TECHNOLOGICAL CHANGE AND PRODUCTIVITY ANALYSIS IN NEBRASKA

Dereje B. Megeressa

University of Nebraska-Lincoln, d_bacha@yahoo.com

Follow this and additional works at: http://digitalcommons.unl.edu/ageconfacpub

Part of the Agricultural and Resource Economics Commons

Megeressa, Dereje B., "TECHNOLOGICAL CHANGE AND PRODUCTIVITY ANALYSIS IN NEBRASKA" (2011). Faculty Publications: Agricultural Economics. 110.

http://digitalcommons.unl.edu/ageconfacpub/110

This Article is brought to you for free and open access by the Agricultural Economics Department at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Faculty Publications: Agricultural Economics by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.
TECHNOLOGICAL CHANGE AND PRODUCTIVITY ANALYSIS IN NEBRASKA

Author: Dereje B. Megeressa

Email: d_bacha@yahoo.com

Department of Agricultural Economics
University of Nebraska Lincoln
Lincoln, NE 68583
Tele: 402-472-3401


Copyright 2010 by [author]. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.
Introduction

Productivity growth has been an important source of US economic growth throughout the century. The years since 1940 have been an even faster growth in agricultural productivity (Ball, et al. 1998; Tokgöz, 2002).

Several factors have been identified as the most important sources of productivity change in US agriculture. Chandler (1962) attributes over 75 percent of the growth in productivity to technological factors in the post-war years.

In Nebraska, several productivity studies conducted that include (Perrin et al, 2001; Ball et al, 2001; and Palestina et al(2009).

None of the studies disaggregate land into poor and good lands and measures their relationships.

As producers respond to higher crop prices, marginal/poor lands will be converted into cropland.

To be able to estimate the indirect effect on land use, one needs to know own and cross price elasticities for the different land types.

Objectives

- Estimate economies of scale and rate of technological progress for the period covering, 1960-2004 in Nebraska
- Estimate own and cross elasticities for the different land types
- Estimate rate of substitution between agricultural inputs in Nebraska

Analytical Approach

Translog Cost Function

\[ \ln C = c_0 + \sum c_i \ln W_i + 1/2 \sum \sum \beta_{ij} \ln W_i \ln W_j + \sum c_i \ln I_i + 1/2 \sum \sum \phi_{ij} \ln I_i \ln I_j + \phi \theta + 1/2 \sum \theta_i \ln I_i + \sum \sum \phi_{ij} \]

Homogeneity: \( \sum c_i = 1 \), \( \sum \beta_{ij} = \sum \theta_i = \sum \phi_{ij} = 0 \)

Symmetry condition: \( \beta_{ij} = \beta_{ji} \) for all \( i, j \) is assumed.

The elasticity of scale, which measures relative changes in output resulting from proportional changes in all inputs, is described by Hanesch as relation to the total cost and output along the expansion path. It can be obtained from the Translog cost function as

\[ e = \frac{1}{\ln C} \frac{C}{\ln Q} = (c_0 + \sum c_i \ln W_i + \sum \beta_{ij} \ln W_i \ln W_j + \sum \phi_{ij} \ln I_i \ln I_j + \phi \theta + 1/2 \sum \theta_i \ln I_i + \sum \phi_{ij}) \]

Following Baumol, Panzar, and Willig(1982), scale economies in a multiple-output case is estimated as

\[ e = \frac{1}{\sum c_i \ln W_i} \sum \frac{1}{\ln I_i} \]

The rate of technological progress \( \lambda \) is given by

\[ \lambda(t) = \log 1 - \left[ \frac{1}{t} \sum \beta_i \log t + \beta_{log t} \sum \frac{1}{t} \log t \right] \]

Technological progress has a factor using bias if \( \beta_i > 0 \). It is neutral with respect to factor \( i \) if \( \beta_i = 0 \) and it is a factor \( i \) saving if \( \beta_i < 0 \).

Results

<table>
<thead>
<tr>
<th>Variables</th>
<th>SHL(labor)</th>
<th>SHL(land)</th>
<th>SHL(capital)</th>
</tr>
</thead>
<tbody>
<tr>
<td>lnV1(labor) fixed input</td>
<td>0.1135***</td>
<td>0.0911</td>
<td>0.1460***</td>
</tr>
<tr>
<td>lnV2(labor)</td>
<td>-0.0055***</td>
<td>0.0195***</td>
<td>0.0505***</td>
</tr>
<tr>
<td>lnV3(capital)</td>
<td>-0.0169***</td>
<td>-0.0259***</td>
<td>0.1720***</td>
</tr>
<tr>
<td>lnV4(fact. inputs)</td>
<td>-0.0041***</td>
<td>-0.0047***</td>
<td>0.0043***</td>
</tr>
<tr>
<td>lnY1(Feed crops)</td>
<td>-0.0042</td>
<td>0.0035***</td>
<td>-0.0044***</td>
</tr>
<tr>
<td>lnY2(Cal Crops)</td>
<td>0.0052</td>
<td>-0.0066***</td>
<td>0.0035***</td>
</tr>
<tr>
<td>lnY3(Feed)</td>
<td>0.0042***</td>
<td>-0.0053***</td>
<td>0.0043***</td>
</tr>
<tr>
<td>Time</td>
<td>-0.0004***</td>
<td>0.0025***</td>
<td>-0.0002***</td>
</tr>
<tr>
<td>Constant</td>
<td>1.1794***</td>
<td>-0.4200***</td>
<td>0.0027***</td>
</tr>
</tbody>
</table>

*Coefficients are bolded if statistically significant

Table 2: Estimated Allen Partial Elasticities of Substitution (\( \sigma_{ij} \))

<table>
<thead>
<tr>
<th>Labor</th>
<th>Land</th>
<th>Capital</th>
<th>Inter. Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor</td>
<td>-0.15884932</td>
<td>-0.09737626</td>
<td></td>
</tr>
<tr>
<td>Land</td>
<td>0.14295868</td>
<td>0.00906876</td>
<td>-0.05271951</td>
</tr>
<tr>
<td>Capital</td>
<td>-0.03653315</td>
<td>0.08948265</td>
<td>0.01429065</td>
</tr>
<tr>
<td>Int. Inputs</td>
<td>-0.02177990</td>
<td>0.00948265</td>
<td>0.00903244</td>
</tr>
</tbody>
</table>

Conclusion

Preliminary analysis of the result suggests that, given the inputs used for the study, there is an increasing economies of scale in the entire period, though in a decreasing rate.

The rate of technological progress was increasing for the period covering 1960 to 1971. The technology going to the production of feed crops and oil crop production have been labor and intermediate inputs saving and capital consuming.

Substitution possibilities and complementarities between the inputs are also observed.