CONSTANT TECHNICAL RELATIONSHIPS BETWEEN INPUTS AND OUTPUTS IN THE NATIVE HATCHERY INDUSTRY

by

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Introduction

Eggs is one of the most essential food to supply people with animal protein.

Egyptian total production of eggs/year are about 455 million eggs by 1952, increased to about 1466 million eggs by 1974 and amounted 1925 million eggs by 1979\(^{(1)}\), i.e. it can be explained that eggs production had been multiplied more than four times during 25 years.

Eggs production distributed between three purposes the 1st as a table consumption, the 2nd purpose for native and mechanical hatcheries, and the 3rd for sweet industries and bakery.

Eggs are production either in rural flocks of small size or in large commercial firms which exceed more than 1400 firms by 1979.

Native hatcheries depend upon rural flocks in obtaining its requirements of fertil eggs, while mechanical hatcheries obtains, its requirement from layer commercial firms.

Rural flocks production of eggs are of mixed varieties. A lot of workers for collecting eggs from the individual farmers are needed. Mechanical hatcheries don't use this varieties of eggs as a source of row material.

Source: Table (1).
Total number of native and mechanical hatcheries amounted 854 and 351 laboratories respectively. Total number of hatched eggs are about 75 million eggs by 1952, increased to about 230 million eggs by 1979.

The hatched chicks represent about 45 million chicks by 1952 increased gradually around 156 million chicks by 1979. It means that technical hatching efficiency had increased from 60% by 1952 to 68% by 1979(1), due to the increase in number and capacities of mechanical hatcheries.

Native hatchery industry is one of the agricultural traditional industries in Egypt. It is one of the transferring industries, which use eggs as a source of raw material. Quantity of hatched chicks produced depend upon many factors. These are number of eggs set, fertility ratio, and mortality ratio before hatching.

In this industry eggs set incubated for 19 days, then transferred to hatching unit for 2 days.

The relationship between number of eggs set and hatched chicks produced was estimated during the period 1970/1971-1981 for Lower, Middle and Upper Egypt.

Source: (1) Table (1).
Tables (1) Total number of eggs produced / year (in million)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Eggs</td>
<td>Million</td>
<td>455</td>
<td>1406</td>
<td>1505</td>
<td>1566</td>
<td>1616</td>
<td>1778</td>
<td>1825</td>
</tr>
<tr>
<td>In cub. eggs</td>
<td>&quot;</td>
<td>464</td>
<td>716</td>
<td>713</td>
<td>718</td>
<td>738</td>
<td>716</td>
<td>822</td>
</tr>
<tr>
<td>Hat. eggs</td>
<td>&quot;</td>
<td>75</td>
<td>199</td>
<td>204</td>
<td>215</td>
<td>228</td>
<td>230</td>
<td>230</td>
</tr>
<tr>
<td>Hat. chicks %</td>
<td>&quot;</td>
<td>60</td>
<td>64</td>
<td>65</td>
<td>65</td>
<td>66</td>
<td>67</td>
<td>68</td>
</tr>
</tbody>
</table>

Imperical Results

Constant technical relationships

The first investigation estimated the relationship between hatchery eggs set and produced chicks in Egyptian hatcheries through the period 1952/1953 - 1979/1980.

This relation was found to be in the form (1),

\[ Y_i = 3.8 + 0.54 X_i \]

\[ (0.06) \quad (52.8) \]

\[ R^2 = 0.998 \]

Where as,

\( Y_i \) = estimated number of hatched chicks by 100 thousands.

\( X_i \) = number of eggs set by 100 thousands.

\( i = 1, 2, \ldots, 30 \)

This equation shows an insignificant statistic for the parameter (\( \alpha \)), while (\( B \)) was found to be statistically significant.

So this relation was reestimated in the form:

\[ Y_i = B X_i \]

\[ = 0.596 X_i \]

\[ (119.2) \]

\[ R^2 = 0.998 \]

From the preceding equation it can be said, that

(1) Source: Table (2).
a liner relation was found between eggs set and chicks hatched with a slope of 0.6.

In the time $R^2$ of about 0.998 represents that set eggs are the unique factor that determines the number of chicks hatched assuming other factors being constant.

The second relationship estimates eggs set in mechanical hatcheries and chicks produced this investigation was found to be in the form

$$Y_i = 1.35 + 0.75 X_i$$

$$(.24) (46.9)$$

$$R^2 = 0.99$$

as,

$$Y_i$$ represent the estimated number of chicks produced by 100 thousands.

$$X_i$$ number of eggs set hatched by 100 thousands.

$$i = 1, 2, \ldots \ldots 30$$

$(X)$ estimate was found to be insignificant, meanwhile $(B)$ was found to be significant statistically.

So this relationship was reestimated in the form (1).

$$Y_i = 0.755 X_i$$

$$(52.0)$$

$$R^2 = 0.99$$

Source (1) table (2)
This relation indicated a linear transformation between eggs set and hatched chicks. In the same time it refers to a rate of transfer from eggs to chicks estimated by about 76% i.e. if number of eggs set increased by 100 eggs, the number of chicks produced will increase by about 76 chicks.

The determination coefficient ($R^2$) represents that about 99% of chicks produced is due to the change in the number of eggs set used.

Another relationship was investigated between the number of set eggs and produced chicks in native hatcheries during the same period. This relation was found to be in the form (1),

$$\hat{y}_i = 1.19 + 0.68 x_i$$

$$R^2 = 0.99$$

Where as

$$\hat{y}_i = \text{estimated number of hatched chicks by 100 thousands.}$$

$$x_i = \text{number of eggs set by 100 thousands.}$$

$$i = 1, 2, \ldots, 30$$

It was found that ($\hat{y}$) estimate is statistically insignificant, meanwhile ($\hat{\beta}$) was found to be statistically significant. So this relation was reestimated in the

(1) Source: Table (2).
This form refers to a rate of transfer from eggs set to chicks produced estimated by about 70%, i.e., if number of eggs set increased by about 100 eggs, chicks produced will increased by about 70 chicks, assuming other variable except number of eggs being constant. The determination coefficient ($R^2$) of 0.99 represents that about 99% of change in the number of produced chicks is due to fluctuation in the number of eggs sets.

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Source: 1 - Table (2).
Table (2): Number of Hat. eggs and of hatching chicks in Mechanical and native hatcheries during the period 1952/1980 (in millions)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total eggs</th>
<th>/mill chicks</th>
<th>Mechanical eggs</th>
<th>/chicks</th>
<th>Native eggs</th>
<th>Hatcheries chicks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1952</td>
<td>95.4</td>
<td>54.3</td>
<td>83.1</td>
<td>46.0</td>
<td>11.9</td>
<td>8.3</td>
</tr>
<tr>
<td>1953</td>
<td>35.2</td>
<td>23.8</td>
<td>17.1</td>
<td>9.2</td>
<td>17.9</td>
<td>14.6</td>
</tr>
<tr>
<td>1954</td>
<td>31.4</td>
<td>19.3</td>
<td>15.8</td>
<td>6.8</td>
<td>15.6</td>
<td>12.5</td>
</tr>
<tr>
<td>1955</td>
<td>97.9</td>
<td>55.7</td>
<td>73.3</td>
<td>36.5</td>
<td>24.6</td>
<td>19.2</td>
</tr>
<tr>
<td>1956</td>
<td>37.5</td>
<td>25.7</td>
<td>11.4</td>
<td>4.5</td>
<td>26.1</td>
<td>21.2</td>
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<tr>
<td>1957</td>
<td>30.5</td>
<td>18.9</td>
<td>13.1</td>
<td>5.0</td>
<td>17.4</td>
<td>13.9</td>
</tr>
<tr>
<td>1958</td>
<td>86.7</td>
<td>49.8</td>
<td>66.0</td>
<td>34.5</td>
<td>20.7</td>
<td>15.3</td>
</tr>
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<td>1959</td>
<td>35.4</td>
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<td>23.5</td>
<td>18.5</td>
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<td>1960</td>
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<td>20.1</td>
<td>20.2</td>
<td>11.9</td>
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<tr>
<td>1961</td>
<td>93.0</td>
<td>53.3</td>
<td>64.5</td>
<td>32.3</td>
<td>28.5</td>
<td>21.0</td>
</tr>
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<td>1962</td>
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<td>20.8</td>
<td>6.8</td>
<td>3.0</td>
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<td>17.8</td>
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<td>1963</td>
<td>34.8</td>
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<td>5.4</td>
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<td>16.8</td>
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<tr>
<td>1964</td>
<td>93.1</td>
<td>54.1</td>
<td>70.1</td>
<td>36.6</td>
<td>23.0</td>
<td>17.7</td>
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<td>1965</td>
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<td>18.7</td>
<td>15.6</td>
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<td>1966</td>
<td>33.7</td>
<td>21.2</td>
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<td>3.1</td>
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<td>18.1</td>
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<td>1967</td>
<td>92.7</td>
<td>53.8</td>
<td>46.1</td>
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<td>1970</td>
<td>96.0</td>
<td>56.7</td>
<td>50.9</td>
<td>21.2</td>
<td>45.1</td>
<td>35.5</td>
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<tr>
<td>1971</td>
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<td>19.0</td>
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<td>2.1</td>
<td>21.3</td>
<td>16.9</td>
</tr>
<tr>
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<td>36.4</td>
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<td>11.8</td>
<td>3.5</td>
<td>24.2</td>
<td>19.3</td>
</tr>
<tr>
<td>1973</td>
<td>86.7</td>
<td>50.8</td>
<td>51.2</td>
<td>23.4</td>
<td>35.5</td>
<td>27.4</td>
</tr>
<tr>
<td>1974</td>
<td>28.4</td>
<td>16.5</td>
<td>6.4</td>
<td>1.5</td>
<td>22.0</td>
<td>15.0</td>
</tr>
<tr>
<td>1975</td>
<td>34.1</td>
<td>22.3</td>
<td>11.3</td>
<td>4.6</td>
<td>22.8</td>
<td>17.7</td>
</tr>
<tr>
<td>1976</td>
<td>83.9</td>
<td>50.5</td>
<td>36.6</td>
<td>13.7</td>
<td>47.3</td>
<td>36.3</td>
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<tr>
<td>1977</td>
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<td>21.2</td>
<td>3.1</td>
<td>3.0</td>
<td>27.3</td>
<td>20.9</td>
</tr>
<tr>
<td>1978</td>
<td>32.5</td>
<td>21.3</td>
<td>—</td>
<td>—</td>
<td>32.3</td>
<td>—</td>
</tr>
<tr>
<td>1979</td>
<td>89.2</td>
<td>52.6</td>
<td>61.2</td>
<td>30.1</td>
<td>28.0</td>
<td>22.5</td>
</tr>
<tr>
<td>1980</td>
<td>27.8</td>
<td>19.0</td>
<td>5.3</td>
<td>—</td>
<td>22.5</td>
<td>—</td>
</tr>
</tbody>
</table>

Conclusions

From the preceding equations, it can be indicated that relations between eggs sets and number of chicks produced are in a linear relation through the origin, or it can be explained that hatchery industry is a transferring industry with a constant technical relationship between inputs and outputs, so production function of hatcheries can be written in the form:

\[ Y = KX \]

Where

- \( Y \) = estimated number of chicks produced
- \( X \) = number of eggs set
- \( K \) = constant technical coefficient

The marginal productivity (MP) will be constant and equate to \( K \).

Then applying the principals of profit maximization will yield a constant soole depend upon the ratio between eggs prices and chicks price.

\[ MP = K \]
\[ VMP = \frac{R}{K} \]
\[ VMP = R \]
\[ R = \frac{11}{K} \]
\[ 11 = \frac{R}{K} \]

Where

- \( 11 \) = Price of chicks
- \( R \) = Price of eggs set

i.e., Price of chicks will equal the ratio between price of eggs set and hatching technical coefficient.
يعتبر البيض من أهم المواد الغذائية اللازمة لبناء الغدد بالبروتينات الحيوانية. يلاحظ التزايد المتدرّب في البيض المنتج على مدى السنوات 1952 إلى 1979. إذ تبين أنّ تغلب 1865 مليون بيضة عام 1979 على 455 مليون بيضة عام 1952، أي أنها زادت بحchefل زيادة ضخمة.

تبلغ نسبة تناول البيض الناتج من القطاع الزراعي أو التجاري في ثلاثة أضعاف. 6.

تعدّ العامل البلديّة تعتبر أساساً على البيض من القطاع الزراعي، والذي بلغ نحو 235 مليون بيضة عام 1979 مقابل 65 مليون بيضة عام 1952، كالتي بلغت ككاكتو 156 مليون ككتوت عام 1979 مقابل 45 مليون ككتوت عام 1952. أي زيادة في الكفاءة الفيزيائية بالعادل 71% عام 1979 مقابل 60% عام 1958، التي تشير إلى زيادة القدرة الإنتاجية للعامل البلدي. 6.

تعتبر العامل البلدية أحد الصناعات القديمة في مصر إذ يضع البيض بالعامل لمدة 21 يوماً لانتاج الكاكتو ومضت دراسة العلاقة بين البيض كدخلات والكاكتو كمخرجات خلال الفترة 1/70. 61 أنها علاقة ثابتة خطية بانحصار يقدر بنحو 2٪. واضح بعدم التحديد أن 89% من كمية الناتج من الكاكتو ترجع إلى البيض المستخدم.

كما أوضحت الدراسة أن العلاقة سيا في العامل البلدية أو اليكانيكية عبر العلاقة ثابتة من نقطة الاتصال بعمول انحدار يقدر بنحو 1٪. 62، لذا التوالّي كما أوضحت الدراسة أن الانحدار الثابت، وأن سبب الكاكتو عبر العلاقة بين معامل البيض الفيزيكية، معامل الفيزيك الثابت.