HORIZON
Data Science Applications

Method to demonstrate value of improved RMR customer portfolio composition

Context

- Recent changes in the composition of the company's portfolio suggest attrition will be lower and RMR higher going forward
  - The company has increased the share of contracts in its portfolio for products shown to have lower attrition rates (shift toward stickier products)
  - Longer contracts, changed industry mix, and shift to better customer case approach also suggest improved attrition/RMR

- The company has a robust relational database that can be used to query contract-level data by relevant contract characteristics

- Univariate analyses already conducted show that recent shifts in the mix of product, term, industry, and case approach are associated with lower attrition/higher RMR historically

- There is a need to quantify the attrition and RMR implications of this shift on a multivariable basis to appropriately account for covariance and more succinctly summarize implications for value

Approach

Analytic challenge

Historical data available on contract attributes, attrition, and revenue, which is relevant to understanding attrition and RMR of current portfolio; however, historical and current portfolios are not comparable at aggregate level due to differences in product, term, industry, and case approach mix

Solution

- Use contract-level data to reweight historical portfolio to adjust for these differences and make historical and current portfolios comparable; historical data on attrition and RMR can then be brought to bear for use in forecasting outcomes of current portfolio

- First, apply **matching procedure** to historical contract-level data to adjust historical portfolio, making it similar in aggregate to current portfolio along key dimensions

- Then, use attrition outcomes and RMR from adjusted historical portfolio to forecast RMR of current portfolio

Specifics of matching procedure

Select characteristics for matching: Product, term length, industry, customer case approach, and *any other differences associated with attrition and RMR*
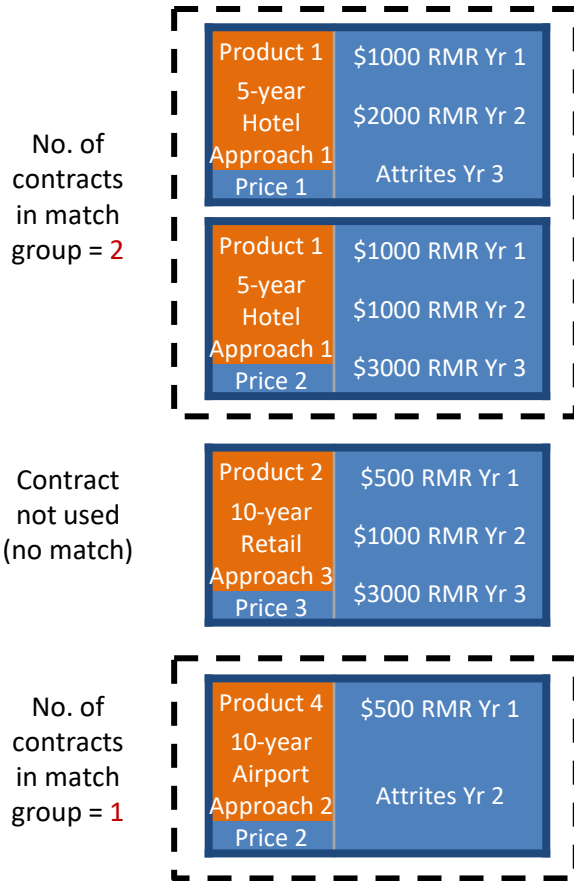
Apply matching algorithm (see example on next slide):

- Several accepted techniques available; given abundance of data and forecasting objective here, we use <u>exact matching</u> on a (current portfolio) contract-by-contract basis

- That is, to each contract in the current portfolio, match all contracts in the historical portfolio that share the same match characteristics

- If it turns out that there are contracts in the current portfolio with no exact historical match, we then augment exact matching with another algorithm (propensity score matching)

- Historical data used to demonstrate accuracy of the forecast methodology

Evaluate outcomes: After implementing the algorithm and validating match quality, the attrition and revenue data from contracts in the adjusted portfolio are used to project future RMR
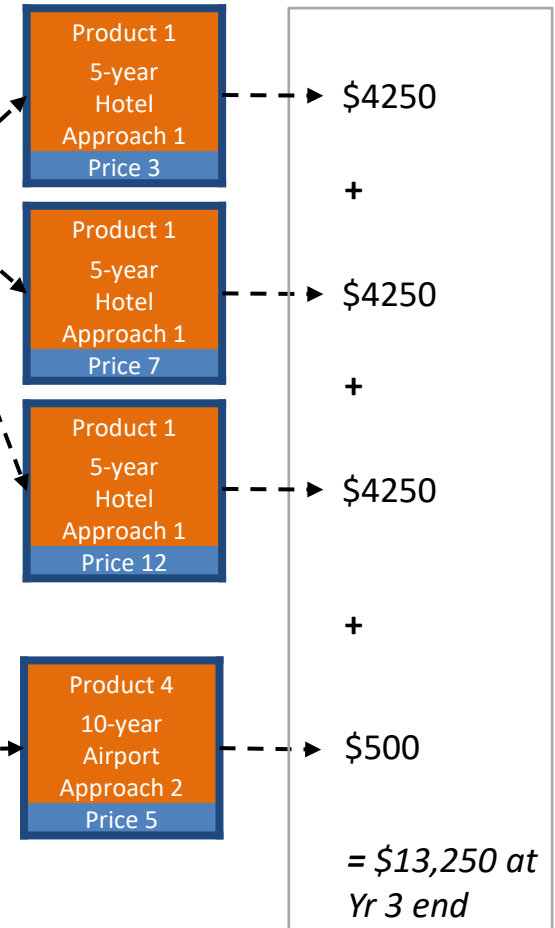
Example: Forecast RMR at end of 2022

Historical portfolio **Current portfolio** **Forecast**

No. of contracts in match group = 2

| Product 1 5-year Hotel Approach 1 Price 1 | $1000 RMR Yr 1 $2000 RMR Yr 2 Attrites Yr 3 |

| Product 1 5-year Hotel Approach 1 Price 2 | $1000 RMR Yr 1 $1000 RMR Yr 2 $3000 RMR Yr 3 |

(1/2)*($1000+$1000) = $1000 RMR Yr 1
(1/2)*($2000+$1500) = $1750 RMR Yr 2
(1/2)*($0+$3000) = $1500 RMR Yr 3
Total RMR at Yr 3 end: $4250

Product 1 5-year Hotel Approach 1 Price 3 → $4250

+

Product 1 5-year Hotel Approach 1 Price 7 → $4250

+

Product 1 5-year Hotel Approach 1 Price 12 → $4250

+

Contract not used (no match)

| Product 2 10-year Retail Approach 3 Price 3 | $500 RMR Yr 1 $1000 RMR Yr 2 $3000 RMR Yr 3 |

No. of contracts in match group = 1

| Product 4 10-year Airport Approach 2 Price 2 | $500 RMR Yr 1 Attrites Yr 2 |

(1/1)*($500) = $500 RMR Yr 1
(1/1)*($0) = $0 RMR Yr 2
(1/1)*($0) = $0 RMR Yr 3
Total RMR at Yr 3 end: $500

Product 4 10-year Airport Approach 2 Price 5 → $500

= $13,250 at Yr 3 end

Notes: 1. ▮ Denotes match characteristics

2. For simplicity, we've assumed for this example that no actual RMR data is available for current portfolio; in practice, we use such data to help evaluate the forecast methodology.

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More on matching: History

- Approach is commonly used in economics (particularly health economics/epidemiology observational research) as a way of addressing differences between study treatment cohorts that would otherwise confound comparisons of their outcomes
  - E.g., is the difference in survival time between these two populations due to the kind of treatment they received, or due to other differences between them like age, gender, prevalence of comorbidities?

- Dates back to at least Rosenbaum and Rubin (1983); more recently, Horizon personnel used this approach in medical insurance claims data to construct a synthetic control cohort with which to estimate the annual incremental cost of medical errors in Massachusetts

More on matching: Present application

- Key difference here vs. more traditional application of matching is that "outcomes" (attrition and RMR profiles at time T) are not yet available for the current cohort; rather than comparing outcomes between cohorts as in the traditional application of this method, we're instead proposing to use the outcomes from one cohort (i.e., an adjusted version of the historical portfolio) to make inferences about the yet-to-be-realized outcomes of the other (i.e., current) cohort

- This difference does not appear to present any new challenges

  o In the traditional application of matching, after matching procedure is performed and validated, the typical assumption is that the **outcomes of the cohorts are the same** but for difference in treatment status (e.g., treated vs. not treated) and any residual confounding (i.e., inadequacy of the adjustment procedure)

  o In the present application, there is no treatment/difference in treatment status; we address potential residual confounding in the traditional way, i.e., evaluation of match quality and sensitivity analyses (e.g., testing of alternative matching specifications and techniques). We also use a regression framework to test for presence of aggregate time trends and incorporate findings into forecast

Other considerations

- Main line of potential critique for using matching-adjusted historical attrition and RMR as proxy for RMR of current portfolio centers on fact that we're still using a proxy; there may be other, unmeasured differences between old and new contracts, and it's possible that some of those differences could make actual attrition and RMR from the current portfolio worse than that suggested by performance of the adjusted historical portfolio

- This is essentially the same as saying there is residual confounding

- To address, we use traditional techniques mentioned on prior slide

- Some key sensitivity analyses also useful (e.g., What if overall attrition rates have drifted up by X% more than we thought?)

- Also important to keep in mind (1) there is no particular reason to believe residual confounding, if present, would *systematically overstate* RMR; and (2) the relevant benchmark: all methods for using the historical portfolio to understand the potential value of the current portfolio are subject to this line of critique