Agricultural Journal 1(3): 156-159, 2006

Investigation of Business Dexterity in the Agricultural Sector in Greece: The Case of Pig Holdings

[1]Stamatis Aggelopoulos, [2]John Mylonakis and [3]Irene Kamenidou
[1]Technological Educational Institute of Thessaloniki, 18 Soumelas str. Kalamaria, Thessaloniki, 55132, Greece
[2]Hellenic Open University, 10 Nikiforou str., Glyfada, Athensm 166 75, Greece
[3]Technological Educational Institute of Kavala, Greece Aghios Loukas, 654 04, Kavala, Greece

Abstract: The agricultural sector is significant in many countries, especially in the Mediterranean economies, Greece. The level of investments employed to maintain profitability places capital management and efficient business practices as key management considerations Profitability in this sector can contribute up to one point to the competitiveness of Greek Farms business. This study presents the results of research carried out in the main producing regions of Greece. Based on technical and economic profile of the holdings examined, net income (return on capital) and profitability of capital invested in pig farming are estimated.

Key words: Profitability, investments, returns on capital ratio, funding, breeding systems

INTRODUCTION

Animal producing operations, especially pig farming businesses require large amounts of capital to not only relocate but also to modernize. The latter requires construction of buildings or stabling facilities, upgrading machinery and replenishing genetic feeds for breeding[1-2]. Poor practices, however, on the part of pig farmers have led to an improvised approach to making investment choices and pursuing ad-hoc operational efficiencies. Up to now, such unscientific methods imposed undue financial costs for owners who must carry the burden of maintaining facilities or other high unnecessary fixed costs, by funding unplanned or aimless investments[3].

In reality, the high levels of investment necessary to operate pig farming units efficiently challenges investors and owners to minutely manage capital and to follow appropriate business practices that meet high operational standards.

Pig farmers or investors who seek to maximize their investments are called upon to solve a wide range of problems related but not limited to: investment data and information, particular characteristics and goals of financial investments, management of technical problems and cost of collecting reliable data. Whether investment choices prove timely will also depend on the quality and suitable empirical analysis of primary data.

The scope of this study is to investigate the potential of investment analysis in the animal producing sector and correlate output of invested capital with breeding systems in relation to interest lending rates.

Currently, pig holding is considered one of the more dynamic sectors of the Greek rural economy. Total invested capital (over 293 million _), as well as, overall production volumes, come to 143,100 tons in the year 2000[4]. There are 927 "commercial" pig holdings in Greece, numbering over 20 sows, with a nominal capacity of 141,128 sow places and their "by-products"[4].

MATERIALS AND METHODS

Research was conducted in the geographical regions of Attica, Viotia and Evia, Thessaly, Etoloakarnania, Central Macedonia, Arta and Preveza. In these regions alone, 81,704 sows have been counted, representing 58% of the total number in Greece[4]. Consequently, it can be argued that the pig holdings situated in these regions represent a valid sample of the pig farms throughout Greece.

The technical and economic data collected refers to the period 1999-2001 recorded in a special structured questionnaire. The method used for the determination of the sample was the analogical stratified sampling method advocated by[5]. The sample comprises 22.4% of the total holdings in these regions and 9% of the total number of holdings in the country. It includes 43 units from Thessaly, 5 from Macedonia, 18 from Attica-Viotia-Evia and 14 units from Etoloakarnania.

Four criteria of classification and correlation, which are breeding systems, were applied in order to evaluate and compare technical and economic characteristics of

Corresponding Author: Stamatis Aggelopoulos, Technological Educational Institute of Thessaloniki, 18 Soumelas str. Kalamaria, Thessaloniki, 55132, Greece

the pig holdings, namely 1) size of breeding unit (B), 2) type of Feed (F), 3) origin of genetic material (G), 4) Fertilization Method (FM).

- The pig holdings were classified into three categories, in terms of the size of the breeding units (B) Dotas[6]: B_1: A low-capacity unit with 20 to 199 sows. These are family-type units that use basic operating equipment. The existing genetic material in these units does not suffice to meet demand, neither is it properly managed and used. B_2: medium-capacity units with 200 to 399 sows. They follow a high rate of modernization in accordance with the most innovative trends in pig farming. B_3: high-capacity units with 400 and more sows. These are industrial-type units, with a high percentage of verticalization.
- As regards the type of Feed (F), the holdings in the sample are divided into four categories Whittemore[7]: F_1, supplementary use of pre-mixes with vitamins-trace elements, used exclusively at all stages of the pigs' development and reproduction, F_2, supplementary use of diet pre-mixes, with vitamins-trace elements-amino acids at a proportion of 2.5-3% of the final fodder (balancers), used exclusively at all stages of the pigs' development and reproduction, F_3, exclusive use of ready-made feed-fodder and F_4, use of mixed types of feed at every stage of the pigs' development and reproduction.
- Categories F_1, F_2, F_4, are solely based on own-produced animal feed, while category F_3 makes exclusive use of bought animal feed.
- Regarding the origin of the genetic material, the following groups were generated Whittemore[7]: G_1: when there is a core of animals in the pig-farming unit, G_2: when the genetic material comes from reproductive animals used for multiple breeding (F_1 generation of animals), G_3: when the genetic material comes from female fatteners, G_4: when the genetic material comes from a supply of F_1 generation animals, combined with animals from the unit's core of reproductive material, G_5: when the genetic material comes from a supply of F_1 generation animals, combined with fatteners from the unit, G_6: when the genetic material comes from a combination of animals from the unit's core of reproductive material and fatteners from the unit.
- Finally, pig holdings are divided into the following groups, based on the method of fertilization applied (FM), Whittemore[7]: FM_1: when artificial sperm insemination is used FM_2: when natural mating is used as a reproduction method.

The analysis of the economic results initially involved in the computation of the net income and the return on capital ratio. The latter is estimated as a percentage of the net income divided by the total invested capital[8].

Knowledge of this term is helpful in comparing the return on capital ratio in the agricultural holding with the interest rate for loans or savings at the Agricultural Bank or at another source of funding.

The statistical analysis of the primary technical and economic data, collected through on-site completion of the relevant questionnaires, was carried out using the statistical package SPSS 11.5. This classification was conducted with the application of the non-parametric Kruskal-Wallis test, which constitutes the corresponding non-parametric test of variation analysis (Anova-analysis) with one (independent variable) factor [9,10]. In the case of statistical significance with the Kruskal-Wallis test, the relevant paired comparisons of the levels of the independent variable were carried out using the Mann-Whitney statistical test, which corresponds to the non-parametric test of the t-test for independent samples[9].

Consequently, the average values of Table 1-4, which are characterized by the same letter on the same line, do not differ in a statistically significant way, at a significance level α=0.05, based on the performed Mann-Whitney test[9,11].

RESULTS AND DISCUSSION

Table 1 presents the classification of the economic results per sow in relation to the size of the breeding unit. The average values on this table, which are characterized by the same letter on the same line, are not statistically significant, at a significance level of α=0.05, according to the Mann-Whitney test that was carried out. The Kruskal-Wallis statistical test reveals that there is a statistically significant difference between the size of the three groups as the return on capital ratio ($\div^2$=8.126, d.f.=2, p=0.016). The observed significance level (p-value) was calculated by using the Monte Carlo simulation method.

High-capacity holdings (B_3) seem to have a greater net income, whereas medium-capacity holdings (B_2) show the lowest net income. On the other hand, low-capacity

Table 1: Comparison of economic results per sow in relation to size of breeding unit

	B_1: 20-199sows N:40 units Mean± Std. Deviation	B_2:200-199 sows N:23 units Mean± Std. Deviation	B_3: =400 sows N:17 units Mean± Std. Deviation
Net income	343.56^a±18.47	297.27^a±17.36	408.33^a±18.57
Return on capital ratio (%)	12.71^a±0.87	2.35^b±0.15	1.52^b±0.07

Table 2: Comparison of economic results per sow in relation to type of feed

Economic results (euros/sow)	F_1:vitamins and trace elements N:21 units Mean±Std. Deviation	F_2: balancers N:18 units Mean±Std. Deviation	F_3: ready-made feed N:6 units Mean±Std. Deviation	F_4:various N:35 units Mean±Std. Deviation
Net income	409.57^{a}±20.9	196.86^{a}±9.8	422.14^{a}±22.1	366.97^{a}±19.5
Return on capital ratio	6.51^{a}±0.32	5.42^{a}±0.27	32.85^{b}±3.8	4.49^{c}±0.5

Table 3: Comparison of economic results per sow in relation to origin of genetic material

Economic results (euros/sow)	G_1: Core of unit animals N: 15 Mean± Std.Deviation	G_2:From F_1 generation animals N: 12 Mean± Std.Deviation	G_3: From fatteners N: 14 Mean± Std.Deviation	G_4: From F_1 generation and core of unit animals N: 23 Mean± Std.Deviation	G_6: From core of unit animals and fatteners N: 11 Mean± Std.Deviation	G_5: From F_1 generation and fatteners N: 5 Mean± Std.Deviation
Net income	492.05^{a}±29.3	251.40^{a}±20.2	384.73^{a}±29.9	343.17^{a}±19.7	255.74^{a}±12.7	350.68^{a}±17.5
Return on capital ratio (%)	12.86^{a}±0.6	5.84^{ab}±1.3	14.65^{a}±0.73	1.83^{b}±0.09	7.99^{ab}±0.5	2.27^{ab}±0.15

Table 4: Comparison of economic results per sow in relation to method of fertilization

Economic results (euros/sow)	FM_1: Artificial insemination N: 29 units Mean±Std. Deviation	FM_2: Natural mating N:51 units Mean±Std.Deviation
Net income	400.80^{a}±32.7	311.72^{b}±15.5
Return on capital ratio (%)	2.26^{a}±0.17	10.25^{a}±0.5

holdings (B_1) present the highest return on capital ratio and therefore achieve the best exploitation of their capital. High-capacity holdings (B_3) present the lowest return on capital ratio and therefore achieve a lower exploitation of their capital.

The interest on loans from the Agricultural Bank for the years 2000 and 2001 was 9 and 7.92%, respectively Agricultural Bank of Greece[12]. Comparing the return on capital ratio at pig holdings (Table 1) and the interest paid to the Agricultural Bank, it is evident that only small pig holdings (B_1) can manage to pay back loans, at the specific rate of interest, whereas medium- and high capacity holdings (B_2 and B_3) may be faced with serious cash-flow problems when undertaking capital lending from financial institutions. Although this result appears initially surprising, it may be explained by the fact that holdings of such a size require large amounts of capital in order to cover their operational needs, as they employ extensive modernization of their physical infrastructure, mechanological equipment and renewal of their genetic material, all of which result in a great amount of total invested capital.

Table 2 illustrates the classification of the economic results per sow in relation to the type of feed. The average values on this table, which are characterized by the same letter on the same line, are not statistically significant, at a significance level of α=0.05, according to the Mann-Whitney test that was carried out. The Kruskal-Wallis test showed that there is statistically significant difference between the four feeding methods used in pig holdings as return on capital ratio ($\div^2$=18,226, d.f.=3, p=0.006).

Net income appears to be larger for the F_3 holdings, followed by the F_1 and F_2 holdings, while the F_4 seem to achieve the lowest net income level. Identical is the study regarding the return on capital ratio as it is higher for the F_3 holdings, followed by the F_1 and F_2, while F_4 holdings present the lowest return on capital ratio.

In Table 3, the economic results in relation to the origin of the genetic material are presented. The Kruskal-Wallis test showed that there is a statistically significant difference between the six categories of origin of genetic material used in holdings, only in relation to the return on capital ratio ($\div^2$=12.372, d.f.=5, p=0.024).

The net income seems to be higher for the G_1 holdings, followed in descending order by the G_3, G_5, G_4, G_6 holdings. The G_2 holdings appear to have the lowest net income per sow. In addition, the return on capital ratio is greater for holdings whose genetic material comes from a core of reproductive material (G_1) and from fatteners (G_3). These are followed by holdings whose genetic material comes from F_1 generation reproduction animals (G_2), holdings whose genetic material comes from a combination of animals from a core of reproductive material and female fatteners (G_6) and holdings whose genetic material comes from a combination of F_1 generation animals and fatteners (G_5). The holdings whose genetic material comes from a combination of F_1 generation animals and animals from the unit's core of reproductive material (G_4) present the lowest return on capital ratio per sow.

The economic results per sow in relation to the method of fertilization are shown in Table 4.

Since the variable "method of fertilization" only involves two options (natural mating and artificial insemination), the Mann-Whitney test was applied to compare the economic results from the two methods (z = -7,211, p = 0,000). The test showed that there is a statistically significant difference between the two methods of fertilization used in holdings, only in relation

to the net income. The net income has a higher value in the FM_1 holdings compared to the FM_2 holdings. On the contrary, the return on capital ratio seems is bigger for the FM_2 holdings.

CONCLUSION

Successful modern pig farming enterprises need large capital to modernize and operate on a competitive basis. The level of investments employed to maintain profitability places capital management and efficient business practices as key management considerations. It follows that producers and investors look for capital expenditures that will improve financial ratios at a relatively low cost incorporating any opportunity costs that may present itself. Given a large set of alternative investment choices, producers and owners will likely invest capital wherever rigorous analysis justifies the highest possible gains.

Based on the results of this study, high-capacity holdings present a significantly higher profitability in the production of pork. Low-capacity holdings present the highest return on capital ratio and consequently the most efficient production factor "capital". High-capacity holdings present the lowest return on capital ratio and therefore the lowest efficiency of capital. Medium-capacity holdings present high rates of modernization and require great amounts of capital for their reorganization, but the cost of the required investments exceeds their net revenue.

Given the interest rates for the years 2000 and 2001, medium and high-capacity holdings seem to find it harder to undertake capital lending from financial institutions. The large funds required by these holdings to modernize and cover operational needs imply the merit of funding and support through community programmes. Furthermore, various improvements, extensions or relocations should be evaluated in accordance to necessity and only be financed if supported by technical analysis.

Moreover, the study of the return on capital ratio for the various categories of pig holdings based on their feed production methods, origin of genetic material and method of fertilization suggest that exclusive use of ready-made animal feed achieve a higher rate of the "capital" factor, while holdings that use self-produced animal feed present the lowest return on capital ratio.

The holdings whose genetic material comes from a core of reproductive material, fatteners and F_1 generation reproductive animals achieve the highest return on capital ratio and therefore these holdings can also effectively make use of investment proposals. On the contrary, the holdings whose genetic material comes from a combination of F_1 generation animals with animals from the unit's core of reproductive material present the lowest return on capital ratio per sow and therefore the lowest capacity to exploit investment proposals.

The profitability of investments seems higher for holdings that use natural mating as a method of fertilization.

REFERENCES

1. Kitsopanidis, G., 1999. Economics of Pig Farming in Greece, Medit, Bari, Italy, 4: 11-18.
2. Vaessen, M. and G. Backus, 1997. Comparison of the cost price of pork in some selected E.U. membership countries, Research Institute for Pig Husbardry, Netherlands
3. Apostolopoulos, C., H. Theodoropoulou, G. Petrakos and G. Theodoropoulos, 2001. Factors Affecting the Regional Pig Meat Productivity of Commercial Pig Units in Greece. Agricultural Economics Review.
4. Ministry of Agriculture, 2001. Animal Production Dpt Data. Present Status of pig farming units in Greece, in Greek)
5. Kamenidou, I., I. Tzimitra-Kalogianni, C.V. Priporas and V. Tziakas, 2002. Greek Consumers V's Private Label Milk, Agricoltura Mediterrenea, 132, 66-76
6. Dotas, D., 1991. Feeding systems for fatteners and prospects. Using sub-products in pig farming, J. Zootechnical Sci., Special Edn., 8. in Greek) pp: 77-93
7. Whittemore, C., 1993. The science and practice of pig production, Longman Group, U.K
8. Êitsopanidis, G. and Ch. Kamenidis, 1992. Rural Economy, Zitis Publications, 2nd Edn., Thessaloniki, in Greek)
9. Hinkle, D., W. Wiersma and S. Jurs, 1988. Applied Statistics for the Behavioral Sciences, 2nd Edn., Boston: Houghton Mifflin Company
10. Agresti, A. and B. Agresti, 1979. Statistical Methods for the Social Sciences, Dellen Publishing Company, San Francisco, U.S.A
11. Toothaker, L., 1993. Multiple Comparisons Procedures. Sage University Paper Series on Quantitative Applications in the Social Sci., 07-89, Newbury Park, CA: Sage
12. Agricultural Bank of Greece, 2003. Research Department Data, Greek.