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Calibration of agricultural risk programming models using positive mathematical programming: a reply

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In this reply, we briefly clarify some points raised in the comment regarding the goal of the paper, model estimation and comparison.

The purpose of the original paper was to compare three positive mathematical programming (PMP) calibration methods by discussing their assumptions, specification, calibration approaches and data suitability, focusing on the practical application. The definition of practicality in the original paper is narrow, which is a conscious choice, because each approach has its own strengths and weaknesses with different assumptions and requirements for data. We agree that none of the approaches is perfect and none of them can fit all situations. Hence, the practicality in the paper only refers to whether the 'true' (recovered or implied) values of the parameters can be estimated and whether the results of sensitivity analysis using simulation data are reasonable.

As to the accuracy criteria, firstly, it remains an open question in the literature whether econometric criteria should be used to compare different PMP approaches. Secondly, due to different settings and assumptions, each approach does have its own set of parameters to calibrate. However, the difference in parameters does not change the fact that if the calibrated values of parameters show large fluctuations with the same data and process, the values are unreliable, which would further adversely affect policy analysis.

In relation to the response criteria, for the P&R-DARA model, the linear cost functions, rather than the choice of initial wealth, cause sudden changes in optimal land allocation. If we replace the initial wealth level in the original paper with decoupled direct payments calculated using total land, the change does not have a significant impact on the calibrated parameter values, nor does it lead to smooth changes in optimal land allocation responding to small changes in price and yields – that is, one or more crops may suddenly drop out from the crop mix (see figure 2 in the original paper as an example). In practice, if the optimal land allocation derived using calibrated linear cost functions is too sensitive to price and/or yield changes, even if an analyst has base case data to obtain reliable values for the parameters, the changes in

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optimal land allocation in the policy analysis phase could easily become unrealistic.

To be clear, we do not dismiss any approach. For example, the use of the P&R-DARA model can become empirically practical when quadratic cost functions are employed. The Arata-CARA model can be powerful when the approach improves the method for calibrating the **Q** matrix's elements. Further, FSSIM-ME-CARA is far from being a perfect approach for calibration. For instance, it needs to be extended to incorporate information from multiple observations in order to have a full **Q** matrix.

Overall, we do not disagree with the comments, but we do think that the calibration methods chosen for our application are sufficiently rigorous for policy analysis purposes.