IMPACT OF THE BIDCO OIL PALM PROJECT ON THE EXISTING OILSEED PRODUCTION AND PROCESSING SECTOR

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Summary
A partial market equilibrium analysis and existing secondary data are used to estimate the impacts of the BIDCO oil palm project on the existing oilseed production and processing sector. With various tax breaks and other concessions, the cost of production of edible vegetable oils from the project is substantially lowered, potentially reducing the competitiveness of existing oilseed producers and processors.

With an anticipated production of palm oil from the project in 2005 to increase the quantity of edible oils on the domestic market by nearly 50%, prices of vegetable oils plummet by 28–71% from the 2003 baseline value of USh 2.5 million per mt. This reduces substantially the profitability of vegetable oil production of existing local oilseed processors, forcing them to scale back production by 9–25% and losing USh 14,320–34,533 million. Oilseed producers are affected through a reduced derived demand effect: average price of oilseeds fall by 8–56%; supply is cut back by 2–16%; and about USh 2,182–14,247 million of producer surplus is lost. The negative impacts are greater when larger amounts of palm oil from the project are put on the domestic market. On the contrary, the negative impacts are lower when demand and supply are more elastic or the value of by-products is relatively high.

This research may not be timely in the decision on whether to go ahead with the project or not, as the agreement between the government and BIDCO was signed in April 2003, the project is underway, and lots of resources been committed. It is hoped that the results will spur all concerned to start thinking about ways to avoid a potentially disastrous situation.

Further research should include analysis of the effects of edible vegetable oil substitutes (e.g. vegetable fats, oils and fats of animal origin) and market for by-products (e.g. seed cake, fatty acids for soaps and detergents). Information on costs of producing and processing oilseeds for different economic groups will be important to examine the distributional impacts. In addition, the export potential of palm oil (even to the East Africa region alone) should be analyzed.
1. Introduction

Since the proposal for the oil palm component of the Vegetable Oil Development Project (VODP), to be implemented by BIDCO Oil Refineries Limited over 30000 hectares (ha) of land for 25 years, there have been several concerns about its economic, financial, environmental and social impacts. One of the main concerns is the impact of the project on the existing oilseed production and processing sector, which this paper aims to quantify. The concerns derive from the various tax breaks and other concessions associated with project, including: zero corporate tax payments (which is normally about 30%); zero import, customs and excise duties (5–60%) on imported equipment; deferred payment of value-added tax (17%); and zero withholding tax on interest on loans.¹ These will dramatically lower the production cost of edible oils associated with the project, potentially reducing the competitiveness of existing oilseed producers and processors.

First, a simple competitive market model is used to develop a methodology for estimating the impacts. This is taken up in the next section. Then existing secondary data on prices, elasticities, and costs of production of edible vegetable oils and oilseeds are used to quantify the impacts. Data and sources and how the impacts are quantified are presented in sections 3. The results are also presented in section 3, and conclusions in section 4.

2. Conceptual framework

The conceptual framework is based on the theory of supply and demand, which explains how price and quantity of commodities sold in markets are determined. Figure 1 (next page) shows how the oil palm project can impact on the domestic market for edible vegetable oils and, consequently, oilseeds. Referring to the top diagram of Figure 1, let the initial equilibrium price and quantity of edible vegetable oils be $P_0^{VO}$ and $Q_0^{VO}$, respectively,² which are given at the intersection of the demand ($D^{VO}$) and initial supply ($S_0^{VO}$) curves. Production of palm oil from the oil palm project that is put on the domestic market will shift the supply curve to $S_1^{VO}$. At the current price of $P_0^{VO}$, the total quantity supplied $Q_1^{VO}$ is greater than the

¹ Details are spelled out in the agreement signed between the Government of the Republic of Uganda and BIDCO Oil Refineries, signed on April 4, 2003.
² For simplicity we assume identical products for all edible vegetable oils.
quantity demanded and so the price will fall to say $P_1^{VO}$. At this lower price the profitability of vegetable oil production is reduced and so existing firms will cut back production from $Q_0^{LVO}$ to $Q_1^{LVO}$. This causes the total quantity supplied by existing firms and oil palm

Figure 1. Impact of a supply shift (subsidized entry) in edible oil production on prices, production, and producer surplus of edible vegetable oils and oilseeds
project to fall. The decline in total quantity supplied will tend to increase the price and, eventually, the market price and quantity for vegetable oils will adjust to $P_{1VO}^{TVO}$ and $Q_{1VO}^{TVO}$ at the intersection of the demand curve $D_{1VO}$ and the new supply curve $S_{1VO}$. At this new equilibrium, existing firms supply $Q_{1VO}^{LVO}$, cutting back on their initial total production by the distance $ab$. The oil palm project will supply the remaining $Q_{1VO}^{TVO} - Q_{1VO}^{LVO}$, equal to the distance $de$. With the fall in the price of vegetable oils reduces and consequent reduction in profitability, the total producer surplus of existing firms declines by the area $P_{1VO} b P_{o}^{VQ}$. 

Changes in the vegetable oil market and profitability of oilseed processing will have an effect on the oilseed market and existing oilseed producers, through a derived demand effect, as shown in the bottom diagram of Figure 1. Basically, reduction in profitability and output of oilseed processors will cause the demand for oilseeds to shift from $D_{0OS}$ to $D_{1OS}$, causing price of oilseeds to fall from $P_{0OS}$ to $P_{1OS}$. This in turn reduces the profitability of oilseed production and causes the equilibrium quantity to fall from $Q_{0OS}$ to $Q_{1OS}$. Similar to vegetable oil producers, the producer surplus of oilseed producers will decline by the area $P_{1OS} h P_{o}^{OS}$.

To quantify the fall in price, production and producer surplus associated with production and processing of oilseeds, we use geometry to estimate the relevant distances and areas discussed above. Details are presented in the Annex for the interested reader. But basically, the expected output of palm oil from the project and price elasticities of supply and demand of edible vegetable oils and oilseeds are used in the calculations.

**Limitations**

The conceptual framework presented above (and details in the annex) is a partial equilibrium analysis where the formulae are derived assuming linear supply and demand curves, and zero cross-price elasticities. This method is similar to examining small changes or policy shocks about a local equilibrium for more general functional forms of single commodities. The main limitation is the linearization error that is introduced when examining large policy shocks.

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3 Note that the (marginal) cost of production of edible oils from the BIDCO project is much lower, due to various tax breaks and other concessions.

4 We are assuming that the demand for export and other domestic consumptive purposes of oil seeds remain unchanged.
For large shocks, “true” functional forms can be used to obtain analytical solutions by solving
the system of non-linear equations, and to obtain numerical solutions using GAMS for
instance. These prove problematic, however. In the existing literature, demand and supply
functions are econometrically estimated over a small range of prices and quantities, providing
very little information on the shape of the curves. The case of Uganda is even more
problematic, as basic econometric estimates of supply and demand elasticities for agricultural
commodities in general, and edible vegetable oils and oilseeds in particular, are not readily
available. Also, budget limitations did not permit development of an extensive model to
capture related markets for by products (cakes, fats, fatty acids for soaps and detergents, etc)
or other edible oils and fats from animal sources. These are discussed more later on issues
further research.

In spite of these limitations, the analysis presented here is very useful and indicative
of the nature and magnitude of the impacts of such large shocks. Furthermore, we provide
greater confidence in the results by using a range of values for key parameters (e.g. supply
and demand elasticities) to examine sensitivity of the estimates.

3. Data and estimation

Data sources

Data on prices, cost of production, and annual production of vegetable oils and oilseeds were
obtained from the Uganda oilseed producers and processors association (UOSPA), from their
office as well as their website. Information on annual demand of vegetable oils and share of
demand met by local oilseed processors were also obtained from UOSPA. Information on the
oil palm project were obtained from various public documents on the project.

Estimation procedure and assumptions

The simulated impacts are based on projections to 2005, which is the anticipated year of
production of the oil refinery complex associated with the oil palm project,\textsuperscript{5} using 2003 as
the baseline year. Due to data anomalies however, average values of 2001–03 are used. Table

\textsuperscript{5} The accumulated impacts over the project life span are not estimated, as it is beyond the scope of this paper.
1 shows annual (2001 to 2003) demand of edible vegetable oils, production of major oilseeds (i.e., used in vegetable oil production), and proportion of national demand met by local production. In general, production of oilseeds has declined. For example, production of sunflower seeds (which is the main oilseed crop) was only about 53% of the amount in 2001, thereby contributing only 26% of the national vegetable oil demand requirement in 2003 instead of 51% in 2001.

Table 1. National edible vegetable oil demand and proportion met by processing of local production and processing of oilseeds, 2001-2003

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edible vegetable oil demand (mt)</td>
<td>43,076</td>
<td>44,153</td>
<td>45,257</td>
</tr>
<tr>
<td>Oilseed crop production (mt)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunflower seeds</td>
<td>88,603</td>
<td>56,184</td>
<td>47,074</td>
</tr>
<tr>
<td>Soya beans</td>
<td>28,232</td>
<td>4,525</td>
<td>12,355</td>
</tr>
<tr>
<td>Cottonseeds</td>
<td>34,700</td>
<td>44,400</td>
<td>38,170</td>
</tr>
<tr>
<td>Total</td>
<td>151,535</td>
<td>105,109</td>
<td>97,599</td>
</tr>
<tr>
<td>Edible vegetable oil production (mt)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunflower seeds</td>
<td>22,151</td>
<td>14,046</td>
<td>11,769</td>
</tr>
<tr>
<td>Soya beans</td>
<td>2,823</td>
<td>453</td>
<td>1,236</td>
</tr>
<tr>
<td>Cottonseeds</td>
<td>3,746</td>
<td>4,794</td>
<td>4,121</td>
</tr>
<tr>
<td>Total</td>
<td>28,720</td>
<td>19,293</td>
<td>17,126</td>
</tr>
<tr>
<td>Contribution to edible vegetable oil demand (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunflower seeds</td>
<td>51.4</td>
<td>31.8</td>
<td>26.0</td>
</tr>
<tr>
<td>Soya beans</td>
<td>6.6</td>
<td>1.0</td>
<td>2.7</td>
</tr>
<tr>
<td>Cottonseeds</td>
<td>8.7</td>
<td>10.9</td>
<td>9.1</td>
</tr>
<tr>
<td>Total</td>
<td>66.7</td>
<td>43.7</td>
<td>37.8</td>
</tr>
</tbody>
</table>

Notes: 1 Assumption is that all sunflower seeds and soya beans are processed into vegetable oils and other by products. With respect to cottonseeds, 80% is used and the remaining 20% is sold to Cotton Development Organization for replanting (Olupot 2003). The respective vegetable oil yields are 25%, 13.5% and 10% per unit of raw material of sunflower seed, cottonseed and soya beans (Otimodoch and Singh 2000).

Source of data on demand and oilseed production: UOSPA.

2003 baseline assumptions

Table 2 shows details of the baseline values of prices and supply and demand quantities.

Total vegetable oil consumption is set at 44,162 mt. Of this amount, 21,713 mt (or 49%) is met by local production from processing sunflower seeds, soya beans and cottonseeds. The remaining 51% of the demand is met through refinement of imported crude oils or importation of finished products. The later includes imports through donors and relief

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6 This value was obtained by summing the product of the amount of each raw material and its average yield. The respective vegetable oil yields are 25%, 13.5% and 10% per unit of raw material of sunflower seed, cottonseed and soya beans (Otimodoch and Singh 2000).
agencies, such as the World Food Programme and USAID/PL–480. Total local raw materials (sunflower seeds, soya beans and cottonseeds) available for processing is set at 110,263 mt. The average price of edible vegetable oils is set at USh 2.5 million per metric ton (mt), based on wholesale price information obtained from a major producer in the industry. The average producer price of oilseeds is set at USh 246,420 per mt, which is a weighted average of the producer prices for sunflower seed, soya bean and cottonseed. Note that other oilseeds, such as sesame and groundnuts, are used to a limited extent, although sesame is the main exported oilseed.

Table 2. 2003 Baseline values and assumptions for estimating impacts of the oil palm project

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand of vegetable oils (mt)</td>
<td>44,162</td>
</tr>
<tr>
<td>Supply of vegetable oils from local oilseeds (mt)</td>
<td>21,713</td>
</tr>
<tr>
<td>Supply of oilseeds (mt)</td>
<td>110,263</td>
</tr>
<tr>
<td>Average price (1000 USh/mt)</td>
<td></td>
</tr>
<tr>
<td>Vegetable oils</td>
<td>2500.00</td>
</tr>
<tr>
<td>Oilseeds</td>
<td>246.42</td>
</tr>
</tbody>
</table>

1 These are average values for 2001–2003 (see Table 1).
2 1 US$≈1900 USh (Ugandan Shillings) in 2003
3 This is a weighted average value, weighted by shares of each oilseed in total oilseeds available for crushing in 2001-03 (58% for sunflower seeds, 14% for soya beans, and 28% for cottonseeds). Average prices offered by mills in 2001-03 are 260, 383 and 150 USh/mt for sunflower seeds, soya beans and cottonseeds, respectively (UOSPA).

2005 simulation assumptions

Key factors here are growth in demand for vegetable oils, and price elasticities of demand and supply of vegetable oils and oilseeds – see Table 3 for details. Growth in demand for vegetable oils is assumed to be 3% per annum (GOU 2003). As mentioned earlier, price elasticities of demand and supply for Uganda are not available, and so we use a range of values based on estimates for other African or developing countries (Rosegrant et al. 2001; Rogers and Lowdermilk 1991; Waterfield 1985; Musgrave 1985). Price elasticity of demand is higher for edible vegetable oils (–0.3 to –1.0) than for oilseeds (–0.2 to –0.5). With respect price elasticity of supply, we set the range at 0.3–0.5 for vegetable oils and 0.2–0.5 for oilseeds.

As discussed in the conceptual framework, the impacts stem from the amount of

7 1 US$≈1900 USh (Ugandan Shillings) in 2003.
vegetable oil produced from the oil palm project that is put on the domestic market. The project, which began in 2003, is for 25 years and expected to be developed over 30,000 ha, including oil palm plantations, palm oil mills, and a refinery complex. Production of fresh oil palm fruit bunches and, therefore, crude oil for the refinery is not expected until year 5 or 6. However, the oil refinery complex is under construction, and expected to begin production of vegetable oil in 2005 using imported crude palm oil (CPO), with gradual substitution of CPO from the palm oil mills.

Table 3. Assumptions for estimating impacts of the oil palm project in 2005

<table>
<thead>
<tr>
<th>Item</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth in demand of vegetable oils (%)</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Growth in supply of vegetable oils/oilseeds (%)</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Price elasticity of demand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetable oils</td>
<td>–0.3</td>
<td>–1.0</td>
</tr>
<tr>
<td>Oilseeds</td>
<td>–0.2</td>
<td>–0.5</td>
</tr>
<tr>
<td>Prices elasticity of supply</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetable oils</td>
<td>0.3</td>
<td>0.5</td>
</tr>
<tr>
<td>Oilseeds</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Amount of palm oil from BIDCO project (79,200 mt) for domestic market¹</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amount (mt)</td>
<td>21,400</td>
<td>39,600</td>
</tr>
<tr>
<td>Proportion (%)</td>
<td>27</td>
<td>50</td>
</tr>
</tbody>
</table>

Notes: ¹ Total output associated with BIDCO project was obtained by using 400 MT/day capacity of the project’s oil refinery operating 220 days in a year at full capacity using imported crude palm oil at a yield of 90%. The low value amount of 21,400 mt (or 27% of total output) for the domestic market is the difference between expected vegetable oil demand requirement (44,162 mt) and production of local oilseed processors (21,713 mt) – see Table 2. The higher rate of 50% was chosen arbitrary for sensitivity analysis.

Sources of data: Elasticity data were obtained from the literature for related commodities in other developing or African countries. Information on oil palm project were obtained from various public documents.

The expected capacity of the oil refinery is 400 mt of CPO per day (UOSPA 2004). Assuming refined vegetable oil yield of about 90% per unit of CPO (Otimodoch and Singh 2000) and operation at full capacity for 220 days a year, then annual production will be 79,200 mt of vegetable oil. How much of this will be put on the domestic market? Although not clear, assume that import substitution is the objective of the project. Then the logical amount that will be put on the domestic market is the difference between the national vegetable oil demand requirement and the amount produced by local oilseed processors. Assuming 2.5% per annum growth in oilseed production and processing, the difference will be 21,400 mt in 2005, equivalent to 27% of 79,200 mt. For sensitivity analysis, we also use
an arbitrary higher rate of 50%.

**Estimated impacts**

**Oilseed processors**

Table 4 shows the impacts on the oilseed processing sector with respect to reduction in average price of vegetable oils, reduction quantity supplied by all vegetable oil suppliers and by local oilseed processors, and reduction in producer surplus of local oilseed processors. It is clear that the oil palm project will have a negative impact on the existing oilseed producers and processors. In general, however, the greater the price elasticity of demand or supply of edible vegetable oils, the smaller the reduction in its average price. Consequently, the greater the price elasticity of demand of vegetable oils, the smaller the reduction in quantity of vegetable oils supplied. With 27% of the vegetable oil output from the oil palm project on the domestic market, the reduction in price is about 28–71% from the 2003 baseline value of USh 2.5 million per mt. The corresponding reduction in quantity supplied of total vegetable oils is 10–27% (or 4,318–11,694 mt) from the baseline value of 44,162 mt. How much of the reduction will be absorbed by local oilseed processors? With a market share of 49%, the reduction is about 1,986–5,379 mt, equivalent to 9–25% of the baseline amount of 21,713 mt. The associated reduction in producer surplus of local oilseed processors is USh 14,320–34,533 million.

Table 4. Estimated impacts of the oil palm project on existing oilseed processing sub-sector in 2005 (reduction in vegetable oil price, output and producer surplus)\(^1\)

<table>
<thead>
<tr>
<th>Price elasticity of demand vegetable oils</th>
<th>Price elasticity of supply vegetable oils</th>
<th>(-0.3)</th>
<th>(0.3)</th>
<th>(-1.0)</th>
<th>(0.5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in average price (%)</td>
<td>71</td>
<td>53</td>
<td>33</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Reduction in output (%)</td>
<td>21</td>
<td>27</td>
<td>10</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>25</td>
<td>9</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Local oilseed processors(^2)</td>
<td>34,533</td>
<td>25,187</td>
<td>16,882</td>
<td>14,320</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reduction in producer surplus of local oilseed processors (Million USh)(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\text{Price elasticity of demand vegetable oils})</td>
</tr>
<tr>
<td>(-0.3)</td>
</tr>
<tr>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>34,533</td>
</tr>
</tbody>
</table>

Notes: \(^1\) Simulated impacts when 27% (21,400 mt) of palm oil from project is put on the domestic market. Reduction is relative to baseline (2003) values – see Table 2. \(^2\) Local oilseed processors refer to oilseed processors using locally-produced oilseeds. \(^3\) 1 US$≈1900 USh (Ugandan Shillings) in 2003.

Note that putting larger shares of output palm oil from the project on the domestic market will have greater negative impacts. At low elasticities, the impacts could not be
estimated, as they were outside the valid range, i.e., prices tended to be negative, and so the results are not reported.\(^8\)

In estimating the impact on local oilseed processors, we have assumed identical costs of production for all firms. However, local oilseed processors operate at different capacities (Otimodoch and Singh 2000) and so they will tend to have different costs of production. For example, it is estimated that about 3% of the national installed milling capacity (1000 mt/day) or operating milling capacity (500 mt/day) is made up of small-scale processing mills with the capacity to process up to 0.1 mt/day only. Medium scale processing mills, with capacity of 0.2–10 mt/day, make up 20%, while large scale and industrial processors, with capacities of 10–50 mt/day and more than 50 mt/day, respectively, make up the remaining 23% and 54%, respectively. Several of the processing mills is not operational, mostly of small and medium scale, due to high costs of production. Thus, the impact of the oil palm project is likely to be most severe on the small and medium scale processors. However, we are unable to estimate the relative impacts, as we could not obtain information on the costs associated with the various scales of production.

On the other hand, it can be argued that the small and medium scale processors, as in many developing countries, constitute an informal sub-sector, i.e., mainly meeting farmers own demand or a small portion of urban demand such that palm oil production from the project will have little substitution effect on such locally-produced edible oils, especially soya bean oil or cottonseed oil. Thus, the impact on small and medium scale processors can also be much less than estimated. Information on the market serviced by various processors are also needed to flush out these issues.

**Oilseed producers**

We first calculated how much oilseeds would be required to produce 1,986–5,379 mt of vegetable oil, which is the reduction in output of vegetable oil by local oilseed processors. The resulting value was then used as the reduction in derived demand of oil oilseeds, as

\(^8\) This is due the assumption of linear demand and supply curves, or constant price elasticities everywhere on the demand and supply curves.
shown in Figure 1, to estimate the impacts of the project on oilseed producers.

The results presented in Table 5 show that the general trend in the impact on the oilseed production sub-sector is similar to that of oilseed processing. With 27% of vegetable oil output from the oil palm project on the domestic market and a reduction in the production of local processors, the reduced demand for oilseeds causes the average price of oilseeds to fall by 8–56% from the baseline value of USh 246,420 per mt, with a corresponding reduction in supply of oilseeds by 2–16% from the baseline amount of 110,263 mt. The associated reduction in producer surplus is about USh 2,182–14,247 million.

Table 5. Estimated impacts of oil palm project on existing oilseed production sub-sector in 2005 (changes in oilseed price, output and producer surplus)\(^1\)

<table>
<thead>
<tr>
<th>Price elasticity of demand vegetable oils</th>
<th>0.3</th>
<th>0.5</th>
<th>0.3</th>
<th>0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price elasticity of supply vegetable oils</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ED oilseeds=−0.2; ES oilseeds=0.2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduction in average price (%)</td>
<td>44</td>
<td>56</td>
<td>21</td>
<td>30</td>
</tr>
<tr>
<td>Reduction in output (%)</td>
<td>9</td>
<td>11</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Reduction in producer surplus (Million USh)(^2)</td>
<td>11,531</td>
<td>14,247</td>
<td>5,455</td>
<td>7,807</td>
</tr>
<tr>
<td><strong>ED oilseeds=−0.2; ES oilseeds=0.5</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduction in average price (%)</td>
<td>25</td>
<td>32</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>Reduction in output (%)</td>
<td>13</td>
<td>16</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Reduction in producer surplus (Million USh)(^2)</td>
<td>6,458</td>
<td>7,936</td>
<td>3,089</td>
<td>4,403</td>
</tr>
<tr>
<td><strong>ED oilseeds=−0.5; ES oilseeds=0.2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduction in average price (%)</td>
<td>25</td>
<td>32</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>Reduction in output (%)</td>
<td>5</td>
<td>6</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Reduction in producer surplus (Million USh)(^2)</td>
<td>6,721</td>
<td>8,346</td>
<td>3,145</td>
<td>4,519</td>
</tr>
<tr>
<td><strong>ED oilseeds=−0.5; ES oilseeds=0.5</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduction in average price (%)</td>
<td>18</td>
<td>22</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Reduction in output (%)</td>
<td>11</td>
<td>11</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Reduction in producer surplus (Million USh)(^2)</td>
<td>4,613</td>
<td>5,699</td>
<td>2,182</td>
<td>3,123</td>
</tr>
</tbody>
</table>

Notes: \(^1\) Simulated impacts when 27% (21,400 mt) of palm oil from project is put on the domestic market; reduction is relative to baseline (2003) values – see Table 2; and ED and ES refer to price elasticity of demand and supply, respectively. \(^2\) 1 US$≈1900 USh (Ugandan Shillings) in 2003.

Similar to oilseed processors, the impact on farm families engaged in oilseed production is not likely to be uniform, as their production costs differ substantially. In 2003, there were almost 45,000 farm families involved in oilseed production, each cultivating an average of 0.8 ha of oilseeds (UOSPA estimates). UOSPA estimates of farm crop budget analysis for oilseeds suggest very high average returns in 2003 (57% for soya bean, 61% for sunflower, 138% for sesame, and 143% for groundnuts). However, equally high variation in yields and costs suggest that some farm families may be producing profitably while others may be producing unprofitably (Pender et al. 2004). Thus, the reduction in prices of oilseeds...
will be disastrous for many farm families.

4. Conclusions and implications

Using a partial market equilibrium analysis and existing secondary data, this paper estimated the impacts of the BIDCO oil palm project on the existing oilseed production and processing sector. With various tax breaks and other concessions, cost of production of edible vegetable oils (especially palm oil) from the project is substantially lowered, potentially reducing the competitiveness of existing oilseed producers and processors.

With an anticipated production of edible oil from the project in 2005 to increase the quantity on the domestic market by nearly 50%, prices plummet by 28–71% from the 2003 baseline value of USh 2.5 million per mt. This reduces substantially the profitability of vegetable oil production of existing local oilseed processors, forcing them to scale back production by 9–25% and losing USh 14,320–34,533 million. Oilseed producers are affected through a reduced derived demand effect: average price of oilseeds fall by 8–56%; supply is cut back by 2–16%; and USh 2,182–14,247 million of producer surplus is lost.

The negative impacts are greater when greater amounts of palm oil from the project are put on the domestic market. On the contrary, the negative impacts are lower when demand and supply are more elastic or the value of by-products is relatively high.

Although the paper provides very useful information and indicative magnitudes of the negative impacts of the BIDCO oil palm project on the existing oilseed production and processing sector, the ongoing discussions at various policy and decision-making levels and among donors on the subject will benefit more from further research. This should include in the analysis the effects of edible vegetable oil substitutes (e.g. vegetable fats and oils and fats of animal origin), demand and supply analysis of by-products (seed cake, fatty acids for soaps and detergents, etc.), and detail costs of producing and processing oilseeds at various scales and for economic subgroups to examine the distributional impacts. In addition, the cumulative impacts over the life span of the project should be examined.

Another issue is the effect of the potential regional market (or export market in general). Currently, almost all countries in the East Africa region import large amounts of
palm oil, while only a very small amount is produced in the region. For example, FAO data shows that average annual imports of palm oil by the 10 countries in the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) region is more than 500,000 mt, in addition to 200,000 mt of other vegetable oil; and Tanzania and Kenya alone import about 100,000 mt and 240,000 mt, respectively. Thus, information on potential palm oil exports (and elasticities) are needed to accurately estimate the domestic impacts of the BIDCO oil palm project.

At this point it is not unwise to question the timeliness and usefulness of this research and further research on the subject. The agreement between the government and BIDCO was signed in April 2003 and the project is underway, with lots of resources already been committed. Thus, it cannot be stopped! Hopefully, however, the negative impacts shown here will spur all concerned to start thinking about instruments and mechanisms that can be put in place to avoid a disastrous situation otherwise.

References


UOSPA (Uganda Oilseed Producers and Processors Association). 2004. Presentation to the

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*Thanks to Xinshen Diao for pointing out this issue as well as providing the data and source.*


ANNEX

Assume a competitive production environment where each firm takes the market price \( P \) as given. Then each firm chooses output \( q_i \) to maximize its profits \( \pi_i \):

\[
(1) \quad \max_{q_i} \pi_i = P q_i - c_i(q_i),
\]

where \( c_i(q_i) \) is the total cost function. The firm’s competitive output \( q_i^* \) is where the price equals the marginal cost of production, \( P = c_i'(q_i^*) \), assuming \( c_i''(q_i) > 0 \). The supply function of the firm \( q_i(P) \) is the upward sloping part of the marginal cost curve that lies above the average variable cost curve (Varian 1992).

The supply function of the industry \( Q_s(P) \) then is simply the sum of the individual firm supply functions given by:

\[
(2) \quad Q_s(P) = \sum_i q_i(P).
\]

This measures the relationship between industry output and the common marginal cost of producing this output. In the competitive market then, the equilibrium price and quantity are determined at the intersection of the aggregate demand and supply curves:

\[
(3) \quad \sum_i q_i(P) = \sum_j x_j(P)
\]

where \( \sum_j x_j(P) \) is the aggregate demand function and is downward sloping.

Change in domestic market price of vegetable oils

Referring to Figure 1 (page 2), change in price of vegetable oils \( \Delta P^{VO} = P_0^{VO} - P_1^{VO} \) is given by the height \( \Delta \) of the triangle \( bce \) (made up of two triangles \( bcd \) and \( dce \)). Use the equation of a straight line to define the slope \( m \) of the hypotenuse of the two triangles \( bcd \) and \( dce \) as:

\[
(4) \quad m_s = \frac{\Delta P^{VO}}{bd}
\]

\[
(5) \quad m_d = \frac{\Delta P^{VO}}{de}
\]

which are equivalent to the slope of the supply and demand curves, respectively. Define elasticity \( \varepsilon \) as:

\[
(6) \quad \varepsilon = \frac{\delta Q}{\delta P} * \frac{P}{Q},
\]

where \( \delta Q/\delta P \) is the slope of the inverse demand or supply curves evaluated at the equilibrium point. Solve for \( \delta Q/\delta P \) and substitute the respective results in equations (4) and (5) to obtain

\[
(7) \quad \frac{\Delta P^{VO}}{bd} = \left[ e_s^{vo} \left( \frac{Q_0^{LVO}}{P_0^{LVO}} \right) \right]^{-1}
\]

\[
(8) \quad \frac{\Delta P^{VO}}{de} = \left[ e_d^{vo} \left( \frac{Q_0^{LVO}}{P_0^{LVO}} \right) \right]^{-1}
\]

where \( e_s^{vo} \) and \( e_d^{vo} \) are the price elasticity of supply and demand of vegetable oils, respectively.
Using $\overline{bd} + \overline{de} = B$, equivalent to the expected amount of vegetable oil from the oil palm project that is put on the domestic market, equations (7) and (8) can be solved simultaneously for $\Delta P^{V_O}$ and $\overline{bd}$. First, substitute $\overline{de} = B - \overline{bd}$ into equation (8), solve for $\overline{bd}$, and use the result in equation (7), to solve for $\Delta P^{V_O}$ to obtain:

$$\Delta P^{V_O} = \frac{B}{\varepsilon_{d}^{V_O} + \varepsilon_{v}^{V_O}} \left( P_{O}^{LVO} / Q_{O}^{LVO} \right).$$

Equation (9) gives the impact of the oil palm project on the domestic market price of edible vegetable oils.

Change in production of vegetable oils and producer surplus

Use the result for $\overline{bd}$ in equation (7) to obtain

$$\overline{bd} = \varepsilon_{d}^{V_O} * \left( Q_{O}^{LVO} / P_{O}^{LVO} \right) * \Delta P^{V_O},$$

which is the reduction in supply of existing vegetable oil producers. Now use $\Delta P^{V_O}$ and $\overline{bd}$ to quantify the change in producer surplus of vegetable oil suppliers ($\Delta P^{S^{V_O}}$), which is given by the area $P_{1}^{V_O} b_{C} P_{O}^{V_O}$ in Figure 1. Mathematically, this is given by:

$$\Delta P^{S^{V_O}} = \Delta P^{V_O} * \left[ Q_{0}^{LVO} \frac{1}{2 \overline{bd}} \right].$$

Equations (10) and (11) are defined for all suppliers of edible vegetable oils, including processors that use locally-produced oilseeds (hereafter referred to as local oilseed processors) or imported crude vegetable oils, as well as those importing the final product. To the extent that the cost structure of these suppliers differs, the respective impacts will be different. To obtain the impact of the oil palm project on local oilseed processors, equations (10) and (11) are scaled by the vegetable oil market share of local oilseed processors.

Change in price of oilseeds and production and producer surplus

The formulae for calculating changes in price of oilseeds and production and producer surplus of existing oilseed producers are identical to those described for vegetable oils. Here, however, we are interested in the derived demand for oilseeds by oilseed processors. Similar to equation (9), the change in price of oilseeds ($\Delta P^{O_S} = P_{0}^{O_S} - P_{1}^{O_S}$), resulting from the shift in the demand curve is estimated by:

$$\Delta P^{O_S} = \frac{\lambda \ast f(s_{LP} \ast \overline{bd})}{\varepsilon_{d}^{O_S} + \varepsilon_{v}^{O_S}} \left( P_{O}^{O_S} / Q_{O}^{O_S} \right)$$

where $\lambda \ast f(s_{LP} \ast \overline{bd})$ represents the shift in the demand for oilseeds associated with the reduction in output of local oilseed processors. The function, $f(*)$, captures the relationship between vegetable oil and oilseeds, and $s_{LP}$ is the vegetable oil market share of local oilseed processors. The parameter $\lambda$ (where $0<\lambda<1$) is an adjustment or market transmission factor, and $\varepsilon_{d}^{O_S}$ and $\varepsilon_{v}^{O_S}$ are the price elasticities of supply and demand of oilseeds, respectively.

Typically, $\lambda$ will depend on the relative value of by-products in oilseed processing such as seed cake for livestock feed and fatty acids for the production of soap and detergents. The

Note that this and the other formulae to follow are similar to those developed by Hayami and Herdt (1977) to evaluate the impacts of technological change on agricultural production and consumption.
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more valuable the by-products, the lower $\lambda$ will be, and the less the shock in the vegetable oil market is transmitted to the oilseed market.

Similar to equations (10) and (11), changes in production of oil seeds, equal to the distance $\overline{hl}$, and producer surplus ($\Delta P^{OS}$) can then be estimated respectively by

\begin{equation}
\overline{hl} = e^{\epsilon*} \left( \frac{Q_0^{OS}}{P_0^{OS}} \right) \Delta P^{OS}
\end{equation}

\begin{equation}
\Delta P^{OS} = \Delta P^{OS} \left[ Q_0^{OS} - \frac{1}{2\overline{hl}} \right].
\end{equation}