The Capitalisation of Fixed per hectare Payment into Land Rental Prices: a Spatial Econometric Analysis of Regions in EU

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Motivation

- As a consequence of the introduction of the decoupled payments scheme in the UE, interest is growing on the capitalisation effect.
- Many studies approach the issue using farm-level data, focusing on either land rents or land market prices, usually employing data for a single country or region.
- Farmland rents (the dependent variable) are however characterized by a large heterogeneity which is unobservable in covariates to the largest extent (characteristics of land, presence of buildings, …).
- In addition agricultural productivity and payments refer to total land, not rented land only.
- In summary, there are non-negligible identification problems in the use of farm level data.
- This research provides a different view, approaching the capitalisation effect from a territorial perspective, in an attempt to mitigate such identification problems.
A Territorial approach

- Different studies have attempted to empirically assess the incidence of EU payments on land prices (Patton *et al*., 2008; Breustedt and Habermann, 2011; Ciaian *et al*., 2011; Ciaian and Kancs, 2012; Guastella *et al*., 2013) using farm level data.
- In the EU, the study by Kilian *et al*. (2008) is the only using municipality data on farmland rents to estimate the capitalisation decoupled subsidies.
- The interest in using territorial data is growing because, following the 2003 reform, agricultural payments are expected to converge to fixed per-ha amounts at the regional level.
- One can reasonably expect the cross-regional variation to be substantially more relevant than the variation between farms in the same region.
The theoretical model

Let

\[ \pi_i = \sum_{k=1}^{K} p_k y_{ik}(a_{ik}) a_{ik} + g \left( \sum_{k=1}^{K} a_{ik} \right) - r \left( \sum_{k=1}^{K} a_{ik} \right) \]

represent the profit function for the representative farmer in the region, where

- \( \pi \) is the total profit
- \( p_k \) is the price of the \( k^{th} \) output
- \( y \) is the per ha productivity of output \( k \) and is a function of land used in production \( a \) only

each farmer receives a fixed per-ha amount \( g \) and pays a rent \( r \) for each ha of land used
Assuming that production is related to land by a CD, the FOC for land quantity is

\[ r = \sum_{k=1}^{K} \beta_k \alpha_k Y_k + \gamma g \]

where

- \( \alpha_k = a_k / \sum a_k \)
- \( Y_k = p_k \)
- \( \beta \) and \( \gamma \) are parameters to be estimated
- \( k \): crop (including cereals, proteins, potatoes, sugar beet, oil-seed and industrial crops), energy crops, vegetables and flowers, fruits, wines and grapes, olives, forage crops and other crops
The empirical model

The following equation is then estimated

\[ r_{st} = d_s + \sum_k \beta_k X_{k,st} + \gamma_1 SPS_{st} + \gamma_2 ECP_{st} + Z_{st}' \delta + \varepsilon_{st} \]

where

- \( X \) is the productivity of output in a region weighted by the coefficient of output specialization
- \( SPS \) is the per ha amount of agricultural payment received under the single payment scheme
- \( ECP \) is the per ha amount received for energy crop
- \( Z \) includes control such
  - Average size of farms
  - Average share of family-to-total labour
  - Average amount of capital (B + ME) per ha
  - Density of animals (nitrate directive)
  - Proportion of rented to total land in the region (propensity to rent)
Introducing spatial relations

- Consider the linear model described before in compact form

\[ r = Q' \theta + \varepsilon \]

- Consistency of the OLS estimator is threatened by the possibility that errors are not independently distributed but, on the opposite, are related among neighbouring regions
  - Omitted variables with a specific territorial effect
  - Farmland price transmission across neighbours
  - Unobserved spatial heterogeneity in the sample

- Space is accounted for by introducing a standard contiguity matrix

\[
 w_{ij} = \begin{cases} 
 \frac{d_{ij}^{-1}}{\sum_j d_{ij}^{-1}} & \text{if } d_{ij} < d^* \\
 0 & \text{otherwise} 
\end{cases}
\]
Model specification

- Space in the dependent variable (price contagion)  
  \[ r = \rho Wr + Q' \theta + \varepsilon \]  

- Space in the error term (unobserved spatial heterogeneity and omitted spatial variables)  
  \[ r = Q' \theta + \varepsilon \]
  \[ \varepsilon = \lambda W \varepsilon + u \]

- Space in the dependent variable and covariates  
  \[ r = \rho Wr + \theta Q + \varphi WQ + u \]

- It can be shown that both [1] and [2] are nested in [3] and specification tests (LR-test) can be conducted accordingly
### Data

- FADN regional (NUTS I and II) aggregates using sampling weights
- All territories in EU25, years 2005-2008

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Mean</th>
<th>SD</th>
<th>CV</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R$</td>
<td>Rent per ha</td>
<td>199.052</td>
<td>185.863</td>
<td>0.934</td>
</tr>
<tr>
<td>$Y1$</td>
<td>Output value per ha – Cereals</td>
<td>1466.269</td>
<td>1436.281</td>
<td>0.980</td>
</tr>
<tr>
<td>$Y2$</td>
<td>Output value per ha – Energy Crops</td>
<td>968.642</td>
<td>2511.057</td>
<td>2.592</td>
</tr>
<tr>
<td>$Y3$</td>
<td>Output value per ha – Vegetables and Flowers</td>
<td>34096.5</td>
<td>66345.69</td>
<td>1.946</td>
</tr>
<tr>
<td>$Y4$</td>
<td>Output value per ha – Fruits</td>
<td>7375.31</td>
<td>7309.231</td>
<td>0.991</td>
</tr>
<tr>
<td>$Y5$</td>
<td>Output value per ha – Wines and Grapes</td>
<td>10177.35</td>
<td>15064.98</td>
<td>1.480</td>
</tr>
<tr>
<td>$Y6$</td>
<td>Output value per ha – Olives</td>
<td>2483.117</td>
<td>2235.006</td>
<td>0.900</td>
</tr>
<tr>
<td>$Y7$</td>
<td>Output value per ha – Forage Crops</td>
<td>186.52</td>
<td>269.33</td>
<td>1.444</td>
</tr>
<tr>
<td>$Y8$</td>
<td>Output per ha – Other Crops</td>
<td>81805.05</td>
<td>697388.2</td>
<td>8.525</td>
</tr>
<tr>
<td>$SAP$</td>
<td>Payment per ha under either SAPS or SPS</td>
<td>482.77</td>
<td>1885.702</td>
<td>3.906</td>
</tr>
<tr>
<td>$ECP$</td>
<td>Payment per ha for Energy Crop</td>
<td>75.167</td>
<td>678.804</td>
<td>9.031</td>
</tr>
<tr>
<td>$A$</td>
<td>Average farm size (in ha)</td>
<td>81.926</td>
<td>116.214</td>
<td>1.419</td>
</tr>
<tr>
<td>$FamLab$</td>
<td>Share of family to total labour</td>
<td>0.725</td>
<td>0.229</td>
<td>0.316</td>
</tr>
<tr>
<td>$FixAss$</td>
<td>Value of Fixed Assets (Machinery and Equipment) per ha</td>
<td>3381.808</td>
<td>4048.983</td>
<td>1.197</td>
</tr>
<tr>
<td>$AnimalID$</td>
<td>Number of animal units (in livestock equivalent) per ha</td>
<td>1.031</td>
<td>1.188</td>
<td>1.152</td>
</tr>
<tr>
<td>$RentProp$</td>
<td>Ratio between rented and total UAA</td>
<td>0.541</td>
<td>0.241</td>
<td>0.445</td>
</tr>
</tbody>
</table>
### Results

Veg and Flowers contribute to higher regional prices to the largest extent

It is estimated that 20% of the additional payment gets capitalized into farmland rents in Europe

More than 90% of regional variation is explained

<table>
<thead>
<tr>
<th></th>
<th>FE</th>
<th>[1]</th>
<th>[2]</th>
<th>[3]</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-Cereals</td>
<td>-0.097* (0.046)</td>
<td>-0.106*** (0.038)</td>
<td>-0.146*** (0.042)</td>
<td>-0.164*** (0.039)</td>
</tr>
<tr>
<td>X-Energy Crops</td>
<td>-0.010 (0.013)</td>
<td>-0.010 (0.010)</td>
<td>-0.011 (0.011)</td>
<td>-0.016 (0.011)</td>
</tr>
<tr>
<td>X-Veg and Flow</td>
<td>0.049* (0.029)</td>
<td>0.049** (0.023)</td>
<td>0.045** (0.023)</td>
<td>0.035 (0.023)</td>
</tr>
<tr>
<td>X-Fruits</td>
<td>-0.022 (0.020)</td>
<td>-0.022 (0.016)</td>
<td>-0.022 (0.015)</td>
<td>-0.034** (0.016)</td>
</tr>
<tr>
<td>X-Wines Grapes</td>
<td>-0.033 (0.030)</td>
<td>-0.034 (0.024)</td>
<td>-0.040* (0.024)</td>
<td>-0.047** (0.024)</td>
</tr>
<tr>
<td>X-Olives</td>
<td>-0.046 (0.051)</td>
<td>-0.047 (0.041)</td>
<td>-0.045 (0.041)</td>
<td>-0.024 (0.041)</td>
</tr>
<tr>
<td>X-Forage</td>
<td>-0.009 (0.019)</td>
<td>-0.011 (0.016)</td>
<td>-0.019 (0.016)</td>
<td>-0.031** (0.016)</td>
</tr>
<tr>
<td>X-Other Crops</td>
<td>-0.039* (0.021)</td>
<td>-0.039** (0.016)</td>
<td>-0.042** (0.016)</td>
<td>-0.046*** (0.016)</td>
</tr>
<tr>
<td>SAP</td>
<td>0.225*** (0.030)</td>
<td>0.224*** (0.024)</td>
<td>0.224*** (0.025)</td>
<td>0.229*** (0.024)</td>
</tr>
<tr>
<td>ECP</td>
<td>0.002 (0.010)</td>
<td>0.001 (0.008)</td>
<td>-0.002 (0.008)</td>
<td>-0.002 (0.008)</td>
</tr>
<tr>
<td>Asize</td>
<td>-0.580*** (0.185)</td>
<td>-0.594*** (0.149)</td>
<td>-0.665*** (0.150)</td>
<td>-0.703*** (0.149)</td>
</tr>
<tr>
<td>FamLab</td>
<td>-0.442* (0.232)</td>
<td>-0.448** (0.185)</td>
<td>-0.469** (0.185)</td>
<td>-0.525*** (0.182)</td>
</tr>
<tr>
<td>FixAss</td>
<td>0.053 (0.097)</td>
<td>0.041 (0.078)</td>
<td>-0.007 (0.081)</td>
<td>-0.018 (0.079)</td>
</tr>
<tr>
<td>AnimalID</td>
<td>-0.116 (0.083)</td>
<td>-0.114* (0.066)</td>
<td>-0.106* (0.066)</td>
<td>-0.123* (0.065)</td>
</tr>
<tr>
<td>RentProp</td>
<td>-1.140** (0.481)</td>
<td>-1.170*** (0.386)</td>
<td>-1.297*** (0.385)</td>
<td>-1.400*** (0.395)</td>
</tr>
</tbody>
</table>
EU flat rate
Min 90% and objective criteria
Conclusion

• Evidence suggests that EU decoupled payments are capitalized into farmland rents, supporting previous literature using territorial data.

• This overall result may potentially mask spatial heterogeneity in the degree of capitalization (EU15-EU10) not accounted for in this model.

• The introduction of a flat rate rebalances substantially the distribution of payments across MS and across regions within each MS, causing farmland prices to increase.

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