POLICY INSTRUMENTS FOR ECOLOGICAL TRANSITION: UNDERSTANDING FARMERS' MOTIVATION AND DECISION STYLES

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INTRODUCTION

Why this focus ?

30+ years of agro-environmental policies…have changed some practices, but have they delivered on promises?

Time for a behavioural turn in agricultural policy making

Build policies that build on realistic knowledge about farmers

Using Danish pesticide taxes as an example

OUTLINE

- Background: Danish pesticide policies
- Pesticide tax I: design and response
- Farmers motivation and decision styles: what we know
- Pesticide II: design and response
- Discussion: results in light of knowledge about farmer motivation
- IPM /sustainable practices: where are Danish farmers on that
- Implications for policy design

BACKGROUND

- Denmark: successive action p
- More or less successful
  - Pesticide use reduced 'init
  - BUT less than expected b

Table 13.4. Treatment frequency index (TFI) in wheat and yield in wheat (2006/2007)

	UK (2006)	France (2006)	Germany (2007)	Denmark (2007)
TFI in wheat	6.74	4.1	5.8*	2.62
Wheat yield, tonnes per ha.	8.0	6.9	7.3	7.3

Source: Jørgensen and Jensen 2011. Note: *Snail pesticides not included.

- Check behavioural assumptions in ex ante models
  - Farmers as profit maximizers
    - I.e. driven by economic gain
    - I.e. decisions made through utility calculations
- How does this match what we know about farmers?

PESTICIDE TAX I – DESIGN AND RESPONSE

Danish pesticide tax up until 2013:

Value added on retail price

Tax rates:

54 pct. on insecticides,

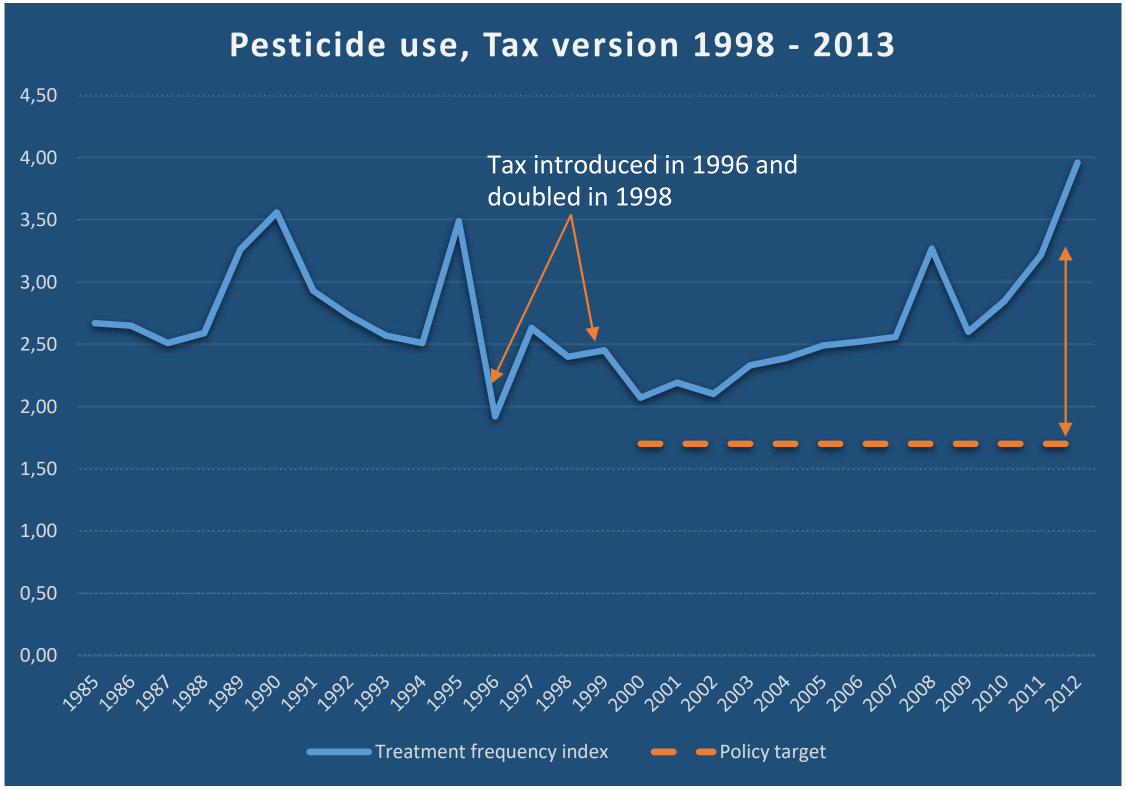
33 pct. on herbicides and fungicides

Objective:

Treatment frequency indicator at 1.7

Results:

- Reduction to around 2,1 in 2000
- Since then: steady increase



MOTIVATION

Table 1. How important are the following objectives for your usage of plant protection chemicals. Please mark a number between 1 and 5 where 1 equals not important at all and 5 equals very important (%), N varies.*

Rationale	1	2	3	4	5	Do not know	Mean score*
Ensure greatest crop yield	1	2	15	40	41	0	4.2
Forestall future problems	1	5	20	44	29	0	3.9
Professional ambition to use few chemicals	2	7	26	37	28	0	3.8
Environmental protection	3	6	29	40	21	1	3.7
Price of crop	3	7	27	38	24	1	3.7
Clean fields	1	12	33	38	16	1	3.6
Price, herbicides	3	9	33	35	20	1	3.6
Price, fungicides	3	9	31	35	20	2	3.6
Price, insecticides	6	12	34	28	16	4	3.4
Costs of bringing out	11	24	30	25	10	1	3.0
Work time, planning	15	20	32	25	8	1	2.9
Price, growth inhibitors	24	14	20	14	11	16	2.7

N=1164

Source Pedersen et al. 2012

Mixed motives……but

Three groups of farmers:

1) Focus on prices of chemicals (45 pct)

2) Focus on production, especially crop yield and clean fields (32 pct.)

3) Limited focus on production goals (18 pct.)

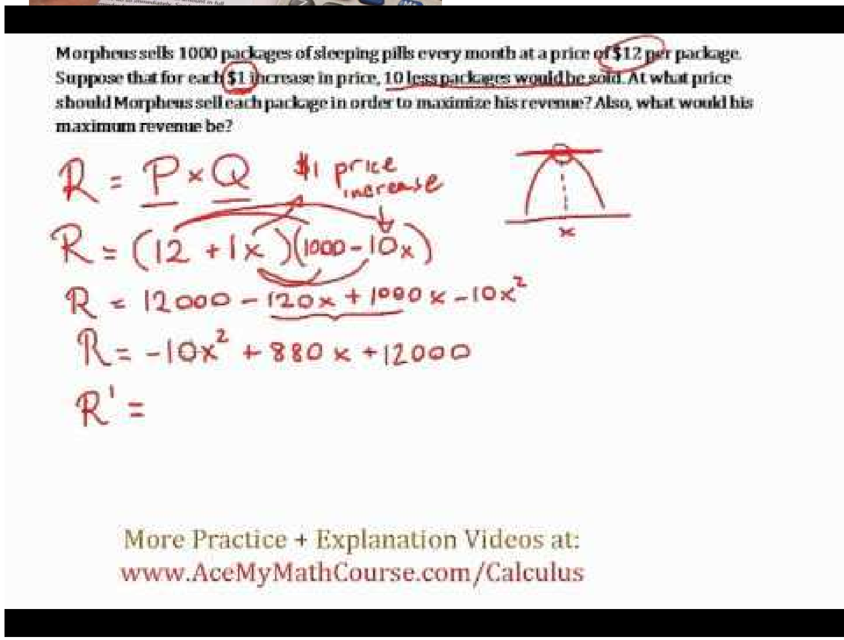
Price focused farmers more likely to respond to significant tax increase

Production focused farmers less likely to respond to significant tax increase

DECISION STYLES

- Heuristics driven –
  - ‘Common sense’
  - Routines and experience
  - Risk prevention at the expense of other criteria
  - Farming norms about ‘clean fields’

Sources: Pedersen et al. 2011, Nielsen 2010



PESTICIDE PLAN, 2013-2016 (CONT. 2017-2021)

Adopted in June 2012, implemented in the summer of 2013

Most important policy instrument: Revised pesticide tax.

- tax differentiated according to impact on environment and health of each product, based on a newly developed indicator (PL)
- Increase in tax rates
- Revenue returned to farmers through reduced taxes on land

Objective:

- Reduction in pesticide load by 40 pct. (sales) by 2015/16, (base year 2011
- Pesticide Load Indicator (PLI) to be reduced to 1.96

Source: (Danish) Ministry of Taxation 2017

PESTICIDE TAX II: DESIGN

TAX BASES	TAX RATES
Basic tax	50 kr./kg active substance (6.5 EUR)
Health	107 kr./kg pesticide pr. unit load index (13.9 EUR)
Environmental effect	107 kr./kg active substance pr. unit load index
Environmental behaviour	107 kr./kg active substance pr. unit load index
	(1 kr. = 0.13 EURO)

Calculation for each pesticide

Average tax rate increased by 125 pct.,
Significant variations:
quadrupling of price on some products; price reductions on others

PESTICIDE TAX II: RESULTS

Sales:

40% reduction load

Use:

Pesticide Load ha (PLI)

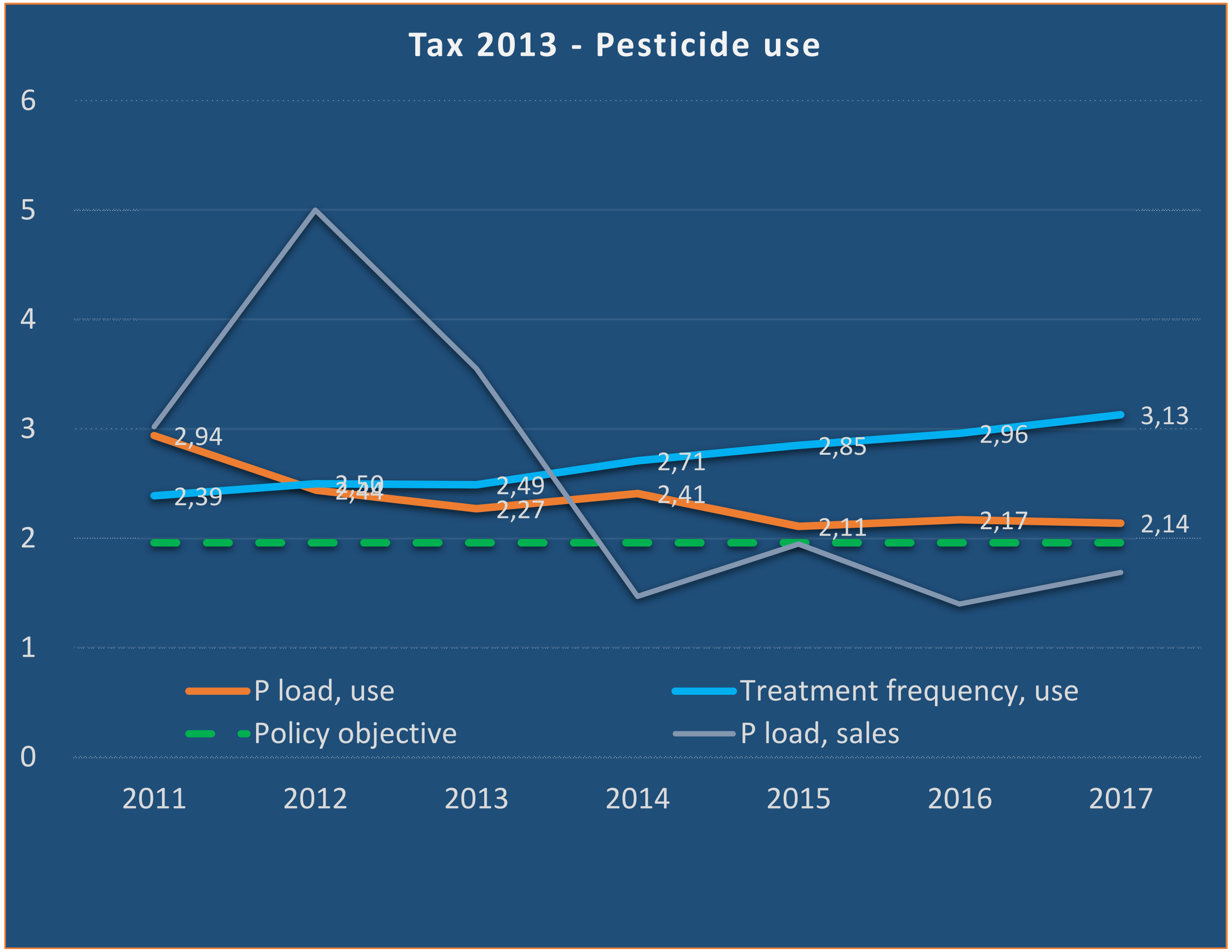
- reduction 27 pct. (2011 to 2017)
- level vs target: 2,14 vs 1,96

Treatment frequency: increase

Conclusion: Tax works,

More sustainable use of pesticides

...but smaller reduction less than economic modelling predicted



DISCUSSION: DESIGN AND RESPONSES

Why has new tax been more effective?

- Price signal is stronger!
- Price signals hamfullness?
- Allows farmers to *substitute* towards more sustainable products ?– can still treat crops

Still: Reduction not completely in line with economic optimization calculations

Motivation ?

- 46 pct. indicate substitution of pesticides primarily due to price increases
- Farmers who have higher scores on production objectives have higher pesticide load
- Farmers who have higher scores on environmental objectives have lower pesticide load
- Farmers who are worried about pesticide resistance have higher pesticide load

So: farmers measure success in different ways – how they measure success will condition susceptibility to sustainable practices and responses to policy instruments

SOURCE: Nielsen et al. forthcoming

DANISH PESTICIDE TAX: A SPECIAL CASE?

Table 7 Cambridgeshire farmers' criterion of 'good' farmer by farm size

	SIZE OF FARM BUSINESS SMALLER	MIDDLE SCORE	LARGER
Good Farmer is one who:			
Produces best crops or livestock	42	36	46
Leaves the land better than he found it	40	41	33
Is progressive, up-to-date, experimental	23	37	32
Preserves the beauty of the countryside	21	11	11
Is most satisfied with his life	32	42	8
Is making most money	10	13	19
Owns his land	11	16	7
Is not indebted	6	7	14
Cares most about well-being of workers	13	17	24
Is well-established in farming community	6	3	12
Number of farmers	31	31	31
Summary:			
Intrinsic	32	31	31
Expressive	32	42	7
Instrumental	9	12	13
Social	10	10	18

Scores for small farmers differ significantly from middle ($p < 0{\cdot}005$)
Scores for small farmers differ significantly from large ($p < 0{\cdot}001$)
Scores for middle farmers differ significantly from large ($p < 0{\cdot}001$).

Source: Gasson 1973

Studies of uptake of AESs – determinants

- Motivation
  - Environmental/conservation
  - Economic/instrumental
- Cognitive factors/biases
  - Knowledge about new practices, confidence about abilities
  - Perceived cost/benefit > actual
  - Risk aversion and uncertainty
- Social and professional norms
  - Farmer/consultant
  - Family/neighborhood:

+ FIT of scheme design

Sources. Dessart et al. 2019; Lastra-Bravo et al. 2015.

WHAT ABOUT IPM ETC? (NIELSEN ET AL. FORTHCOMING)

To what degree use these practices? Pct.	1	2	3	4	5
Time sowing to minimize weeds	12	12	25	29	22
Use advisory services on IPM	41	13	18	15	10
No till	70	11	8	4	6

Risk associated with use of pesticidesPct.	1	2	3	4	5
Reduced yield if reduce use of pesticides	2	5	15	40	37
Development of resistance to substances	2	10	27	33	23
Risk to health from handling of pesticides	21	35	27	11	4
Pollution of ground/drinking water	31	42	15	5	3

Attitude - agreement with statement? Pct.	Disagree very much	Disagree	Neutral	Agree	Agree very much
The substances approved for use in Denmark are so harmless to the environment that we do not need to focus on reducing use	7	14	29	26	22

IMPLICATIONS AND CONCLUSIONS

1. Policy design and ex-ante analyses: know your farmers
   - Use economic models
   - BUT integrate knowledge from other sources to ensure realistic behavioural models

2. Farmer heterogeneity → policy instrument mix
   - Marketbased : economically motivated
   - Information and clear signals about sustainable behaviour: environmentally motivated
   - Production/profession oriented farmers: redefine craftsmanship
     - Education (longer term)
     - Social comparisons etc
     - Budget/cap/quote on use: redefine craftsmanship, spur innovation and learning?

3. Involve stakeholders in policy design

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2016 data: grant no. 667-00120. Evaluation of the redesigned pesticide tax

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