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Modeling Eggs Producers' Behaviour Under Technological and Economic Risks

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In a recent issue, *Poultry Science* has published several articles on egg industry and especially on its main trends. From this series, it appears that the sustainability of egg production and animal welfare are central concern of consumers and these trends are transmitted to all stakeholders in the sector of eggs' production. One of the fundamental changes affecting the sector of production of eggs is about the modes of production including a variety of housing systems ranging from the method of conventional cages to free range. Moreover, as in other agri-food sectors, the organic egg experienced a strong growth even if it still represents a small amount of the consumption. However, the changing patterns of production had additional technological risk associated with the production of eggs. A move from conventional cages to either an enriched cage or a free range system may affect the safety or quality, or both, of the eggs. This additional risk must be taken into account when considering economic issues associated with the production of table eggs. Moreover, even if consumers' concerns for animal welfare drive some of these new production modes, some research suggests that each mode of production contains negative elements on animal welfare. This ambiguity of the gain on animal welfare introduces an additional economic/marketing risk. A modification of consumers' specific beliefs of consumers on the welfare on "Free range" hens can reduce the premium associated with these particular modes of production. In addition a number of these new "types" of eggs production are classified as specialty products. Then, they are not "full" protected from international competition by the high level tariffs, which introduce an additional risk associated with international price variability.

In this study, we document the level of risk in the eggs sector (conventional and non conventional production). And, using a quadratic programming approach applied to expected mean-variance model, we analyze the impact of risk on decision to invest when the resources must be allocated to different type of production with different risk levels. Indeed, in the eggs production, very often, producers involved in production of specially eggs (free range, organic,...) also exploit farms producing conventional eggs. Overall our results show how, given their risk aversion parameter, producers achieve minimum risk level by devoting their resources to the least risky type of eggs. We also document producers' optimal choices under correlated multiples uncertainties (type of eggs prices, costs of production and the correlation between prices and costs of production. The policy implications of this research are important given the structural change in demand facing the egg industry (growth in egg for processing) and technical and economic issues on social sustainability of eggs production.