Farm household level risk balancing: Implications for policy and risk management

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Introduction

Traditionally, agricultural economists employ farm level modeling for a variety of purposes. Central to these modeling techniques is the behavioral assumption of farm profit maximization, or, when risk preferences are put into play (risk aversion), utility maximization. However, there is abundant literature, from different (sub)disciplines such as farming systems research, rural sociology, rural development and rural economic geography that views farm household activities in the wider economic context (e.g. Gasson et al., 1988, Dries et al., 2011, Bessant, 2006). In such view, farm households are considered pluriactive and may distribute assets between agricultural and non-agricultural purposes to accomplish their goals. Hence, according to this view, a more realistic behavioral assumption than profit maximization at the farm level would be the optimization of farm household risk (i.e. the chance of falling below a certain threshold level of household cash flow). Focusing on farm household level risk is a natural transition from farm-level risk analysis since the largest proportion of farms in the EU are family farms and many farmers already implement risk management strategies at the household level. Although the income maximization assumption is being contested in literature (e.g. Freshwater and Jette-Nantel, 2011) and more concern is being given about the welfare and well-being of households instead of focusing on the level of income (e.g. Boisvert, 2002), to the best of our knowledge, it is very uncommon in the agricultural economics literature on risk analysis to include a measure of household risk or consider the household as the entity of interest. This paper develops a farm household simulation model that describes the potential implications of considering the optimizing of farm household level risk as a behavioral response. It starts from conceptual descriptions of operational -, financial -, farm - and farm household risk. It then models the behavior of a typical dairy farm household as one optimizing farm household risk and derives the implications of alternative risk management strategies.

Method and data

The method uses optimization in a simulation framework. A simulation approach was chosen in favor of an empirical data analysis (e.g. panel regression analysis) due to data availability and the greater flexibility of simulation. The overall approach can be summarized as: (i) expanding an existing (deterministic) typical dairy farm model to encompass our concepts of operational, total farm and household risk, (ii) making the model stochastic by introducing variability of and correlation between critical input variables, and (iii) simulating producer responses to different risk management programs as a result of the optimization of decisions variables given the behavioral assumption of household risk (or welfare) optimization. Using a whole-farm simulation model, combined with a typical–or representative–farm, is a widely used approach to investigate possible impact of strategies, technologies and policies (Escalante and Barry, 2001, Stokes et al., 2000, Antón and Kimura, 2009). The overall approach followed, was proposed by the OECD (2011).

The basis of the model constitutes a widely used and validated typical dairy farm model, TIPICAL (Hemme, 2000) which was constructed using an expert panel combined with micro- and macro-data from national and regional statistics. The farm used in this study is representative for the Belgium-North region. We extended TIPICAL to the household level by including private liquidity, off-farm income and typical family living budgets to calculate total household cash flow, aside from operating and total farm cash flow.

The risk to which farmers are subject, is introduced by moving from deterministic values for output prices, input prices and production to stochastic values. Hence, we model market, price and production risk. The data used is Belgian farm-level FADN data. Further, we introduce correlations between price and production, taken from the same data source. Last, correlations and stochasticties are introduced—where relevant—between farm variables and household variables, e.g. between farm income and off-farm income. As data in Belgium on the household level characteristics is very sparse, we use data from literature and expert opinions in this case.

In the model, the producer chooses the optimal capital structure, decides on a number of hours worked off-farm, on the amount of cash that is added to or withdrawn from the liquidity reserves, to optimize the household risk (or welfare). We introduce several risk management instruments and government risk reduction programs, and investigate farm households' responses. Last, a sensitivity analysis is performed on a number of farm household characteristics, e.g. labor availability, education level (and associated off-farm wage), and initial wealth. Stochastic dominance techniques are used to compare the different simulated options, on the basis of both farm and household cash flow.

Results

We show that a typical farm household, setting a constraint to farm household risk, may exhibit behavioral responses that are unanticipated when adopting a farm level approach. More specifically, a shock in operational risk, which is mostly the target and result of government programs, may induce a shift elsewhere in the farm household, such as a shift in off-farm employment, household expenses, reserves or the financial position, a phenomenon we refer to as farm household risk balancing. Our concept of household risk balancing complements the original Gabriel and Baker (1980) risk balancing hypothesis that a farm will balance operational and financial risk to maintain a feasible level of total farm risk. Finding empirical evidence for this hypothesis proved difficult in literature. Here, we illustrate that the empirical validity of the risk balancing hypothesis can be expanded by incorporating the role of the farm household.

Discussion

The policy implications of this study are twofold. Firstly, our results show that shocks in operational risk induced by policy are not linearly transmitted to the household level; dynamic effects due to risk balancing propose that actual outcomes might differ from policy targets. This is undesirable from both a government perspective—efficient allocation to produce food productively is not achieved by not being able to support farmers into high risk-high return situations—and a farm household perspective—which still faces a high level of risk despite government intervention. Such unanticipated risk balancing impacts have been previously described for the Gabriel and Baker hypothesis (e.g. Collins, 1985, Featherstone et al., 1988). Secondly, this study broadens the range of instruments and strategies that both farmers and policy makers can employ to manage risks. For instance, rural development policies aimed at offering greater off-farm employment possibilities may have a far better influence on the stability of farm household incomes than policies directed at stabilizing agricultural markets (that might have more public costs or could be even market disturbing).

References

Antón, J. and Kimura, S. (2009). Farm level analysis of risk, and risk management strategies and policies: Evidence from German crop farms. *International Association of Agricultural Economists Conference, August 16-22, Beijing, China.* International Association of Agricultural Economists.

Bessant, K. C. (2006). A farm household conception of pluriactivity in Canadian agriculture: Motivation, diversification and livelihood. *Canadian Review of Sociology/Revue canadienne de sociologie*, 43**,** 51-72.

Boisvert, R. N. (2002). Analysis of a re-focused agricultural policy within a farm-household framework. Some data requirements. *Workshop on the Farm Household-Firm Unit: Its Importance in Agriculture and Implications for Statistics, April 12-13, London, UK.* International Agricultural Policy Reform and Adjustment Project (IAPRAP).

Collins, R. A. (1985). Expected utility, debt-equity structure, and risk balancing. *American Journal of Agricultural Economics*, 67**,** 627-629.

Dries, L., Pascucci, S. and Gardebroek, C. (2011). Pluriactivity in Italian agriculture: Are farmers using interlinked strategies? *European Association of Agricultural Economists 2011 International Congress, August 30 - September 2, Zürich, Switzerland.* European Association of Agricultural Economists.

Escalante, C. L. and Barry, P. J. (2001). Risk balancing in an integrated farm risk management plan. *Journal of Agricultural and Applied Economics,* 33**,** 413-429.

Featherstone, A. M., Moss, C. B., Baker, T. G. and Preckel, P. V. (1988). The theoretical effects of farm policies on optimal leverage and the probability of equity losses. *American Journal of Agricultural Economics,* 70**,** 572-579.

Freshwater, D. and Jette-Nantel, S. (2011). Risk management and the role of off-farm income. Version 2.1, January 12, 2011. Kentucky, USA.

Gabriel, S. C. and Baker, C. B. (1980). Concepts of business and financial risk. *American Journal of Agricultural Economics,* 62**,** 560.

Gasson, R., Crow, G., Errington, A., Hutson, J., Marsden, T. and Winter, D. M. (1988). The farm as a family business: A review. *Journal of Agricultural Economics,* 39**,** 1-41.

Hemme, T. (2000). IFCN – A concept for international analysis of the policy and technology impacts in agriculture. Dissertation. Landbauforschung Völkenrode, Special Issue 215. Völkenrode, Germany.

Oecd. (2011). Farm level analysis of risk and risk management strategies and policies. Technical note. OECD, Paris, France.

Stokes, J. R., Coble, K. H. and Dismukes, R. (2000). Producer behavior in the presence of an income stabilization program. *Agricultural Finance Review,* 60**,** 34-59.