Economic Analysis of Increasing the Minimum Size for Fresh Potatoes

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Executive Summary

The Idaho Potato Commission funded a project to help answer the question: What would be the economic impact if the potato industry increased the minimum size for fresh potatoes? We estimate that increasing the minimum size from 4 to 5 ounces would divert about 5 million cwt to dehydrators. Idaho fresh potato revenue would increase $140 million. Idaho dehydrated potato revenue would increase $18 million. The total impact would be increased revenue of $158 million. A sensitivity analysis showed that revenue increases are larger when more potatoes are diverted.

Size Data

The Idaho Agricultural Statistics Service (IASS) conducts annual field digs to document russet potato size and grade. We used this data to estimate the amount of potatoes that would be diverted from the fresh market to dehydration processing if the minimum size standard increased. IASS provides data for five Idaho regions: Eastern Counties, Eastern Seed Counties, South-central Counties, Southwest Counties and Other Counties. We chose the Eastern Counties as the best indicator for the potato size profile of the fresh potato industry.

The average size distribution for the 2000 to 2010 crops is in Figure 1. The largest size category, at 27% of the total, is ‘2’ or 4-6 ounces’. On average more than one-fourth (26%) of the Eastern Idaho crop is in this size range. The range was from 22% in 2002 to 33% in 2010.
The IASS data does not specify a 4-5 ounce category. We assumed that half the 4-6 ounce category is made up of 4-5 ounce potatoes. That puts 13% of the potato crop is in the 4-5 ounce category.

Ignoring the small amount of 'baby potatoes' marketed from Idaho, we estimate that the share of fresh potatoes in the 4-5 ounce category is 15.4% of total shipments. Using the 2000-10 average for Idaho fresh shipments of 33.34 million cwt, the 4-5 ounce quantity is 5.13 million cwt. That is the amount of potatoes that would be diverted from fresh to dehy. Total fresh shipments would drop from 33.34 to 28.2 million cwt (Table 1).

<table>
<thead>
<tr>
<th>Size</th>
<th>Min = 4 oz</th>
<th>Min = 5 oz</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-5 ounces</td>
<td>5.13</td>
<td>0</td>
</tr>
<tr>
<td>5-6 ounces</td>
<td>5.13</td>
<td>5.13</td>
</tr>
<tr>
<td>Over 6 ounces</td>
<td>23.07</td>
<td>23.07</td>
</tr>
<tr>
<td>Total</td>
<td>33.34</td>
<td>28.20</td>
</tr>
</tbody>
</table>

Quantities are million cwt

Impact on the Fresh Potato Industry

Diverting small potatoes from the fresh market would have two impacts:

1. Reduced quantity sold in the fresh market
2. Increased prices for fresh potatoes

Prices could also change due to demand for more uniform sizing. Idaho shippers marketing non-size A packs with a 5 ounce minimum get a premium price. In late July 2010 the suggested premium was $1.50 for 5-9 ounce packs and $0.75 for size A packs, according to the United Potato Growers of Idaho (UPGI) website.

We built an econometric model to estimate the impact of reduced supply going into the fresh market. The model explains 94% of the changes in annual Fresh Weighted Average (FWA) prices, a shipper-level price that accounts for various fresh pack sizes and containers. The explanatory variables in the model are:

Q_{ID} = Quantity of Idaho fresh potatoes shipped (million cwt)
Q_{US} = Quantity of US non-Idaho fresh potatoes shipped (million cwt)
Size = portion of the Eastern Idaho crop that is 8 ounces or larger (%)
Inc = US disposable income per capita, deflated to 2005 ($/person)
Adv = IPC shift from regional to national advertising in 2007 (binary variable)

We used the econometric model to calculate price flexibility (F), which is a measure of price sensitivity. F for this model is -3.7, which means that for each one percent change in the quantity of Idaho potatoes shipped, the FWA price moves 3.7% in the
opposite direction. For the 15.4% reduction in fresh shipments we would expect the price to increase 57%.

We used the price flexibility to estimate an average $140 million increase in fresh potato shipper revenue if the minimum size standard were raised to 5 ounces (Table 2). In spite of a drop of more than 5 million cwt in the amount of potatoes sold, revenue would increase by 30% due to the jump in FWA prices.

**Table 2. Impact on 5-ounce minimum on Idaho potato shipper revenue**

<table>
<thead>
<tr>
<th></th>
<th>Min = 4 oz</th>
<th>Min = 5 oz</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity (million cwt)</td>
<td>33.34</td>
<td>28.2</td>
<td>-5.1</td>
</tr>
<tr>
<td>Price ($/cwt FWA)</td>
<td>$12.84</td>
<td>$20.16</td>
<td>$7.32</td>
</tr>
<tr>
<td>Revenue ($ million)</td>
<td>$428</td>
<td>$568</td>
<td>$140</td>
</tr>
<tr>
<td><strong>Average 2000-2010</strong></td>
<td></td>
<td></td>
<td><strong>Estimated</strong></td>
</tr>
</tbody>
</table>

The revenue increase does not include adjustments for price premiums that shippers currently get for 5-ounce minimum packs. Since quantities are not reported for those packs it could not be included in the econometric model. Other research sponsored by the Idaho Potato Commission found that minimum sizing is not an important quality issue among consumers.

If the Idaho potato industry increased the minimum size standard, growers might respond to higher prices by planting more potatoes. Supply response is beyond the scope of this project and is influenced by the supply management programs of United Potato Growers of Idaho.

**Impact on the Dehydrated Potato Industry**

Diverting small potatoes into the dehydrated market would have two impacts:
1. Increased quantity sold in the dehydrated market
2. Decreased prices for dehydrated potatoes

We built an econometric model to estimate the impact of increased supply in the US dehydrated market. Due to a lack of data we could not build an Idaho model. Since a large part of the industry is in Idaho we used the US model to analyze Idaho impacts. The model explains 91% of the changes in US dehydrated potato product prices for the 2000-2010 crops. The explanatory variables in the model are:

\[ Q_{US} = \text{Quantity of US dehydrated potatoes (million lbs.)} \]
\[ \text{Time} = \text{Accounts for an upward trend in dehydrated potato prices} \]

From the model we calculated the price flexibility (F) for US dehydrated potatoes. F for this model is -0.54, which means that for each one percent change in dehydrated potato quantity, the price moves 0.54% in the opposite direction.
Diverting 5 million cwt from Idaho fresh to dehy, at an 8:1 raw to finished product conversion rate, would increase US dehydrated potato supply by 12%. This would cause finished product price to decline by 6%. US dehy revenue would increase $25 million (Table 3).

We asked several industry experts to estimate the share of the US dehydrated potato industry that is in Idaho. The average estimate was 70%. We used this figure to calculate that $20 million of the estimated $25 million increase in dehy revenue would be in Idaho.

Table 3. Impact of 5-ounce minimum on dehydrated potato revenue

<table>
<thead>
<tr>
<th></th>
<th>Min = 4 oz</th>
<th>Min = 5 oz</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>US Quantity (million lbs.)</td>
<td>550.4</td>
<td>614.5</td>
<td>64.1</td>
</tr>
<tr>
<td>US Price ($/lb.)</td>
<td>$0.99</td>
<td>$0.93</td>
<td>-$0.06</td>
</tr>
<tr>
<td>US Revenue ($ million)</td>
<td>$545</td>
<td>$570</td>
<td>$25</td>
</tr>
<tr>
<td>ID Revenue ($ million)</td>
<td>$381</td>
<td>$399</td>
<td>$18</td>
</tr>
</tbody>
</table>

Average 2000-2010 Estimated

Previous IPC-sponsored Potato Demand Research

The Idaho Potato Commission funded another potato demand research project more than 20 years ago. The researchers estimated price flexibilities in the retail market at -7.1 for fresh potatoes and -1.3 for dehydrated potatoes (Guenthner, et al 1991). In the current study we estimate the flexibilities at -3.7 and -0.54, respectively. The smaller numbers suggest that prices are less sensitive to changes in supply.

Flexibilities in the older study differ from the ones in this study for three reasons.

1. **Product.** The older study was on US fresh potatoes and the current one focused on Idaho fresh potatoes. Since there are more substitutes for Idaho potatoes (eg Washington potatoes) than there are for US potatoes, we expect the price flexibility to be smaller.

2. **Market.** The older study analyzed the retail link of the market chain and used prices that consumers pay. This study used price data from the fresh shipper and dehydration processor parts of the market.

3. **Time.** In this study we used data from 2000 to 2010 to model current market behavior. The older study used data from 1975-1988.

Reference:
**Sensitivity Analysis**

The impact estimates are based on averages for the quantity of Idaho fresh potatoes shipped and the portion of potatoes in the 4-5 ounce range. We also conducted a sensitivity analysis to estimate the impacts when those two variables were at their highest and lowest values from 2000 to 2010 (Table 4).

**Table 4. Sensitivity analysis for Idaho potato industry revenue**

<table>
<thead>
<tr>
<th></th>
<th>Fresh</th>
<th>Dehy</th>
<th>Total</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual 2000-10 average</td>
<td>$428</td>
<td>$381</td>
<td>$809</td>
<td>-</td>
</tr>
<tr>
<td>Min = 5 oz</td>
<td>$568</td>
<td>$399</td>
<td>$967</td>
<td>$158</td>
</tr>
<tr>
<td><strong>ID Quantity shipped:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Largest (37.3 mcwt)</td>
<td>$636</td>
<td>$401</td>
<td>$1,036</td>
<td>$228</td>
</tr>
<tr>
<td>Smallest (30.7 mcwt)</td>
<td>$523</td>
<td>$398</td>
<td>$921</td>
<td>$112</td>
</tr>
<tr>
<td><strong>Size profile:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highest 4-5 oz (19.7%)</td>
<td>$600</td>
<td>$396</td>
<td>$996</td>
<td>$187</td>
</tr>
<tr>
<td>Lowest 4-5 oz (12.3%)</td>
<td>$544</td>
<td>$399</td>
<td>$943</td>
<td>$134</td>
</tr>
</tbody>
</table>

Note: revenue is $million

We found that the largest impact would have been when Idaho fresh shipments were at the largest -- 37.3 million cwt for the 2000 crop. With that quantity and a 5-ounce minimum, revenue would have increased $208 million in the fresh industry and $20 million in the dehy industry. The next largest increase in revenue ($187 million) would have been when the largest share of fresh potatoes were in the 4-5 ounce category – 19.7% in 2010. The biggest benefits occur when large quantities of potatoes are diverted from fresh to dehy.

**Value of IPC Advertising**

In 2007 the Idaho potato industry supported an increased tax for promotion of Idaho potatoes. The Idaho Potato Commission used the new tax rate of $0.125 per cwt to shift from regional advertising to national advertising. We used a statistical tool, known as a binary variable or dummy variable, to estimate the influence of increased advertising on Idaho fresh shipper revenue. Our model estimates that the change in advertising, after accounting for the influence of other variables, increased the Fresh Weighted Average (FWA) price $1.80 per cwt. At the average of 33.34 million cwt of fresh potatoes shipped that is an increase in revenue of $60 million each year.