PRODUCTIVITY GROWTH IN SMALLHOLDER SUGARCANE PRODUCTION IN KENYA: A MALMQUIST TFP DECOMPOSITION

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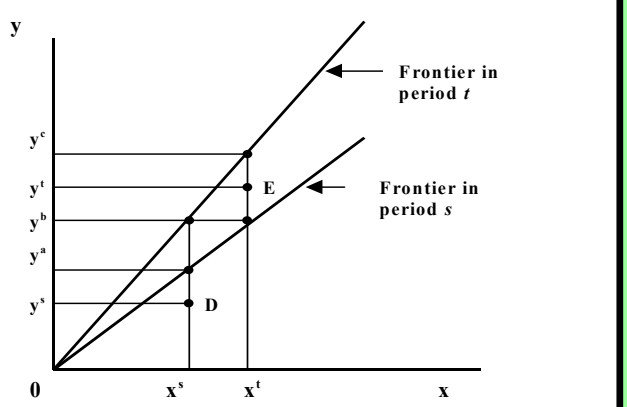
1. BACKGROUND INFORMATION AND OBJECTIVES

- An effective economic development strategy depends critically on promoting productivity and output growth in the agricultural sector, particularly among small-scale producers (SSP).
- The percentage market share of SSP output in Kenya has risen from slightly over 56% in 1990 to 70% in 2001 (Economic survey, 2001).
- In cane areas, they represent 90% of the total cane surface area
- Cane yields in the last 10 years have been on a declining trend. The study aims at determining total factor productivity and decomposing it to efficiency and technological components, to determine source of decline.

2. MODEL : THE MALMQUIST TFP INDEX

- Total factor productivity (TFP) is the ratio of output to the aggregate measure of the inputs of all the factors of production.
- The Malmquist TFP index measures the change between two data points by calculating the ratio of distances at each data point relative to a common technology.
- It has additional benefits over the Fisher and Torqvist indices, that price data are not required.
- TFP indices obtained may be decomposed into two components, one part due to technical efficiency change (farms getting closer to the frontier) and another part due to technological change (shifts in frontier itself).
- Distance functions allow one to describe a multi-input, multi-output production technology without the need to specify a behavioral objective (such as cost minimization or profit maximization).
- The output-oriented Farrell measure is the radial measure of technical efficiency in which the efficiency is obtained by expanding the level of output while holding the level of inputs constant.
- Points D and E in figure 1 below represent the input-output combinations of a production unit in periods *s* and *t* respectively.
- In both cases, it is operating below the production possibility frontier.

MALMQUIST TFP DETERMINATION



$$F_o^t(y_t,x_t)=\left[d_o^t(y_t,x_t)\right]^{-1} \quad \text{Max}\theta^t \quad \lambda$$

s.t.

$$x^t_{ij^*} \geq \sum_j \lambda_j x^t_{ij} \qquad \forall i$$

$$\theta^t y^t_{rj^*} \leq \sum_j \lambda_j y^t_{rj} \qquad \forall r$$

$$\lambda_j \geq 0 \qquad \forall j.$$

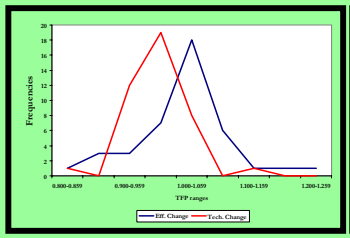
- The aim is to maximize the output of the firm while holding inputs constant.
- θ is the measure of level of
- Maximization. If θ >1, the firm is inefficient. But if θ =1, firm is efficient.
- We calculate *thetas* of D and E in relation to frontiers *s* and *t* to get 4 thetas
- We then get the geometrical mean of the thetas to get the TFP change between the two periods.

$$m\ (x^t, y^t, x^s, y^s) = \left[\frac{d^s(x^t,y^t)}{d^s(x^s,y^s)} \times \frac{d^t(x^t,y^t)}{d^t(x^s,y^s)}\right]^{1/2}$$

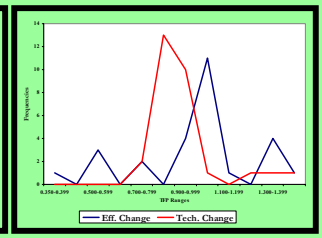
3. RESULTS

EFFICIENCY AND TECHONOGICAL CHANGES IN THE SCHEMES

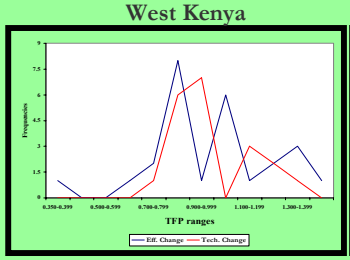
Mumias



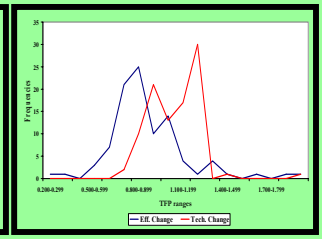
Chemelil



West Kenya



Overall



4. DISCUSSIONS AND CONCLUSIONS

The mean efficiency and technological changes are different in the schemes. In Mumias and Chemelil, mean efficiency remained unchanged at around 1 while tech. change was below 1. In West-Kenya, the two were almost equal.

The problems in Kenya sugar production are both from efficiency and technology. There is room for improving efficiency with current technologies, or improving both efficiency and technology and efficiency concurrently.

5. REFERENCES

- Coelli, T., Rao, D.S.P., AND G.E. Battese (1998): *An Introduction to efficiency and Productivity Analysis*. Kluwer Academic Publishers.
- Färe, R., Grosskopf, S. and C.A.K Lovell (1994): *Production Frontiers*, Cambridge University Press, Cambridge.
- Grifell-Tatjé, E. and C.A.K Lovell (1995): 'A Note on the Malmquist Productivity Index', *Economic Letters*, 47, 169-175.
- Kenya, Republic of. Central Bureau of Statistics (2001): *Economic survey*, Government printer, Nairobi.

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