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 rotable 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 rotable spare parts.

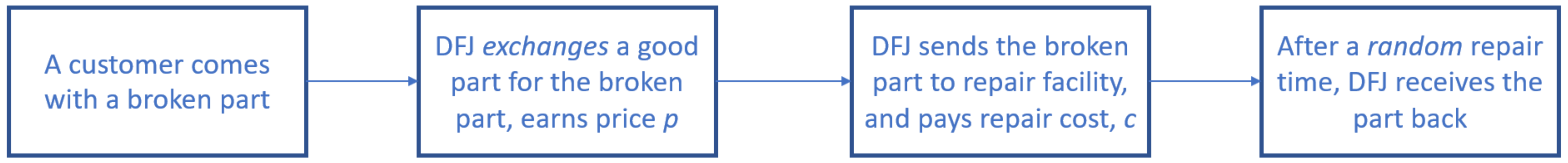

Figure 1. Dynamics of rotable spare parts

Price Optimization Model

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

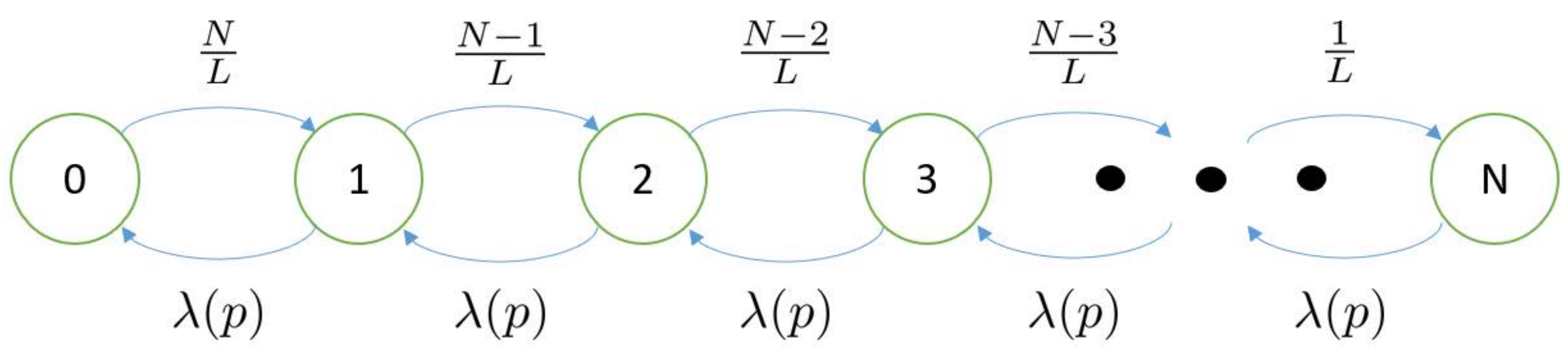

Figure 2. Price optimization model

We made following two key assumptions in establishing the price optimization model:

1. Customers arrive according to a Poisson Process of rate $\lambda(p)$
2. Repair time is exponentially distributed with mean L

The above two assumptions help us in simplifying the model. Moreover, these assumptions are coherent with the data. Figure 3 shows the distribution of the interarrival time and repair time for a popular rotable spare part.

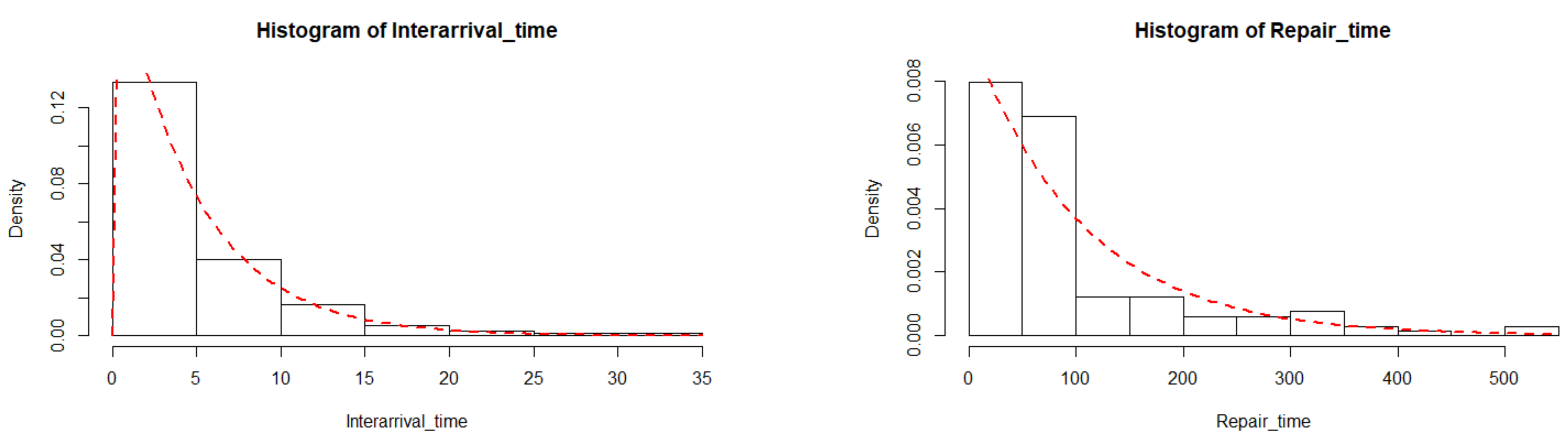

Figure 3. Distributions of interarrival time (left) and repair time (right) with exponential fittings

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.

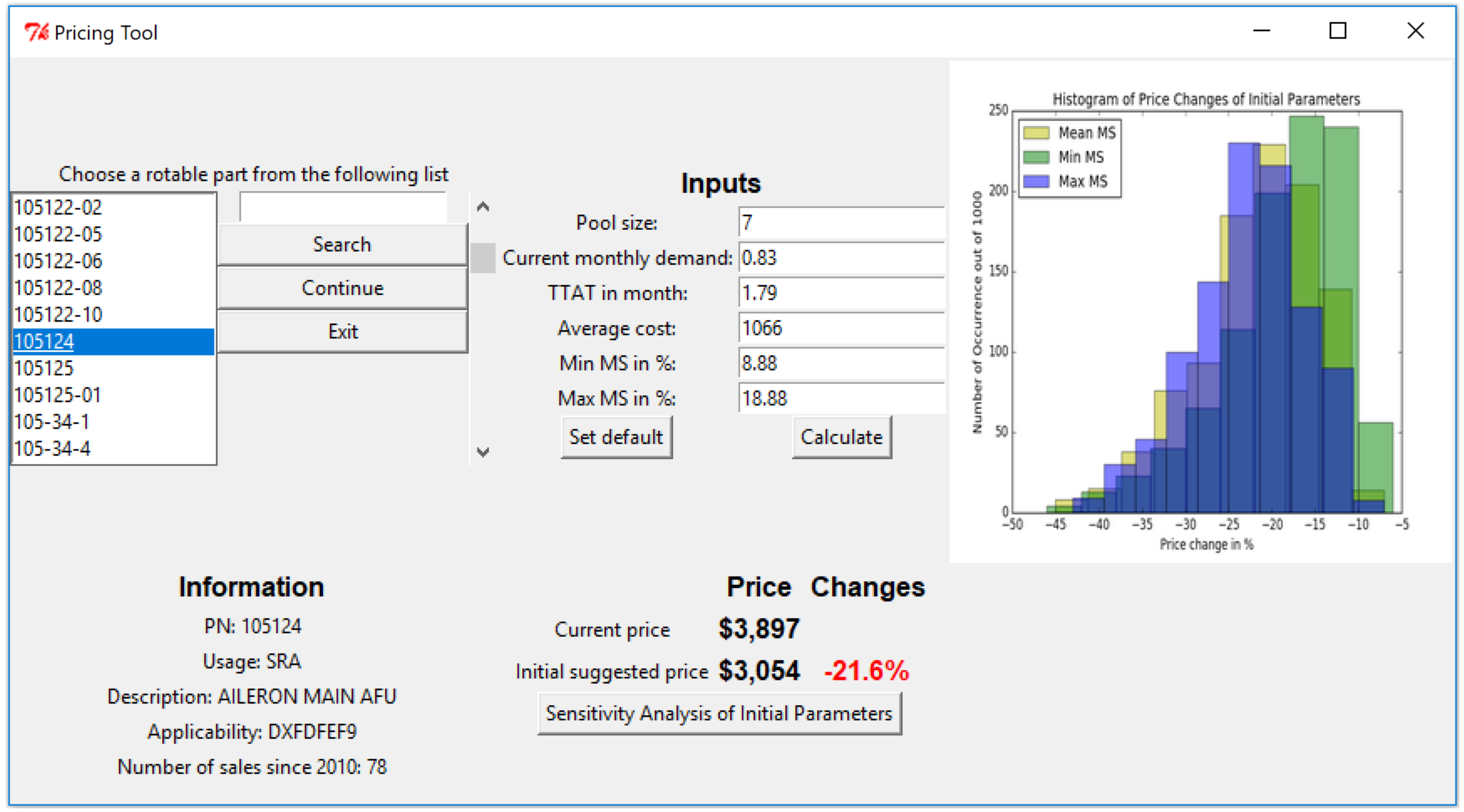

Figure 4. A screenshot of visualization & decision support tool

Implementation Result

We conduct a controlled experiment of the price optimization model on 1,702 rotable 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.

Profit	Before	After	Percentage Difference
Control	$10.45M	$9.04M	-13.49%
Test	$8.45M	$8.06M	-4.66%
Difference	-$2M	-$0.98M	**8.83%**

Table 1. DiD comparison of profit

Acknowledgments

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