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### **Profit optimization issues in livestock production in a randomly variable environment**

We use quite general stochastic differential equation models to describe the dynamical behaviour of the individual growth of animals raised in a randomly varying environment. These models are conceptually more adequate to describe the effects of random environmental variations on growth than the classical regression techniques (which are appropriate to describe measurement errors). We describe parameter estimation and prediction methods, illustrating with data on cow growth of the Mertolengo breed raised in Alentejo (Portugal) under natural conditions and show that they outperform the traditional regression models in predictive power. Mixed models, with random variation among animals of average asymptotic size, are also considered.

An application of these models to profit optimization in livestock production is shown.

Assuming the animal is to be sold when it reaches some prescribed age and that there are fixed and variable costs (per unit time) in raising the animal and the selling price is proportional to the animal's weight, we determine the optimal age at which an animal should be sold in order to maximize profit.

The first passage time distribution through a prescribed size is studied and used to determine the optimal size at which the animal should be sold. We can then determine which policy (selling at a fixed age or selling at a fixed size) is preferable in terms of expected profit.

Some issues related to optimization for the simultaneous raising of several animals will also be discussed.