S1: PMAUP domain and constraints

Land use limits. The sum of all alternative land uses, including fallow land, must be 1.

$$\sum_{i=1}^{n} X_i = 1 \quad \text{[EQ1]}$$

Water use limits. Agricultural water use must be equal or lower than the total water allotment, i.e.:

$$\sum_{i=1}^{n} w_c X_c \leq W \quad \text{[EQ2]}$$

where w_c are the water needs of crop i (in m^3/ha), X_i is the share of land allotted to crop i and W is the total water allotment for the agent (m^3/ha).

Climate and soil constraints. Only crops that can be planted under the climate and soil conditions of the area are eligible. The set of eligible crops is based on the historical crops observed and agronomic studies (Essenfelder et al., 2018):

$$\sum_{i=1}^{n} y_i x_i = 0 \mid y_i \in \{0,1\} \quad \text{[EQ3]}$$

where $y_i = 0$ for eligible crops and $y_i = 1$ means the crop is not eligible for that specific location.

Crop specific constraints. Selected crops cannot be higher/lower than a predetermined surface (e.g. irrigable surface). The upper threshold of crop specific constraints is as follows (for the lower threshold, the inequality would be the opposite, and the right-hand side of the equation would be a sum):

$$\varphi_i x_i \leq (1 - b_i) x_i^0 \mid \varphi_i \in \{0,1\};\ 0 \leq b_i \leq 1 \quad \text{[EQ4]}$$

Where φ_i is a binary vector that (de)activates the constraint, b_i is the upper threshold (in %) and X_i^0 is the *observed* share of land devoted to crop i. For ligneous crops, the maximum/minimum threshold is set at ±1% of the observed land share, to prevent large (dis)investments with potentially large impacts on e.g. carbon sequestration, whose economic value is not accounted for in the models, which focus on yearly market variables (notably profit) (Essenfelder et al., 2018).

Crop rotation. Agronomic rotation patterns are based on observed historical data and agronomic studies for that area:

$$\sum_{i,j} g_{i,j} X_i \leq \sum_{i,j} h_{i,j} X_i^0 \mid g_{i,j} \in \{0,1\};\ h_{i,j} \in \{0,1\} \quad \text{[EQ5]}$$

where $g_{i,j}$ and $h_{i,j}$ are binary vectors that (de)activate the constraint for each specific crop.

S2: PMAUP utility attributes

Following the multi-attribute utility programming methods proposed by Gómez-Limón et al., (2016); Gutierrez-Martin & Gomez, (2011), we assessed the relevance of three attributes in multi-attribute models: expected profit; risk avoidance; and management complexity avoidance, which is measured through a proxy: hired labor avoidance per unit of revenue:

1. **Expected profit (Z1)** is measured as the expected gross margin. It is obtained as the summation of the expected per hectare gross margin of each crop π_i (obtained as price (in EUR/kg) multiplied by yield (in kg/ha) plus coupled subsidies minus the variable costs (in EUR/ha) multiplied by that crop's land share (X):

$$Z1(X) = \sum_i X_i \bar{\pi}_i \quad \text{[EQ6]}$$

where $\bar{\pi}_i$ is the average gross margin for each crop i in the period 2004-2015, i.e. the summation of the observed gross margin of crop i for every year during this period divided by the number of years.

2. **Risk avoidance (Z2)** is measured as the difference between the profit variability of the profit maximizing crop portfolio $\hat{X}$ and that of an alternative crop portfolio $\boldsymbol{X}$:

$$Z2(X) = \hat{X}^t VCV(\pi)\hat{X} - X^t VCV(\pi) X \quad \text{[EQ7]}$$

where $VCV(\pi)$ is the variance and covariance matrix of profit in the period (2004-2015). The first term in the right-hand side of the equation, $\hat{X}^t VCV(\pi)\hat{X}$, yields the risk of the profit maximizing crop portfolio, while the second term, $X^t VCV(\pi)X$, yields the risk of the observed crop portfolio. Provided there is a tradeoff between risk and profit (the higher the profit, the higher the risk), risk avoidance ($Z2(X)$) will be positive.

3. **Hired labor avoidance (Z3)** is measured as the difference between the number of hired labor used in the profit maximizing crop portfolio and that of an alternative crop portfolio X:

$$Z3(X) = \bar{H} - H\,(X) \quad \text{[EQ8]}$$

Where H (X) = $\sum_i X_i H_i$ is the labor requirement per hectare to produce the crop portfolio X.

$\bar{H}$ is the hired labor requirement per hectare to produce the profit maximizing crop portfolio.

S3: PMAUP calibration

PMAUP models elicit the parameters of a multi-attribute objective function by means of equalizing the slope of the indifference curve, or marginal rate of substitution, to the tangency point along the efficiency frontier, or marginal rate of transformation (Essenfelder et al., 2018). This yields as many candidates' objective functions as possible combinations of utility-relevant attributes are explored, which are subsequently ranked according to their performance/calibration residual metrics in order to determine the most accurate representation of the objective function. While all the PMAUP calibration techniques available in the literature share the calibration process described above, they differ in the method used to approximate the efficiency frontier. The method presented in this paper approximate the efficiency frontier using a projection method(Gutierrez-Martin & Gomez, 2011).

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