small literature (mixture of problem & methodological innovation)
- Need to understand "what is a technology set"
- In multiple technology setting we need to understand what is assumed to be adoption – ad-hoc
- Dorfman (1996) – defines 2 technology sets (irrigation and IPM)
- Irrigation – 4 practices (1 → adoption)
- IPM – 10 practices (3 → adoption)
- Llewellyn et al. (2007) – 6 practices (3 → adoption)

Econometric Modelling (Collingwood)

- Multiple adoption lends itself to:

1. MNL (Wu and Babcock, 1998)
2. But IIA leads to MNP(Dorfman, 1996)
3. Issues of selection (Wu and Babcock, 1998)
4. Issues of selection & sequential adoption (Khanna, 2003)

- We employ MNL (preliminary)
- Currently examining selection/endogeneity

Data Set Technologies (Bell)

Pest Management Technology Adoption (n=513)

Technology	Percentage Adopted
Rotating crops	75
Treat seeds/seedlings (chemical, heat, microbial)	68
Field Margins	68
Adjusting Time of planting	58
Using Disease Resistant Varieties	58
Using Different Varieties in the Field	56
Hand rogueing	56
Rotate Pesticide Classes to Avoid Resistance	54
Spot Spraying/spraying field edges	51
Cultivation or using rotary hoe for weeds	33
Using Flower Strips to encourage beneficial insects	28
Bettle banks	22
Using Pheromones to monitor and control insects	21
Using Mixed Varieties in the field	7
Introduce predators/parasites of insect pests	6
Using a Trap crop	3

PCA (Prior)

Technology Sets

Technology Set One "Integrated Weed Control"	Technology Set Two "Integrated Insecticide Control"	Technology Set Three "Conservation Bio-Control"
Cultivate Weeds	Pheromones	Trap Crops
Crop Rotation	Spot Spraying	Introductions
Timing of Operations	Rotate Pesticide Classes	Field Margins
Hand rougeing	Resistant varieties	Beetle banks
Mixed Varieties	Different varieties	Floral Strips
	Treat seeds	

Technology Sets (Bresnan)

- **Three technology sets:**
  'integrated weed control' {1,0,0}
  'integrated insecticide control' {0,1,0}
  'conservation bio-control' {0,0,1}

- **Adoption (=1) if at least 2 elements technology set employed.**

- **8 portfolios: {0,0,0}, {1,0,0}, {0,1,0}, {0,0,1}, {1,1,0}, {1,0,1}, {0,1,1}, {1,1,1}.**
- **The distribution of adoptions technology set for the 513 farms are as follows: (73, 60, 42, 13, 146, 42, 14, 123)**

- **73 out 513 farms - adopted zero**
- **146 have adopted portfolios of sets one and two**
- **123 farms have adopted a portfolio containing all sets.**

MNL Results I (Swanne)

- All technology sets except {0,1,1} have some statistically significant coefficients
- Particularly a function of fact only 14 out 513 adopt this set.
- If zero adoption – negative relationship VI
- If adopt {1,1,0} – negative relationship with AEP
- If adopt {0,0,1} – Age/Age^2 positive

MNL Results II (Tremlett)

- If adopt {1,1,1} – Area, Other Crop, Full Time, Envir Help, VI and AEP positive and significant
- Only growing Wheat is negative
- Re-estimate models – delete insignificant regressors (passes LR test)
- For {0,1,1} now Area and Env Help positive
- No other significant changes

Summary (Anderson)

- Paper examines what constitutes adoption
- How to generate variables that describe a technology (PCA)
- When does adoption occur (arbitrary choice)
- Employ MNL to try and explain adoption
- Results indicate limited number of farm/farmer characteristics
- Farm size – important explanatory variable
- Limitations – econometrics (IIA/Selection)

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QUESTIONS