Economic Impacts of Shutting Down Hawaii’s Sugar Industry

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The purpose of this publication is to assess the economic repercussions of a complete shutdown of Hawaii’s sugarcane cultivation and processing industry. The sugar industry has gone through another dramatic transformation in the past decade, following previous decades of decline. It dropped from 55 farms producing 6.5 million tons of cane in 1990 to only two farms producing 2.1 million tons of cane in 2002 (Table 1). The possibility of a complete demise of Hawaii’s sugar industry has been a major concern in the state. Estimating the economic impact of a potential, sudden disappearance of the entire sugar industry on the Hawaii economy will provide state legislators and others with much-needed information as they continue to deliberate and act to accommodate the major structural changes that have occurred with sugar’s decline.

Methodology for estimating economic impacts
We used the latest available (1997) input-output (I-O) model of 131 sectors in the Hawaii economy for an economic impact assessment of a complete elimination of the sugar industry. Economic impact is expressed in terms of output (business sales), value added (industry’s contribution to the gross state product), employment, labor earnings, and state taxes.

The I-O model provides a comprehensive snapshot of the intertwined economy at a particular point in time. It allows us to trace the direct, indirect, and induced effects of a reduction in a particular sector of concern.

For example, a reduction of $1 in sugar sales will directly reduce sugar output by $1. The indirect effect of this $1 reduction in turn will decrease the input purchases (fertilizers, water, fuel, etc.) by the sugar industry from other sectors. The reduction in the sales of these sectors will trigger further decreases in their supporting input sectors. This will continue on throughout the economy with further rounds of sales reduction. Furthermore, the sugar industry and its direct and indirect input suppliers pay their employees, who will use the earnings to purchase goods and services in the economy; these are the induced effects. Similarly, the sugar industry and its direct and indirect input suppliers pay rents and interest on loans, and they take home profits; these incomes are eventually spent in the economy as well.

A sector’s indirect and induced effects are generally referred to as its “backward linkage” impacts, which, together with its direct effect, provide a measure of the sector’s total impact on the economy.1

The I-O model provides a systematic way to estimate sectors’ impacts on the economy. Specifically, we use a supply-driven approach to (counterfactually) simulate how Hawaii’s economy would have been affected had its sugar industry been shut down in a specific year.2

1Sectors can also have forward linkages through selling their products to other sectors. Because virtually all final products of Hawaii’s sugar industry are destined for final consumption (primarily for exports), its forward linkage is trivial.

2A brief technical explanation of the simulation methodology is provided in the Appendix. For more details about the supply-driven approach, see Leung and Pooley (2002), “Regional economic impacts of reductions in fisheries production: a supply driven approach” in Marine Resource Economics 16:251–262.
Simulated impacts of sugar industry shutdown

Had the sugar industry been shut down in 2002, its total impact on Hawaii’s economy would have been a loss of $264 million in output, $137 million in value added, $71 million in labor earnings, $9.4 million in state taxes, and 2,570 jobs (Table 2). For comparison, the entire economy in Hawaii generated a $46-billion gross state product (GSP or value added), $26 billion in labor earnings, and $3.6 billion in state taxes in 2002, and over 772,000 jobs in 2001.

The direct impacts would have amounted to a loss of $165 million in output, $67 million in value added, $44 million in labor earnings, $3.0 million in state taxes, and 1,453 jobs in the sugar industry (Table 2).

The indirect and induced impacts would have included a $99 million output loss, a $70 million loss in value added, $27 million lost in labor earnings, a $6.5 million tax loss, and 1,118 fewer jobs in the rest of the economy (Table 2).³

Table 2 also shows the separate impacts of sugarcane cultivation and sugar processing as two subsectors of the sugar industry. In general, the impacts from the

³The sectors most affected by the reduction of the sugar industry include real estate (land rental), wholesale trade, manufacturing (chemical and petroleum), electricity, transportation (water and trucking), and services (repairing, warehousing, insurance, banking, employment services, etc.).
Table 2: Simulated economic impacts of shutting down Hawaii’s sugar industry (2002).

<table>
<thead>
<tr>
<th></th>
<th>Output (million $)</th>
<th>Value added (million $)</th>
<th>Employment (jobs)</th>
<th>Labor earnings (million $)</th>
<th>State taxes (million $)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Entire sugar industry</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct impacts</td>
<td>164.60</td>
<td>66.66</td>
<td>1453</td>
<td>44.12</td>
<td>2.99</td>
</tr>
<tr>
<td>Indirect and induced impacts</td>
<td>99.28</td>
<td>70.12</td>
<td>1118</td>
<td>27.33</td>
<td>6.45</td>
</tr>
<tr>
<td>Total impacts</td>
<td>263.88</td>
<td>136.78</td>
<td>2570</td>
<td>71.45</td>
<td>9.44</td>
</tr>
<tr>
<td><strong>Sugarcane cultivation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct impacts</td>
<td>64.30</td>
<td>43.81</td>
<td>1000</td>
<td>31.62</td>
<td>2.16</td>
</tr>
<tr>
<td>Indirect and induced impacts</td>
<td>63.94</td>
<td>39.16</td>
<td>527</td>
<td>12.98</td>
<td>3.58</td>
</tr>
<tr>
<td>Total impacts</td>
<td>128.24</td>
<td>82.97</td>
<td>1527</td>
<td>44.61</td>
<td>5.74</td>
</tr>
<tr>
<td><strong>Sugar processing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct impacts</td>
<td>100.30</td>
<td>22.85</td>
<td>453</td>
<td>12.49</td>
<td>0.83</td>
</tr>
<tr>
<td>Indirect and induced impacts</td>
<td>35.34</td>
<td>30.96</td>
<td>591</td>
<td>14.35</td>
<td>2.87</td>
</tr>
<tr>
<td>Total impacts</td>
<td>135.64</td>
<td>53.81</td>
<td>1044</td>
<td>26.84</td>
<td>3.70</td>
</tr>
</tbody>
</table>

To account for possible annual fluctuations in production and prices, we also simulated the impacts of completely shutting down the sugar industry in each year of the recent past, from 1997 to 2001 (Table 3). As expected, the estimated annual total economic impacts show a declining trend as a result of the continuing reduction in sugar production since 1997. The estimated loss in total output is estimated at $349 million in 1997, declining to a low of $238 million in 2001, and rebounding slightly to $264 million in 2002.

**Conclusion**

Hawaii’s sugar industry remains a vital contributor of export income and rural employment to the state economy. For example, the sugar industry directly and indirectly generated 2,570 jobs in 2002, which amounts to 2.1 percent of the total employment on Kauai and Maui, where the remaining two sugar operations are located.
The sugar industry also has an aesthetic value, providing an open, green, agricultural landscape pleasing both to residents and to the millions of visitors who come to Hawaii annually and support our vitally important tourism industry. Also, many observers of Hawaii’s resources believe that sugarcane cultivation can potentially benefit groundwater recharge, thus serving as an important contributor to Hawaii’s water supply. Values such as these go beyond the traditional economic values as estimated in this analysis.

**Appendix**

The simulation is based on a 1997 input-output model of 131 sectors of the Hawaii economy.

We partition the 131-sector Leontief input-output model into

\[
\begin{pmatrix}
  x_i \\
  x_j
\end{pmatrix} = \begin{pmatrix}
  A_{ii} & A_{ij} \\
  A_{ji} & A_{jj}
\end{pmatrix} \begin{pmatrix}
  x_i \\
  x_j
\end{pmatrix} + \begin{pmatrix}
  f_i \\
  f_j
\end{pmatrix}
\]

where \( x_i \) (or \( f_i \)) is a 2×1 vector with elements being the outputs (or final demands) of sugarcane cultivation and sugar processing, \( x_j \) (or \( f_j \)) is a 129×1 vector with elements being other sectors’ outputs (or final demands), and \( A_{ii}, A_{ij}, A_{ji}, A_{jj} \) are partitioned components of the direct requirement matrix.

Based on this model, the backward-linkage impacts of a hypothetical sugar industry shutdown can be calculated by the formula \( \Delta x_j = (I - A_{jj})^{-1} A_{ji} \Delta x_i \), where \( \Delta x_j \) represents the (direct) output losses in the sugar industry, and \( \Delta x_i \) represents the (indirect) output losses in the rest of the economy.

With the estimated impacts on outputs, the impacts on other dimensions (e.g., value added, labor earnings, jobs, state taxes, etc.) can easily be calculated.

Assume that the structure of Hawaii’s economy has not changed much from 1997 to 2002; then, the multipliers estimated from the 1997 input-output model can be used to estimate the indirect impacts of the shutdown of the sugar industry in each of the years from 1998 to 2002.

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