

agriculture in the Kazbegi region:  
production processes, efficiency and  
production potential

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## farmers' survey in Kazbegi

- questionnaire was developed for major farming activities
- questionnaires were tested and interviewers were trained
- combination of respondent-driven and stratified sampling methods was employed
  - former included every producer who during the team visit was at home and did not object to interview
  - latter comprised producers of “new” crops, strawberry and lettuce
- survey was carried out by Rati Shavgulidze + Hiwis in June/July 2015
- 154 producers were interviewed

# distribution of the surveyed farmers in targeted villages

| #     | Village     | # of Producers |
|-------|-------------|----------------|
| 1     | Sioni       | 51             |
| 2     | Pkhelshe    | 31             |
| 3     | Sno         | 27             |
| 4     | Kanobi      | 16             |
| 5     | Akhaltsikhe | 12             |
| 6     | Arsha       | 10             |
| 7     | Goristsikhe | 3              |
| 8     | Garbani     | 2              |
| 9     | Gergeti     | 1              |
| 10    | Vardisubani | 1              |
| Total |             | 154            |

# experiences during the survey

- Questionnaire was revised and simplified
  - 57 producers were surveyed using original questionnaire, and 97 producers were surveyed using revised/ simplified questionnaire
- It was a very strong impression that respondents were under-reporting feedback plus many “no-responses”
- It seemed difficult for producers to identify their plots on the maps; moreover the process was very time-consuming, and it was decided to drop it
- Depending on availability, both female and male representatives of the households were interviewed; only in one case spouses have participated together in the interview

| gender of surveyed producers |      |             |       |
|------------------------------|------|-------------|-------|
| female                       | male | female/male | total |
| 79                           | 74   | 1           | 154   |

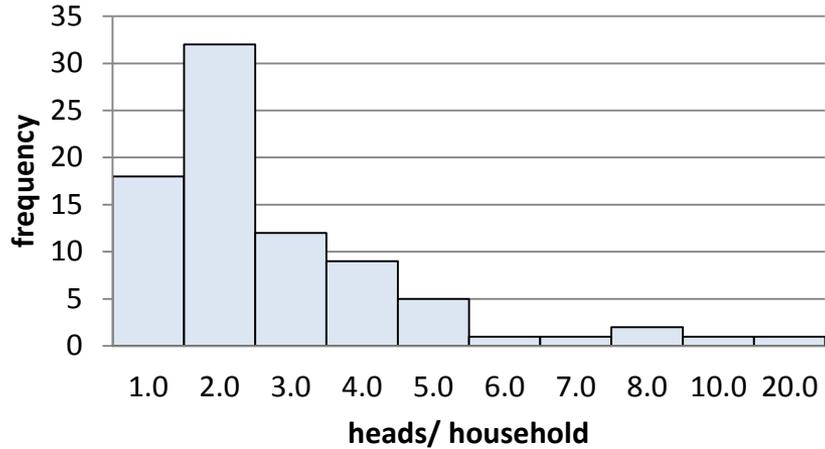
- With the exception of two households, all were involved in potato production
- Most of the households were involved in potato and dairy farming, or just in potato production

# surveyed producer farming activities

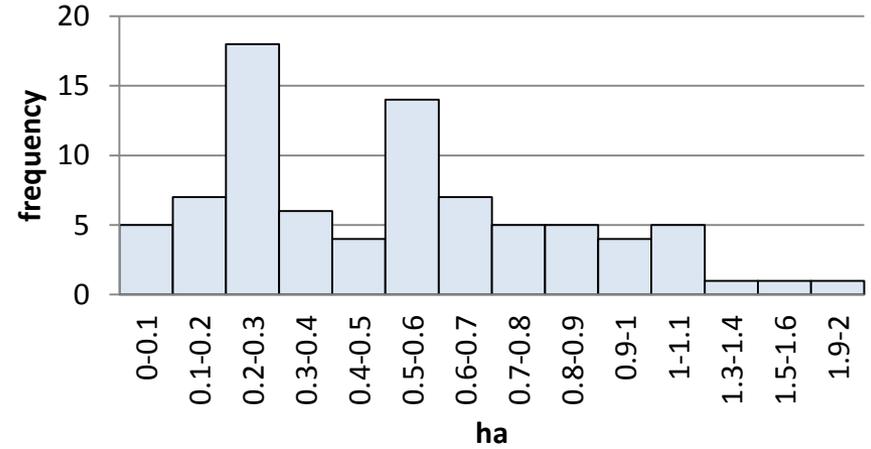
| activities pursued             | # of producers |
|--------------------------------|----------------|
| potato, dairy                  | 70             |
| potato, dairy                  | 53             |
| potato, lettuce, dairy         | 9              |
| potato, lettuce                | 6              |
| potato, strawberry             | 5              |
| dairy                          | 2              |
| potato, dairy, beekeeping      | 2              |
| potato, strawberry, dairy      | 2              |
| lettuce, beekeeping            | 1              |
| potato, dairy, sheep           | 1              |
| potato, lettuce, beekeeping    | 1              |
| potato, sheep                  | 1              |
| potato, strawberry, beekeeping | 1              |

# dairy/ cheese

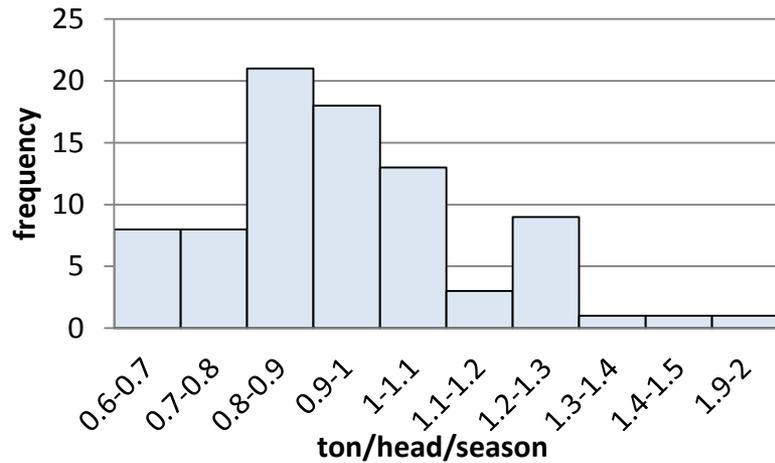
## # dairy cattle



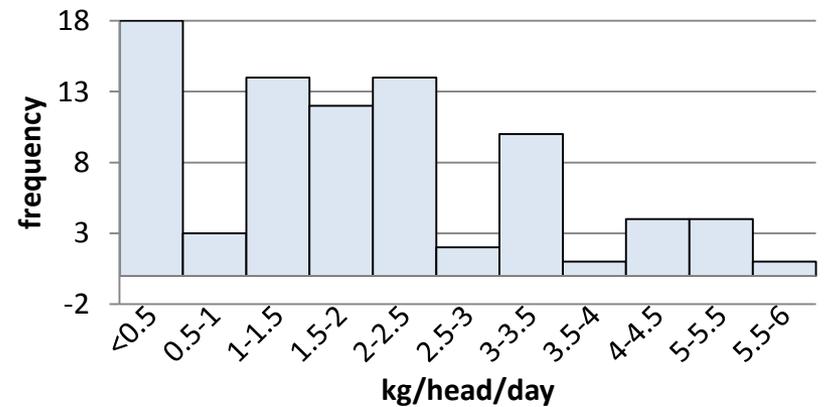
## grass land area



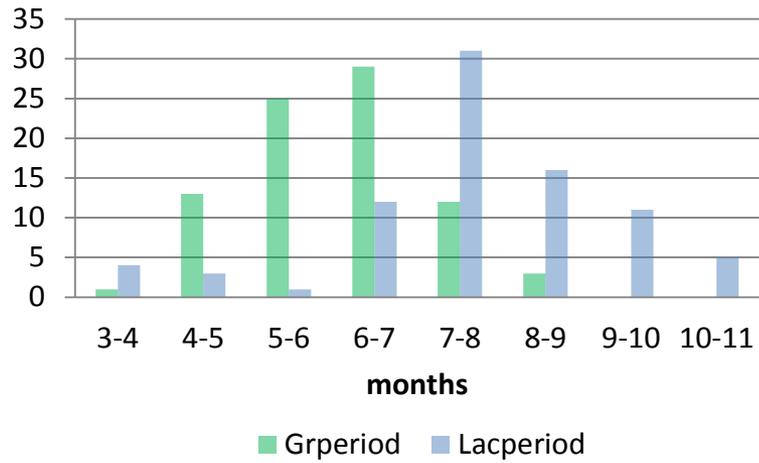
## hey feeding rate



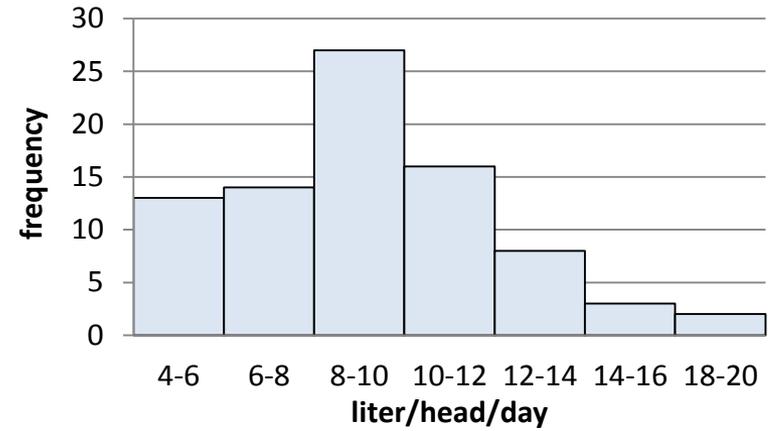
## bran feeding rate



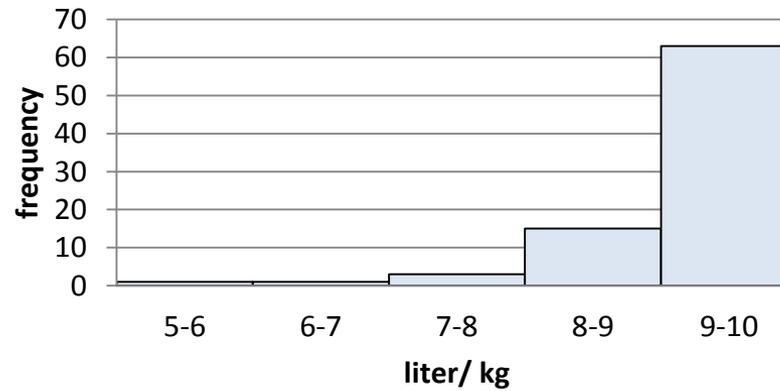
### grazing and lactation months



### milking rate



### milk to cheese conversion rate



# gross margin

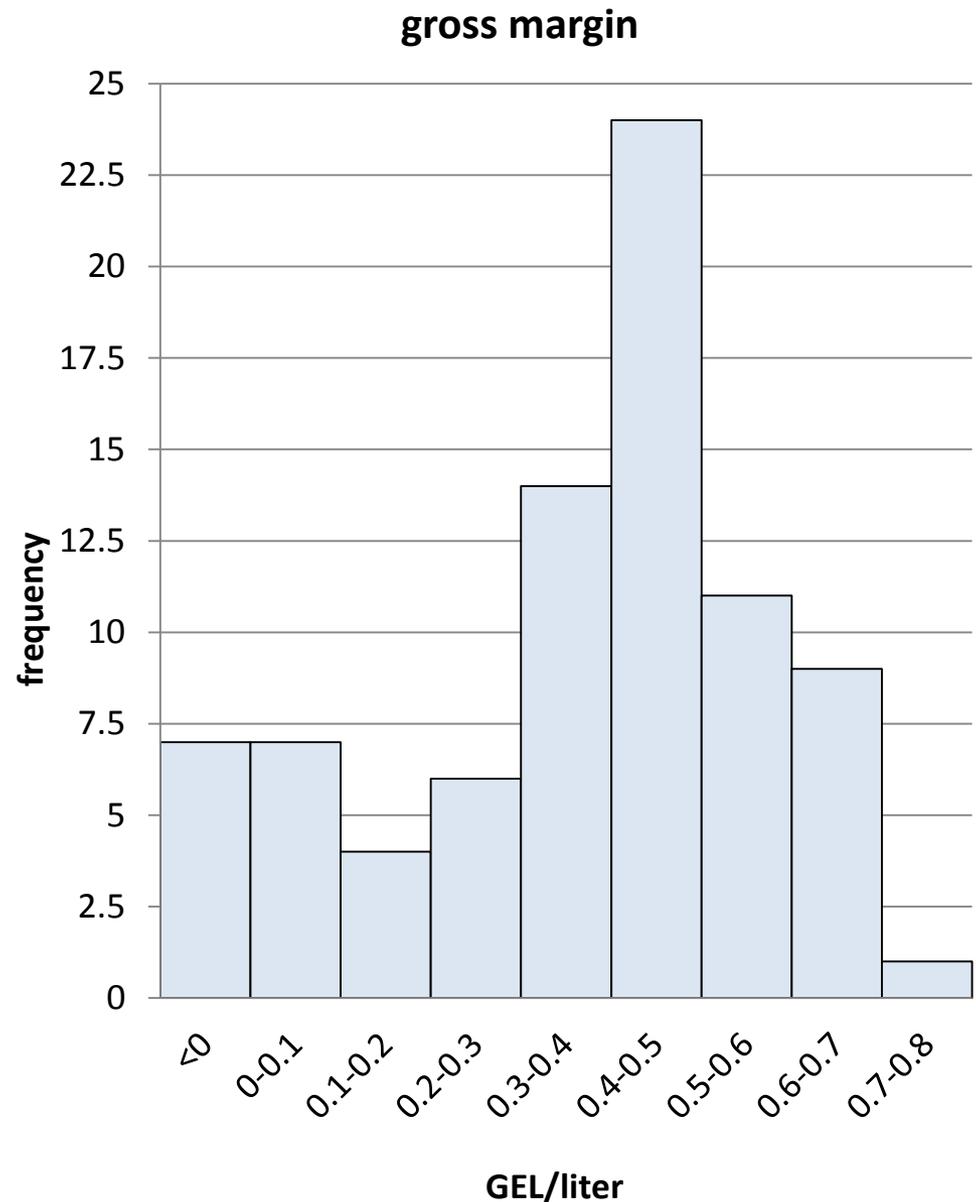
estimated average gross margin 0.36 GEL/liter

estimated gross margin ratio - 46%

imputed family labor input and costs (milking, cleaning, feeding, etc.)

imputed input costs (hey, transportation, etc.)

Self-consumed output valued at market prices



# technical efficiency

- hypothesis:
  - inefficiency effects are absent
    - *rejected at  $p < 5\%$*
  - inefficiency effects are not stochastic
    - *rejected at  $p < 1\%$*
- variables tested
  - regressors: milking rate, milk to cheese conversion rate, area of grass land, periods of grazing, and feeding with hay and bran, bran and hay feeding rate, lactation period, herd size, TVC, labor, and consumption of hay and bran
  - technical inefficiency measures: HH size, # of pensioners in the HH, proportion of adult females in the HH, # of adults, # of adult females in the HH, higher education of HH heads and spouses, off-farm activity and income, pensioner(s) in the HH, cattle

feeding with combined feed, implementation of animal health protection measures, HH income from sales of agriculture products, quality of hey fields

- one stage estimation of SF production and inefficiency models

- stochastic frontier production model

$$\ln(\text{CHEESEOUTPUT}_{it}) = \beta_0 + \beta_1 \ln(\text{LACTATIONPERIOD}) - \beta_2 (\text{HEY FEEDING RATE/SEASON}) + V_{it} - U_{it}$$

- inefficiency model

$$- U_{it} = \delta_0 - \delta_1 (\#ADULTS_{it}) + \delta_2 (\#PENSIONERS_{it}) - \delta_3 (\text{AGRINCOME}_{it}) + W_{it}$$

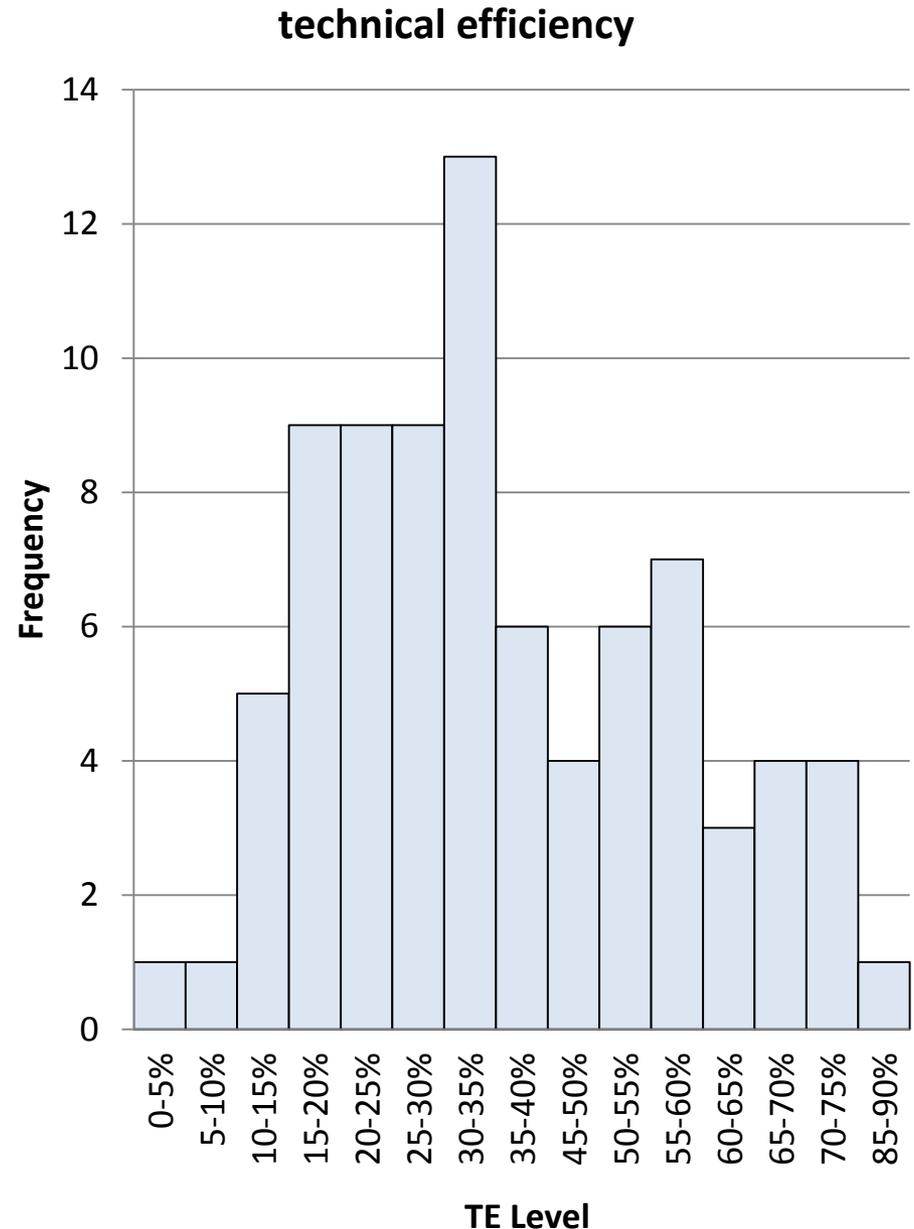
| variable                                    | significance | sign | explanation   |
|---|--------------|------|---|
| <b>stochastic frontier production model</b> |              |      |   |
| intercept                                   | p<1%         | +    |   |
| lactation period                            | p<1%         | +    | longer lactation period is positively related with cheese output (elastic)              |
| hey feeding rate                            | p<1%         | -    | inadequate nutritional quality of hey is inversely related with cheese output (elastic) |
| <b>inefficiency model</b>                   |              |      |   |
| intercept                                   | p<1%         | +    |   |
| #adults                                     | p<10%        | -    | # of adults in the HH is inversely related with inefficiency                            |
| agincome (dummy var.)                       | P<10%        | -    | income generated through agriculture sales inversely related with inefficiency          |
| #pensioners                                 | p<10%        | +    | # of pensioners in the HH positively related with inefficiency                          |

farmers, on average, reached 37% of efficiency level

there is a scope to increase output by 63% by employing the same level of inputs and improving husbandry practices

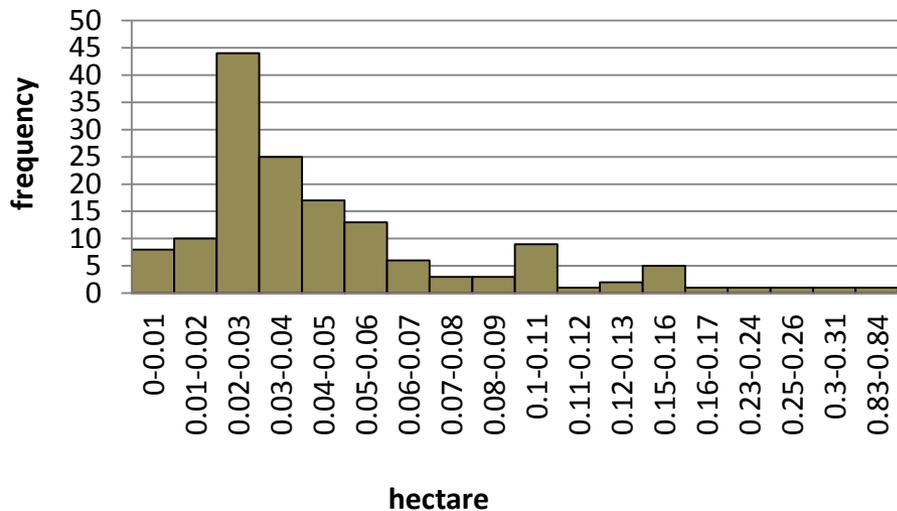
77% variability in farmer performance can be explained by technical inefficiency

decreasing returns to scale estimate indicating on inefficiency in husbandry practices

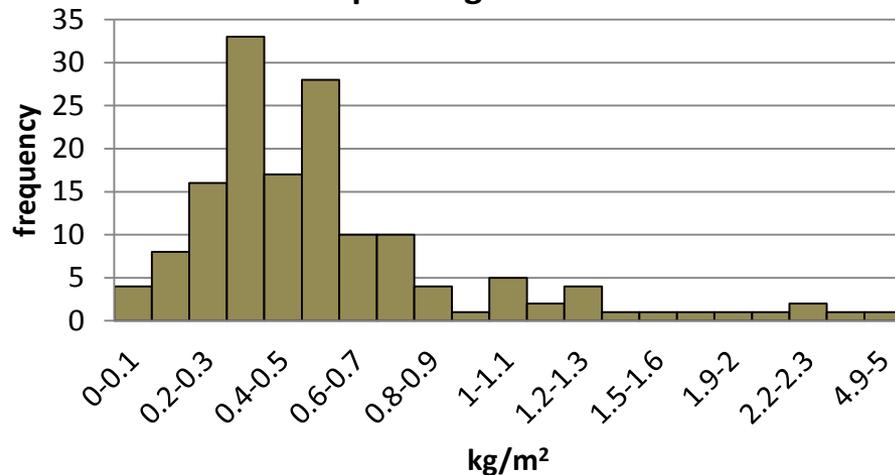


# potato

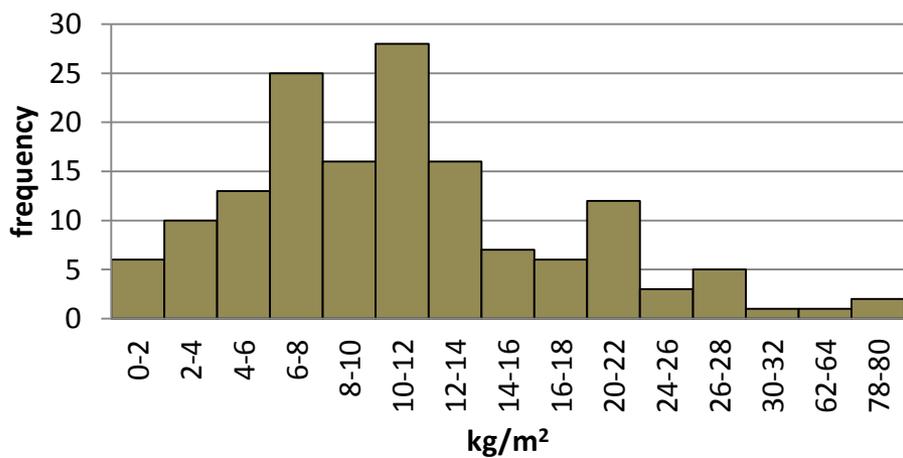
## area planted with potato



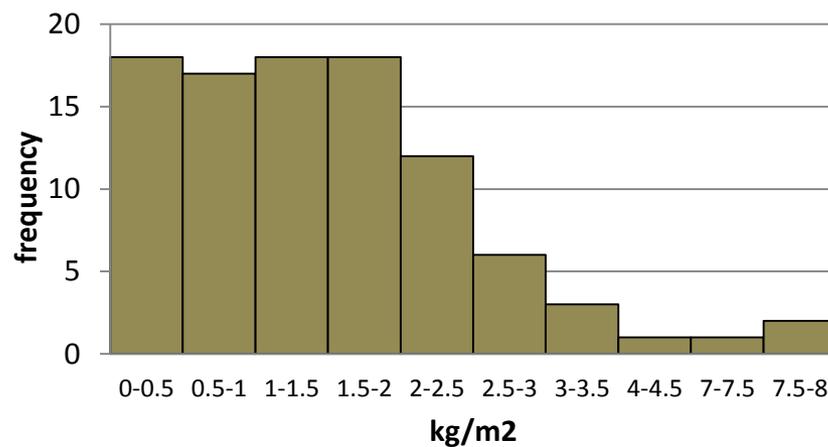
## planting rate



## manure application rate



## potato yield



# gross margin

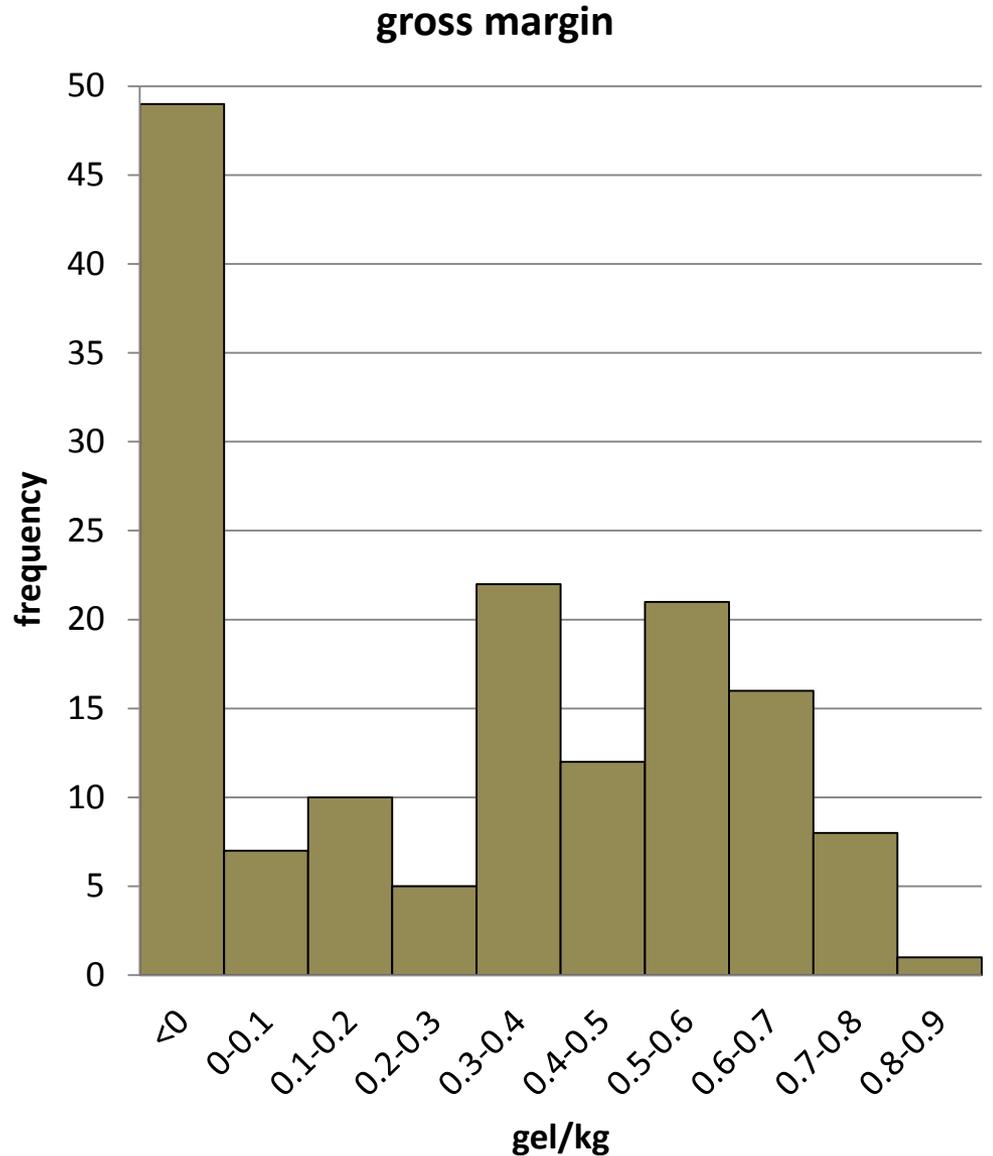
estimated average gross margin 0.27 GEL/kg

estimated gross margin ratio - 28%

imputed family labor input and costs (cultivation, harvest, etc.)

imputed input costs (manure, seeds, etc.)

Self-consumed output valued at market prices



# technical efficiency

- hypothesis:
  - inefficiency effects are absent
    - *rejected at  $p < 1\%$*
  - inefficiency effects are not stochastic
    - *rejected at  $p < 1\%$*
- variables tested
  - regressors: planting rate, planted area, manure application rate, TVC, labor
  - technical inefficiency measures: HH size, # of pensioners in the HH, proportion of adult females in the HH, # of adults, # of adult females in the HH, higher education of HH heads and spouses, off-farm activity and income, pensioner(s) in the HH, HH income from sales of agriculture products, measures against pests/diseases, quality of arable land, years of the use of harvest as seed, seed quality

- one stage estimation of SF production and inefficiency models
- stochastic frontier production model
  - $\ln(\text{POTATOOUTPUT}_{it}) = \beta_0 + \beta_1 \ln(\text{AREAPLANTED}) + V_{it} - U_{it}$
- inefficiency model
  - $U_{it} = -\delta_0 - \delta_1(\text{PPMEASURES}_{it}) - \delta_2(\text{QUALITYSEED}_{it}) + W_{it}$

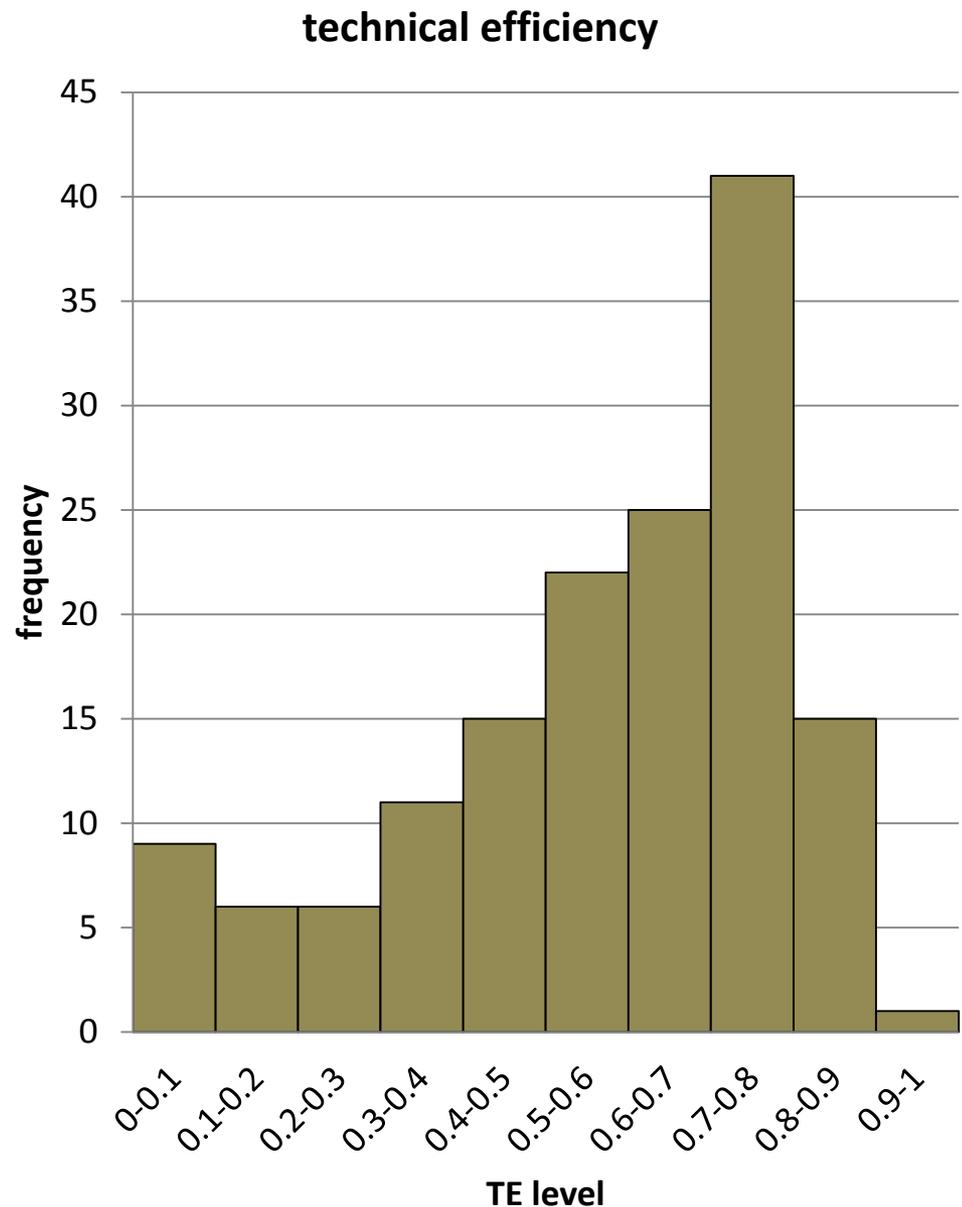
| variable                             | significance | sign | explanation  |
|--------------------------------------|--------------|------|--|
| stochastic frontier production model |              |      |  |
| intercept                            | p<1%         | +    |  |
| area                                 | p<1%         | +    | larger area planted with potatoes is positively related with potato output (inelastic)       |
| inefficiency model                   |              |      |  |
| intercept                            | p<10%        | -    |  |
| PPmeasures<br>(dummy<br>var.)        | p<10%        | -    | Implementation of plant protection measures is inversely related with technical inefficiency |
| QualitySeed<br>(dummy<br>var.)       | P<10%        | -    | Use of quality seeds is inversely related with technical inefficiency                        |

farmers, on average, reached 57% of efficiency level

there is a scope to increase output by 43% by employing the same level of inputs and improving agronomic practices

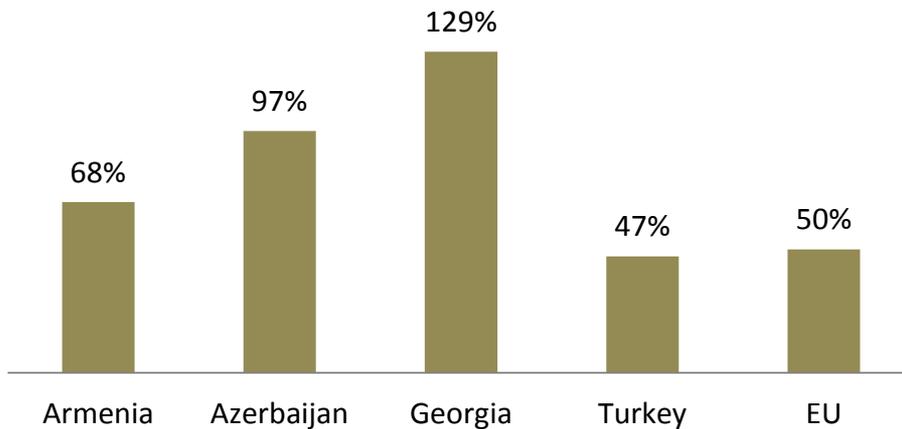
95% variability in farmer performance can be explained by technical inefficiency

decreasing returns to scale estimate indicating on inefficiency in agronomic practices



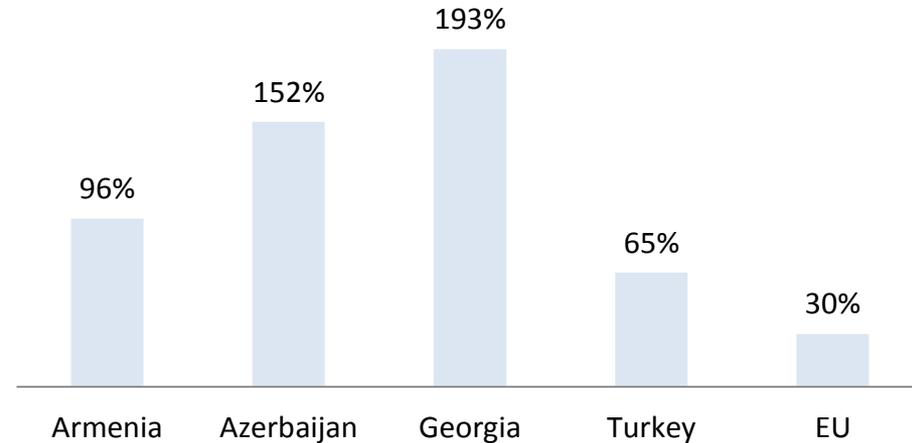
# Policy Response (target: increased household income)

potato yield in Kazbegi vs Georgia, Armenia, Azerbaijan, Turkey, and EU



Source: FAO, own estimates

milk annual yield in Kazbegi vs Armenia, Azerbaijan, Georgia, Turkey and EU



- empowerment of local extension service to provide need based advisory services to farmers
- Implementation of support programmes that would
  - explicitly address efficient use of existing technology among farmers inclusive of education, information acquisition, learning by doing process
  - favor reasonable specialization and commercialization of local farmers
  - improve availability and accessibility to farm inputs (including seeds, feed, etc.)
  - facilitate to the development of non-agriculture livelihood opportunities