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 plans since late 1980s
  • More or less successful
  • Pesticide use reduced ‘initially’
    • BUT less than expected based on in ex-ante modelling
  • 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?

<table>
<thead>
<tr>
<th></th>
<th>UK</th>
<th>France</th>
<th>Germany</th>
<th>Denmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>TFI in wheat</td>
<td>6.74</td>
<td>4.1</td>
<td>5.8*</td>
<td>2.62</td>
</tr>
<tr>
<td>Wheat yield,</td>
<td>8.0</td>
<td>6.9</td>
<td>7.3</td>
<td>7.3</td>
</tr>
<tr>
<td>tonnes per ha.</td>
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</tbody>
</table>

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

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

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

Source Pedersen et al. 2012
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

<table>
<thead>
<tr>
<th>TAX BASES</th>
<th>TAX RATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic tax</td>
<td>50 kr./kg active substance (6.5 EUR)</td>
</tr>
<tr>
<td>Health</td>
<td>107 kr./kg pesticide pr. unit load index (13.9 EUR)</td>
</tr>
<tr>
<td>Environmental effect</td>
<td>107 kr./kg active substance pr. unit load index</td>
</tr>
<tr>
<td>Environmental behaviour</td>
<td>107 kr./kg active substance pr. unit load index</td>
</tr>
<tr>
<td></td>
<td>(1 kr. = 0.13 EURO)</td>
</tr>
</tbody>
</table>

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)
- 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

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

Scores for small farmers differ significantly from middle ($p < 0.005$)
Scores for small farmers differ significantly from large ($p < 0.001$)
Scores for middle farmers differ significantly from large ($p < 0.001$).

Source: Dessart et al. 2019; Lastra-Bravo et al. 2015.
WHAT ABOUT IPM ETC?  
(NIELSEN ET AL. FORTHCOMING)

### To what degree use these practices? Pct.

<table>
<thead>
<tr>
<th>Practice</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time sowing to minimize weeds</td>
<td>12</td>
<td>12</td>
<td>25</td>
<td>29</td>
<td>22</td>
</tr>
<tr>
<td>Use advisory services on IPM</td>
<td>41</td>
<td>13</td>
<td>18</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>No till</td>
<td>70</td>
<td>11</td>
<td>8</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

### Risk associated with use of pesticides Pct.

<table>
<thead>
<tr>
<th>Risk</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced yield if reduce use of pesticides</td>
<td>2</td>
<td>5</td>
<td>15</td>
<td>40</td>
<td>37</td>
</tr>
<tr>
<td>Development of resistance to substances</td>
<td>2</td>
<td>10</td>
<td>27</td>
<td>33</td>
<td>23</td>
</tr>
<tr>
<td>Risk to health from handling of pesticides</td>
<td>21</td>
<td>35</td>
<td>27</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Pollution of ground/drinking water</td>
<td>31</td>
<td>42</td>
<td>15</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

### Attitude - agreement with statement? Pct.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Disagree very much</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Agree very much</th>
</tr>
</thead>
<tbody>
<tr>
<td>The substances approved for use in Denmark are so harmless to the environment that we do not need to focus on reducing use</td>
<td>7</td>
<td>14</td>
<td>29</td>
<td>26</td>
<td>22</td>
</tr>
</tbody>
</table>
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
   - Market-based: 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
ACKNOWLEDGEMENT

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2016 data: grant no. 667-00120. Evaluation of the redesigned pesticide tax
2009 data: Barriers in farmers decision processes.
REFERENCES

- Nielsen et al. forthcoming. Evaluation of the re-designed pesticide tax. The importance of decision behaviour for pesticide use. Danish Environmental Protection Agency, the Danish Pesticide Research Programme.