Price Optimization for Rotable Spare Parts

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Problem
Working in collaboration with Dassault Falcon Jet (DFJ), a major business jet manufacturer, we address the problem of pricing for rotatable spare parts, one special type of spare part that can be repaired and reused. Shown in Figure 1 is the special system dynamics in selling rotatable spare parts.

Price Optimization Model
We develop a price optimization model to maximize the long-run expected profit rate through selling rotatable spare parts while incorporating the system information of rotatable spare parts such as the total number of units DFJ owns ($N$), the average repair time ($\lambda(L)$) and cost ($c$), and the demand rate ($\lambda(p)$). Figure 2 illustrates our price optimization model.

Visualization & Decision Support Tool
We built a visualization and decision support tool embedding pricing analytics. This tool takes inputs estimated from data and returns a robust suggested price based on the price optimization model. The tool also provides the sensitivity analysis of the suggestion. Figure 4 shows a screenshot of the tool.

Implementation Result
We conduct a controlled experiment of the price optimization model on 1,702 rotatable spare parts at the beginning of May 2018. 852 parts were selected into the Test group and 850 parts were in the Control group. We perform difference-in-difference (DiD) analysis in aggregate level for 150 working days before and after implementation. The result is summarized in the following table.

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
<th>Percentage Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>$10.45M</td>
<td>$9.04M</td>
<td>-13.49%</td>
</tr>
<tr>
<td>Test</td>
<td>$8.45M</td>
<td>$8.06M</td>
<td>-4.66%</td>
</tr>
<tr>
<td>Difference</td>
<td>-$2M</td>
<td>-$0.98M</td>
<td>8.83%</td>
</tr>
</tbody>
</table>

Table 1. DiD comparison of profit

Acknowledgments
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