A Test of Labour Market efficiency in Sudan: A Production Function Approach

By:

Osman M. Babikir
Prof. Babiker I. Babiker
Prof. Siegfried Bauer
Gezira Scheme location:
The Importance of Gezira scheme:

- Sudan Agriculture (84 m.ha.) (11 m. ha.)
  - FORESTRY
  - LIVESTOCK
  - MECHANIZED RAINFED (4 m.ha.)
  - TRADITIONAL RAINFED (5 m.ha.)
  - IRRIgATED (1,9 m.ha.)
  - Gezira Sheme (0,9 m.ha.)
  - OTHER IRRIgATED SCHEMES (1 m.ha.)
Labour Markets in Sudan:

- Labour Markets in Sudan
  - Urban
    - Nomadic Pastoralists
    - Formal
    - Informal
  - Rural
    - Non-agricultural Workers
    - Agricultural Workers
    - Traditional Peasants
      - Hired Labourers
      - Family Labourers
Labour markets in Gezira scheme:
man power in Gezira scheme:
Labour classes in Gezira scheme:

- family
- local
- migrant

Labour in Gezira scheme:

- Hired
- Family
  - Causal
  - regular
Research Objectives

To give a preliminary test of efficiency regarding the operation of the rural labour market in Sudan, taking the Gezira Scheme as example from the irrigated agriculture.
There is an ongoing debate in development economics about the appropriate characterization of rural labour markets:


2. The absence of well functioning markets, especially for labour but often for other inputs and output as well (Radwan, 1989; Kanwar, 1998; and Lamb and Worthington, 2003).

In order to test whether the labour market operate efficiently or not, the relationship between the estimated marginal products and effective wage is examined.

Based on the assumption that household labour will be supplied to the point that its marginal product equates with the real wage, the following Form was used:
\( W^* = \alpha + \beta W_m + e \)

where:

- \( W^* \) is the shadow wage rate,
- \( W_m \) is the prevailing market wage, and
- \( e \) is the error term.

\( \alpha \) and \( \beta \) are constants.

The objective is that, the test will support labour market efficiency, if \( \alpha = 0, \beta = 1 \).

The rejection of the null hypothesis is that \( F \)-value is significant at any level of significance.
**Methodology**

Following the administrative division of the Gezira scheme into two areas then further into groups and blocks, the primary data was taken as follow:

- **Gezira scheme**
  - **Gezira main**
    - Groups (3)
    - Blocks (2*3)
    - Tenants (2*3*15)
    - 30 labourers
  - **Managil Extension**
    - Groups (2)
    - Blocks (2*2)
    - Tenants (2*2*15)
    - 30 labourers

- 150 tenants + 60 labourers
**Results**

**Production function:**

\[ Y = ax_1 \beta_1 x_2 \beta_2 x_3 \beta_3 \ldots \ldots x_n \beta_n + e \]

\[ \log Y = \log a + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + \beta_5 \log X_5 + \beta_6 \log X_6 + \beta_7 X_7 + \beta_8 X_8 + e \]

Where:

- The dependent variable (Y) is the output of crop, taken in physical units, Kentar per feddan for cotton, sacks per feddan for wheat, sorghum and groundnut.
- \( \beta_1, \beta_2 \) to \( \beta_6 \) are the coefficients (elasticities).
- \( x_1, x_2 \) to \( x_8 \) are the independent variables.
- e is the error term.
- \( X_1 \) is the average area cultivated for each crop in feddans.
- \( X_2 \) is the average labour/crop in mandays per feddan.
- \( X_3 \) is the average total net farm income (S.D.).
- \( X_4 \) is the off-farm income (S.D.).
- \( X_5 \) is the average number of irrigations for each crop.
- \( X_6 \) is the average number of weedings for each crop.
- \( X_7 \) is a dummy variable, sowing date.
- \( X_8 \) is a dummy variable, harvesting date.
Regression coefficients and statistics for the production functions of the major field crops in Gezira scheme

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cotton</th>
<th>Wheat</th>
<th>Sorghum</th>
<th>Groundnut</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivated area (Fed.)</td>
<td>0.264 (1.031)</td>
<td>0.275 (1.797)*</td>
<td>0.258 (1.869)*</td>
<td>0.112 (1.436)</td>
</tr>
<tr>
<td>Total labour (mandays)</td>
<td>0.480 (5.647)***</td>
<td>0.201 (1.896)*</td>
<td>0.371 (6.870)***</td>
<td>0.396 (3.094)***</td>
</tr>
<tr>
<td>Capital expenses (SD)</td>
<td>0.303 (1.762)*</td>
<td>0.328 (2.262)**</td>
<td>0.389 (3.325)**</td>
<td>0.405 (5.063)***</td>
</tr>
<tr>
<td>Number of irrigations</td>
<td>0.161 (1.258)</td>
<td>0.147 (1.081)</td>
<td>0.239 (2.915)**</td>
<td>0.029 (0.492)</td>
</tr>
<tr>
<td>Number of weedings</td>
<td>0.005 (0.054)</td>
<td>-</td>
<td>0.001 (0.017)</td>
<td>0.043 (0.915)</td>
</tr>
<tr>
<td>Tenant age (years)</td>
<td>0.507 (3.380)***</td>
<td>0.087 (1.891)*</td>
<td>0.034 (0.358)</td>
<td>0.021 (0.750)</td>
</tr>
<tr>
<td>Educational level (years)</td>
<td>0.102 (2.914)**</td>
<td>0.014 (0.875)</td>
<td>0.028 (1.077)</td>
<td>0.001 (0.125)</td>
</tr>
<tr>
<td>Sowing date (dummy)</td>
<td>0.059 (1.180)</td>
<td>-0.195 (7.500)***</td>
<td>-0.025 (-0.714)</td>
<td>0.108 (5.684)***</td>
</tr>
<tr>
<td>Harvesting date (dummy)</td>
<td>-0.131 (-2.673)**</td>
<td>-0.245 (-6.622)***</td>
<td>-0.022 (-0.846)</td>
<td>-0.096 (5.333)***</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.644</td>
<td>0.704</td>
<td>0.579</td>
<td>0.654</td>
</tr>
<tr>
<td>F-value</td>
<td>24.531</td>
<td>39.851</td>
<td>18.612</td>
<td>22.714</td>
</tr>
<tr>
<td>Constant</td>
<td>1.554 (2.556)**</td>
<td>2.778 (7.149)***</td>
<td>2.977 (10.945)***</td>
<td>3.262 (20.516)***</td>
</tr>
</tbody>
</table>

Figures in parenthesis are t-values
F-value: 9.459 (0.000). $R^2 = 0,572$. $R^2 = 0,511$
* , ** and *** denotes significance at 10%, 5% and 1% levels respectively.
### Test of equality of estimated labour shadow wages and prevailing market wages in Gezira scheme

<table>
<thead>
<tr>
<th>Crop</th>
<th>Estimated shadow wage</th>
<th>R2</th>
<th>F-value</th>
<th>Constant</th>
<th>Log wage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotton</td>
<td>681.7</td>
<td>0.339</td>
<td>4.652</td>
<td>0.647</td>
<td>0.758</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.087)</td>
<td>(0.648)</td>
<td>(2.157)**</td>
</tr>
<tr>
<td>Wheat</td>
<td>953.8</td>
<td>0.391</td>
<td>3.229</td>
<td>0.205</td>
<td>-0.643</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.077)</td>
<td>(2.029)**</td>
<td>(-1.797)*</td>
</tr>
<tr>
<td>Sorghum</td>
<td>463.0</td>
<td>0.301</td>
<td>2.972</td>
<td>0.411</td>
<td>-518</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.087)</td>
<td>(3.262)**</td>
<td>(-1.724)*</td>
</tr>
<tr>
<td>Groundnut</td>
<td>218.0</td>
<td>0.404</td>
<td>3.142</td>
<td>0.404</td>
<td>-0.785</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.080)</td>
<td>(3.206)**</td>
<td>(-1.773)*</td>
</tr>
</tbody>
</table>

*, ** and *** denotes significance at 10%, 5% and 1% levels respectively.
These results may support:

- The phenomenon of low productivity of labour in the developing countries.
- In case of each crop, the shadow wage of labour were significantly different from the ruling market wages.
- They were also different and lower compared to the ruling wages in non-agricultural activities.
- Non-market forces such as household characteristics and government policies.
- There may also be some employment constraints, some transaction costs or labour market imperfections. There is also seasonality in labour demand and supply.
- Markets do not behave as predicted by the neoclassical competitive notion, hence the shadow wages significantly deviates from the market wage.

* faire market-regulations, effective labour market information system and labour organizations