Analysis of Efficiency of Pig Farms in the Valencian Community

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Abstract
The aim of this study is to analyse the efficiency of livestock operations in the Valencian Community, particularly for pig, which currently provides the greatest economic weight to the agricultural GDP of the community. By creating a production function representative of the existing allocations on farms, the farms that reach an optimal level of production in the absence of inefficiencies will be determined. The results will help determine standards that facilitate error correction to improve the competitiveness of the sector.

Keywords: Efficiency, Pig Farms, DEA.

Introduction
The evolution of the Spanish economy has determined the development of pig production. The country has been able to quickly adapt to changes and new demands required by the sector, ultimately transforming it into the leading livestock sector. Specifically, during 2013, the number of pigs was 25,494,715, representing 51.07% of all livestock. Spain is a country with high pig farming production, although with serious limitations due to the market situation and environmental requirements (Lainez, et al. 2002). In the European Union (EU), Spain is the second largest producer of pigs, followed by Germany (Eurostat, 2011).

The aim of this study was to analyse the efficiency of livestock operations in the Valencian Community (VC), particularly for pig, which currently provides the greatest economic weight to the agricultural GDP of the community. By creating a production function representative of the existing allocations on farms, the farms that reach an optimal level of production in the absence of inefficiencies will be determined. In order to do so, Data Envelopment Analysis (DEA) is used, as this method is backed by a great deal of literature on similar issues (Arzubi et al, 2009; Chirinos and Urdaneta, 2007, among others). The results will help determine standards that facilitate error correction to improve the competitiveness of the sector. The novel contribution of this article is the economic approach to studying pig livestock in the VC by creating variables that are not directly identified by the Agricultural Census. The results obtained will allow identify patterns of behaviour for increasing competitiveness and resource savings.

Methodology and sample description
The Data Envelopment Analysis (DEA) is a nonparametric technique to measure the relative efficiency of homogenous units. This method is used most often in the presence of multiple inputs and outputs to determine which observations are best by comparing each with all possible linear combinations of the variables of the rest of the sample. It is then possible to use these variables to define an empirical production frontier. Thus, the efficiency of each unit analysed is measured as the distance to the frontier (Charnes, Cooper and Rhodes, 1978).

The application of the DEA methodology requires the definition of inputs and outputs that are going to constitute the model. Furthermore, it was necessary to treat the farming operations as an "industry" capable of transforming resources into a final product (outputs).

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The database was constructed from microdata provided by the Agricultural Census and the Farm Accountancy Data Network (FADN). The Census is regularly conducted by the National Statistics Institute (NSI) through a process of surveys on production methods in farming operations. Given the complexity of the census, it is always published with a certain lag. Thus, the latest information available is from 2009.

The opacity of the value of some variables considered in this study required making direct inquiries to obtain them. Specifically, information on pig fattening operations in the VC was requested after verifying that the number of operations in the survey sample was representative of the entire community.

Thus, it was possible to construct a sample of 516 pig fattening farms, all registered in the Agricultural Census of the VC. TSO was taken as the only output and was identified as the gross monetary value (euros) of pig at the operation exit price. The variables that define the inputs covered the aspects inherent to pig production as follows:

- Utilised Agricultural Area (UAA): Area in hectares of land for permanent pasture and arable land.
- Total Labor Input (TLIs): Total labor input of holding expressed in annual work unit (full-time person equivalent).
- Livestock Unit (LU): LU is equivalent to one head of cattle and is calculated by multiplying the number of cattle by a weighting factor depending on the species and type of animal.
- Specific costs of pig operations:
  - Feed Cost for Grazing Livestock (FC): Value in euros spent on concentrate and coarse fodder.
  - Cost of Animal Feed (CAF): Value in euros spent on feed for pigs.
  - Other Livestock Specific Costs (OCs): Value in euros of veterinary fees and reproduction costs.
- General operating costs (GOC): Costs in euros linked to productive activity.
- Machinery and Buildings Current Cost (CC): Costs of current upkeep of equipment and purchase of minor equipment.
- Energy Cost (EC): Value in euros of consumption of fuels and lubricants for engines as well as electricity and fuel for heating.
- Contract Work (W): Costs linked to work carried out by contractors and to the hire of machinery.
- Other Direct Costs (DCs): Costs in euros of water consumption, insurance and other farming overheads.
- Depreciation (D): Depreciation of capital assets estimated at replacement value over the accounting year.

Efficiency results

The efficiency results of each pig farm represented an indicator of good/bad management performed at a particular time. However, the level of efficiency obtained for each farm was relative, as it was conditioned by the other units in the sample that it was compared with. This study measured the efficiency of pig farms in the VC using a sample of 516 observations, which were all within their respective category, representing a homogeneous group in terms of their production process.
Table 1. Efficiency results of farms of Valencia

<table>
<thead>
<tr>
<th>Location</th>
<th>No. Efficient Farms</th>
<th>No. Inefficient Farms</th>
<th>Mean Efficiency</th>
<th>Minimum Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alicante</td>
<td>2 (25%)</td>
<td>6</td>
<td>0.493</td>
<td>0.102</td>
</tr>
<tr>
<td>Castellón</td>
<td>10 (3.2%)</td>
<td>296</td>
<td>0.289</td>
<td>0.092</td>
</tr>
<tr>
<td>Valencia</td>
<td>17 (8.4%)</td>
<td>185</td>
<td>0.365</td>
<td>0.092</td>
</tr>
<tr>
<td>Total</td>
<td>29 (5.6%)</td>
<td>487</td>
<td>0.329</td>
<td>0.092</td>
</tr>
</tbody>
</table>

Source: Own elaboration

As shown in Table 1, the proportion of efficient farms within the VC was low (6%), thus suggesting that efforts should be made in management to improve their performance, especially in the province of Castellón, where less than 3% of the farms were efficient. According to the initial approach of the study, this result implied that the resources selected were not being used appropriately. The mean efficiency value reached 0.32, thus indicating that these operations could increase their output by 68% without affecting their inputs.

Overall, 29 farms were found to be efficient. To identify a behaviour profile of these farms, it is necessary to know which characteristics they have regarding their legal status and training of staff (Table 2).

Table 2. Qualitative characteristics of efficient pig farms

<table>
<thead>
<tr>
<th>Legal Status</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Person</td>
<td>73.60</td>
</tr>
<tr>
<td>Corporation</td>
<td>15.78</td>
</tr>
<tr>
<td>Cooperative Society</td>
<td>2.60</td>
</tr>
<tr>
<td>Other legal condition 1</td>
<td>7.89</td>
</tr>
<tr>
<td>Agricultural training</td>
<td></td>
</tr>
<tr>
<td>Agricultural experience</td>
<td>81.57</td>
</tr>
<tr>
<td>Agricultural courses</td>
<td>15.78</td>
</tr>
<tr>
<td>Agricultural professional studies</td>
<td>2.63</td>
</tr>
<tr>
<td>Agricultural university studies</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: Own elaboration

Overall, the most efficient farms were established by unskilled individuals (Table 2). The heads of the operation used their own experience to set up the business, thereby achieving efficiency in production.

Conclusions

Livestock in the VC has been transformed in recent decades due to changes generated by regional and agricultural policies at the European, national or regional levels. Currently, the livestock sector is a key
element for sustaining the population in the Valencian countryside due to the qualitative and quantitative significance it holds in overall economic activity.

The study of efficiency of pig fattening farms, which is the primary livestock species of the VC, revealed that none of the provinces in the community reached the desired levels of efficiency. Only 25% of Alicante farms were completely efficient. This low productivity was more acute in the most vulnerable areas, such as the interior of Castellón and Valencia, where this activity is so important that it constitutes the primary support mechanism for the rural population.

A thorough restructuring of the farms is required through better utilisation of its productive factors. The legal-administrative profile of efficient farms is fragile. The individuals with experience but without academic training in the sector are unable to transfer the advantages offered by the farmer group synergies that are characteristic of cooperative societies to production. Furthermore, it is increasingly necessary to train a workforce that leads to the use of more advanced processes that meet the needs of higher productivity, thereby improving the suitability of the sector. It is necessary for workers to be motivated with sufficient technical knowledge to perform tasks belonging to pig operations.

In quantitative terms, this study revealed that it is necessary to reduce the running costs of farming operations. The smallholder farms characteristic of the VC support a significant amount of costs that would be difficult to transfer to the selling price of its product without losing competitiveness. Agricultural policies aimed at this sector should promote the efficient use of available resources, which in some cases could happen by grouping pig farms into cooperatives or by increasing the size of farms.

Therefore, it could be argued that a personnel policy regarding the organisation of work leads to greater staff involvement in the production and economic performance of farming operations.

References


