

**Extended Abstract**  
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<b>Paper/ Title</b>	<b>Rational Inefficiency in Pig Farming</b>
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<b>Abstract</b>	<b>200 words max</b>
<p>This article studies the relationship between water use and farms' technical efficiency levels. The analysis extends the rational inefficiency concept to pig farming. The empirical application focuses on cross-section data of Catalan specialized pig farms from the year 2018. Results suggest farm technical inefficiency could be attributed to the farmers' rational decisions. However, assuming a profit-maximizing behavior for all farmers, it is unlikely that rational inefficient farmers would implement sustainable water management practices making them worse off.</p>	
<b>Keywords</b>	Pig farms, water use, environmental sustainability, technical efficiency
<b>JEL Code</b>	Q12, Q18, Q25, M11
<b>Introduction</b>	<b>100 – 250 words</b>
<p>Agricultural technical inefficiency is frequently viewed as a waste of natural resources since it entails using an excessive amount of inputs to produce too little output. The frequent droughts hitting the Mediterranean region, and the growing demand for a large amount of water in pig farming is challenging the sustainability of livestock farming systems. Relying on the rational inefficiency concept, this paper aims to investigate whether water use may explain some of the observed technical inefficiency in Catalan pig farming. Pig production in Catalonia has experienced profound growth and a structural transformation over the last decades leading to more intensified and efficient production practices. It has been suggested that such high performance could be attributed to the adoption of technological innovations, integrated contractual arrangements, changes in environmental regulations, and consumption habits. These achievements, however, have come at the cost of increased external environmental costs.</p>	

In addition to the water scarcity and drought challenges in Europe (European Commission, 2007), the main European Environmental legislation affecting pig farming is the Council Directive 91/676/EEC, which concerns the protection of waters against pollution. This directive forces member states to act against problems arising from intensive livestock production. Against this background, it is crucial to investigate whether there is a trade-off between water use and slurry management from pig farming and farm technical efficiency.

## **Methodology**

*100 – 250 words*

We use a production function approach where a pig producer produces a single output with a vector of inputs. Further, while the literature indicates that farmers' production decisions are suggested to be driven by a profit-maximization condition, other studies support the hypothesis that farmers' production decisions are influenced by factors other than profitability and productivity, but also on non-economic criteria such as ethics, social and environmental values. In this study, we specifically explore the relationship between farmers' technical efficiency and water use and slurry release. The empirical model of the production frontier is estimated using a Cobb—Douglas specification. The application focuses on a sample of Catalan pig farms.

With the overarching aim of testing trade-offs between farm technical efficiency and water use, our sample farms are classified into four groups. Farms with water or slurry ratios values above the median and efficiency scores below the median were categorized as the “inefficient” group (G1). Farms with both high levels of water or slurry ratios and high efficiency ratings were considered as being the “technically efficient” group (G2). The “rational inefficiency” group (G3) includes farms with water or slurry values below the median, while they are still unable to achieve higher levels of technical efficiency. While the farms with relatively low levels of water or slurry to output ratios and high levels of efficiency are classified into the “multi-efficient” group (G4).

## **Results**

*100 – 250 words*

The estimated coefficients of the input variables of the production frontier model are all positive (fulfilling the monotonicity condition) except the coefficient of the veterinary costs, which has a negative sign. This negative sign may indicate that farmers with low veterinary costs save money not only in terms of direct production cost, but also indirectly through a healthier and more productive herd. Our findings point to a high level of technical efficiency in Catalan pig

farming, which is consistent with the fact that the Spanish pig farming sector is overwhelmingly intensive and heavily concentrated.

Turning to the rational inefficiency concept, our results show that the farms belonging to the rational inefficiency group had significantly lower values of water to output ratio compared with the other groups. These lower levels of water use in the rational inefficiency group indicate that these farms would potentially choose to use less water, thereby reducing their technical efficiency scores. This can be interpreted as a potential situation of rational inefficiency among pig farms. Further, testing whether the four groups are equally balanced or not, is one way to understand whether there would be synergies or trade-offs between farm technical efficiency and water use. Results indicate that neither the technical efficiency scores nor the water or slurry to output ratios are determinant factors that affect the independence between the groups. This provides empirical evidence of a lack of trade-off possibilities between the amounts of water use or slurry released and farm technical efficiency.

#### **Discussion and Conclusion**

*100 – 250 words*

Our results provide nuanced support for the hypothesis of rational inefficiency. This theory holds when comparing the farms located in the rational inefficient group (G3) to the technically efficient group (G2). Following this hypothesis, one could explain that the observed inefficiency levels for these farms are, in fact, the result of low levels of water use. Assuming that both group farmers (G3 and G2) are driven by profit-maximizing objectives (which can be achieved through higher efficiency and savings effects), the low performance of the rational inefficient farms in comparison to the technically efficiency farms may thus not be attributed to poor production decisions, but rather, to the farmers' environmental awareness and water conservation issues. This result further confirms that ignoring producer motivation tends to confound poor production outcomes resulting from rational decisions with inefficiency.

A somewhat less clear-cut evidence of the rational inefficiency notion is observed between the rational efficient group and the multi-efficient group. Here, our results show that the rational inefficiency farms obtain relatively similar values in terms of water use and slurry management to those of the multi-efficiency farms. These low-efficiency scores of the rational inefficient farms compared with the multi-efficient group could be interpreted as a result of farmers' rational decisions, which most likely place a greater weight on water scarcity and environmental pollution than on higher economic performance. However, assuming a profit maximizing

behavior for all farmers, it is unlikely that rational inefficient farmers would implement sustainable water management practices making them worse off.