Final Project: Hawaiian-Alaska Airlines Merger Analysis

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Contents


```r
# Load the airline market dataset
data <- read_csv("/Users/kirsten/Downloads/db1bmarket.csv")

# Preview structure
#glimpse(data)
#summary(data)
```

```r
# Focus on Hawaiian ("HA") and Alaskan ("AS") carriers
data_filtered <- data %>%
  filter(rpcarrier %in% c("HA", "AS"))

# Quick check: distribution of observations by carrier
table(data_filtered$rpcarrier)
```

```
##
##   AS   HA
## 5848  668
```

0.1 Dataset Description

The analysis in this report is based on the `db1bmarket.csv` dataset provided through Canvas. This dataset contains route-level information on airline pricing and market shares for all U.S. domestic markets in which either Hawaiian Airlines (HA) or Alaska Airlines (AS) operated during the first quarter of 2024.

Each observation in the dataset represents a carrier-route combination and includes the following key variables: origin and destination airport codes, corresponding state names, market identifier, ticket quantity sold (`q`), average fare (`mktfare`), and market size (`msize`). Carrier information is captured both pre-merger (`rpcarrier`) and post-merger (`rpcarrier_merged`), allowing us to simulate outcomes under various merger scenarios.

This dataset enables us to estimate market concentration, calculate diversion ratios, compute route-level marginal costs and markups, and simulate potential price effects of the proposed Hawaiian-Alaska merger.

0.1.1 Carrier Coverage in the Dataset

After filtering the dataset to include only observations where either Hawaiian Airlines (HA) or Alaska Airlines (AS) were active, we observe a total of 6,516 carrier-route combinations. Of these, Alaska Airlines accounts for 5,848 observations, while Hawaiian Airlines represents 668. This distribution reflects Alaska's significantly larger domestic network relative to Hawaiian's more regionally focused presence.

1 Industry Overview

1.1 Financial Position of Alaskan and Hawaiian Airlines in 2024

This analysis begins with an overview of the financial standing of both Alaska Airlines and Hawaiian Airlines during the first quarter of 2024, providing context for evaluating the merger's potential economic effects.

Alaska Airlines (Alaska Air Group Inc.) reported strong financial performance in 2024. The company generated $11.7 billion in revenue—an increase of 13% over the prior year—and earned $395 million in net income. Reflecting this success, the airline distributed $325 million in incentive pay to employees, the equivalent of approximately six weeks' salary for most of its workforce. Alaska carried 36 million passengers over the year and maintained an employee base of 33,941 across its operations[1][2].

Hawaiian Airlines (Hawaiian Holdings Inc.), in contrast, faced ongoing financial strain. In Q1 2024, the airline posted a net loss of $137.6 million and reported accumulated net operating losses of $451 million (federal) and $969 million (state-level) as of March 31. Hawaiian's workforce totaled 7,362 employees during this period[3][4].

The stark difference in performance underscores Alaska's relative operational strength and Hawaiian's ongoing financial challenges. This asymmetry may have implications for the rationale of the merger and the competitive pressures affecting each firm.

```r
# Identify AS/HA presence by market
carrier_flags <- data %>%
  filter(rpcarrier %in% c("AS", "HA")) %>%
  distinct(mkt, rpcarrier) %>%
  mutate(flag = 1) %>%
  pivot_wider(names_from = rpcarrier, values_from = flag, values_fill = 0) %>%
  mutate(
    category = case_when(
      AS == 1 & HA == 1 ~ "Both AS & HA",
      AS == 1 ~ "AS Only",
      HA == 1 ~ "HA Only",
```

[1] Alaska Air Group 2024 Financial Report. Retrieved from https://news.alaskaair.com/wp-content/uploads/2025/03/ALK-2024-Annual-Report-BMK.pdf

[2] Alaska Airlines Q4 and Full Year 2024 Results. https://news.alaskaair.com/company/alaska-air-group-fourth-quarter-and-full-year-2024-results

[3] Hawaiian Airlines Q1 2024 Results. https://newsroom.hawaiianairlines.com/releases/hawaiian-holdings-reports-2024-first-quarter-financial-results

[4] Beat of Hawaii. "Hawaiian Airlines Outlook After Posting $138 Million Loss." https://beatofhawaii.com/hawaiian-airlines-outlook-after-posting-138-million-loss

```r
      TRUE ~ "Other"
    )
  ) %>%
  select(mkt, category)
# Pre-merger HHI by market
hhi_pre <- data %>%
  group_by(mkt) %>%
  summarise(hhi_pre = 10000 * sum(ms^2), .groups = "drop")
# Merge with pre-merger HHI values
hhi_carrier_flagged <- left_join(hhi_pre, carrier_flags, by = "mkt")

# Step 1: Calculate pre-merger HHI by market
hhi_pre <- data %>%
  group_by(mkt) %>%
  summarise(hhi_pre = 10000 * sum(ms^2), .groups = "drop")

# Step 2: Calculate post-merger HHI using merged carriers
hhi_post <- data %>%
  group_by(mkt, rpcarrier_merged) %>%
  summarise(ms_merged = sum(ms), .groups = "drop") %>%
  group_by(mkt) %>%
  summarise(hhi_post = 10000 * sum(ms_merged^2), .groups = "drop")

# Step 3: Join and compute delta and flags
hhi_final <- left_join(hhi_pre, hhi_post, by = "mkt") %>%
  mutate(
    delta_hhi = hhi_post - hhi_pre,
    hhi_flag = case_when(
      hhi_pre < 1500 ~ "Green",
      hhi_pre >= 1500 & hhi_pre < 2500 & delta_hhi < 100 ~ "Yellow",
      hhi_post >= 2500 & delta_hhi >= 200 ~ "Red",
      TRUE ~ "Neutral"
    )
  )
```

---

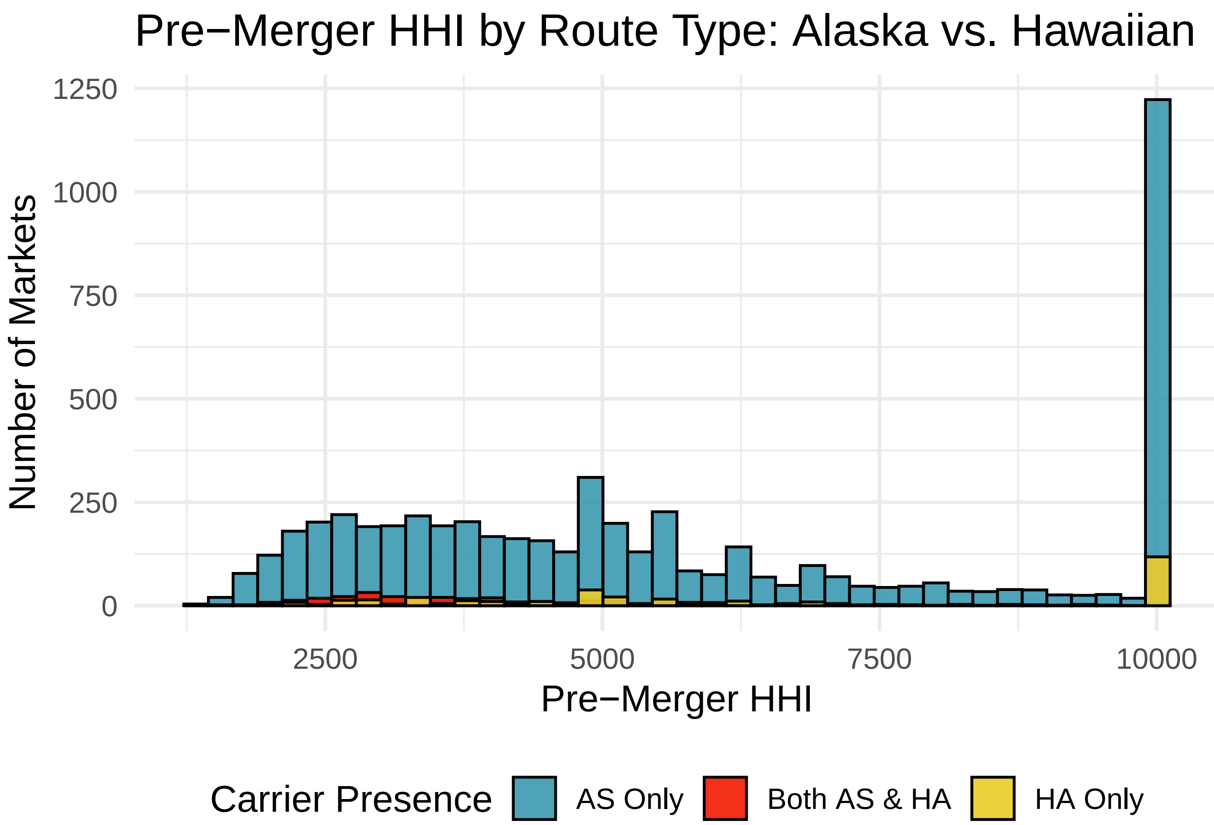
2 Merger Analysis 1: HHI Indices

2.1 R Markdown Code: HHI Graph

```r
# Define 3 distinct high-contrast colors from Zissou1
carrier_colors <- c(
  "Both AS & HA" = wes_palette("Zissou1")[5],  # strong contrast (red-purple)
  "AS Only"      = wes_palette("Zissou1")[1],  # blue
  "HA Only"      = wes_palette("Zissou1")[3]   # orange/yellow
)

# Plot histogram by carrier presence
ggplot(hhi_carrier_flagged, aes(x = hhi_pre, fill = category)) +
  geom_histogram(bins = 40, color = "black", alpha = 0.9, position = "identity") +
  scale_fill_manual(values = carrier_colors) +
  labs(
```

```r
    title = "Pre-Merger HHI by Route Type: Alaska vs. Hawaiian",
    x = "Pre-Merger HHI",
    y = "Number of Markets",
    fill = "Carrier Presence"
  ) +
  theme_minimal(base_size = 14) +
  theme(legend.position = "bottom")
```




```r
# Step 1: Recalculate pre-merger HHI by market
hhi_pre <- data %>%
  group_by(mkt) %>%
  summarise(hhi_pre = 10000 * sum(ms^2), .groups = "drop")

# Step 2: Compute average and median HHI
hhi_summary <- hhi_pre %>%
  summarise(
    mean_hhi = mean(hhi_pre, na.rm = TRUE),
    median_hhi = median(hhi_pre, na.rm = TRUE)
  )

hhi_summary
```

```
## # A tibble: 1 x 2
##   mean_hhi median_hhi
##      <dbl>      <dbl>
## 1    5729.       5000
```

2.2 Pre-Merger HHI Summary

To establish a baseline level of concentration, we computed the Herfindahl-Hirschman Index (HHI) for each route in our dataset prior to the proposed merger. The HHI is calculated as:

$$HHI = 10{,}000 \times \sum_j s_j^2$$

where s_j is the market share of airline j on a given route.

Our results show that the **average pre-merger HHI** across all routes was **5,729**, and the **median HHI** was **5,000**. These values far exceed the Department of Justice's 2,500 threshold for highly concentrated markets, indicating that competitive conditions were already limited in many routes where Alaska and Hawaiian Airlines operated.

```
# Step 1: Recalculate market shares after merger using rpcarrier_merged (ASHA = Alaska + Hawaiian)
hhi_post <- data %>%
  group_by(mkt, rpcarrier_merged) %>%
  summarise(ms_merged = sum(ms), .groups = "drop") %>%
  group_by(mkt) %>%
  summarise(hhi_post = 10000 * sum(ms_merged^2), .groups = "drop")

# Step 2: Compute average and median post-merger HHI
hhi_post_summary <- hhi_post %>%
  summarise(
    mean_hhi_post = mean(hhi_post, na.rm = TRUE),
    median_hhi_post = median(hhi_post, na.rm = TRUE)
  )

hhi_post_summary
```

```
## # A tibble: 1 x 2
##   mean_hhi_post median_hhi_post
##           <dbl>           <dbl>
## 1         5749.           5011.
```

2.3 Post-Merger HHI Simulation

To evaluate the impact of the merger, we simulate post-merger market concentration by combining the market shares of Alaska Airlines (AS) and Hawaiian Airlines (HA) into a single merged entity. Using the revised shares from the `rpcarrier_merged` variable, we recalculate the Herfindahl-Hirschman Index (HHI) for each route.

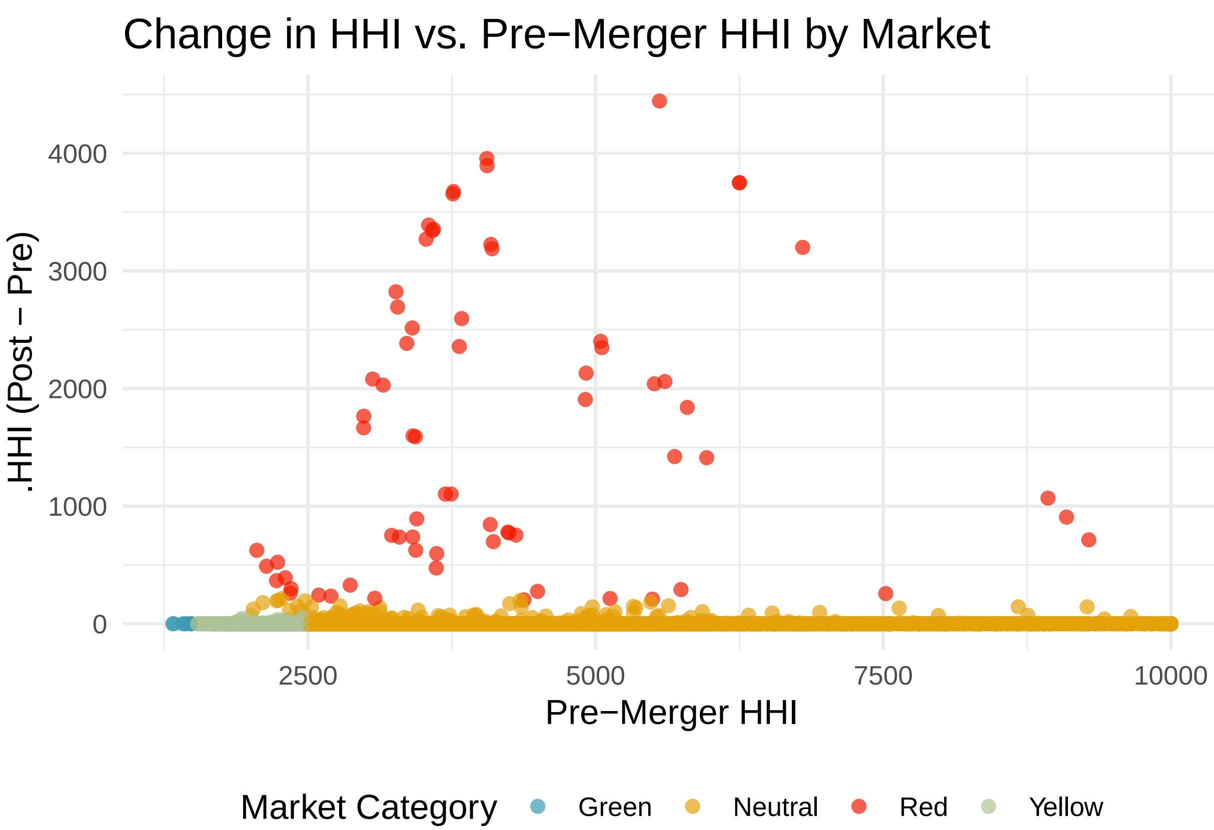
Our results show that the **average post-merger HHI** across all routes increases to **5,749**, with a **median post-merger HHI** of **5,011**. While these increases appear modest in absolute terms, they occur in markets that were already highly concentrated before the merger.

In merger review, even small increases in HHI (particularly when they exceed 200 points in already concentrated markets) may signal a **substantial lessening of competition** and warrant further scrutiny under DOJ and FTC guidelines.

```
# Load Zissou1 palette with 4 colors
wes_colors <- wes_palette("Zissou1", 4, type = "continuous")

# Plot HHI results
ggplot(hhi_final, aes(x = hhi_pre, y = delta_hhi, color = hhi_flag)) +
  geom_point(alpha = 0.7, size = 2) +
```

```r
  scale_color_manual(
    values = c(
      "Green" = wes_colors[1],
      "Yellow" = wes_colors[2],
      "Red" = wes_colors[4],
      "Neutral" = wes_colors[3]
    )
  ) +
  labs(
    title = "Change in HHI vs. Pre-Merger HHI by Market",
    x = "Pre-Merger HHI",
    y = "ΔHHI (Post - Pre)",
    color = "Market Category"
  ) +
  theme_minimal(base_size = 13) +
  theme(legend.position = "bottom")
```




```r
# Join pre- and post-merger HHI data by market
hhi_delta <- left_join(hhi_pre, hhi_post, by = "mkt") %>%
  mutate(delta_hhi = hhi_post - hhi_pre)

# Preview
#head(hhi_delta)

# Summarize change in HHI across all markets
hhi_delta_summary <- hhi_delta %>%
  summarise(
    mean_delta = mean(delta_hhi, na.rm = TRUE),
```

```r
    median_delta = median(delta_hhi, na.rm = TRUE),
    max_delta = max(delta_hhi, na.rm = TRUE),
    min_delta = min(delta_hhi, na.rm = TRUE)
  )

hhi_delta_summary
```

```
## # A tibble: 1 x 4
##   mean_delta median_delta max_delta min_delta
##        <dbl>        <dbl>     <dbl>     <dbl>
## 1       19.6            0     4444. -1.82e-12
```

2.4 Change in HHI by Route

We compute the change in the Herfindahl-Hirschman Index (ΔHHI) for each market to assess how the proposed merger would alter market concentration.

Across all routes in our dataset: - The **average ΔHHI** is **19.64** - The **median ΔHHI** is **0** - The **maximum observed ΔHHI** is **4,444.45** - The **minimum ΔHHI** is effectively zero

These figures suggest that the vast majority of markets see no change in concentration from the merger. However, a small set of markets experience large increases in HHI, indicating direct overlap and a heightened risk of anticompetitive effects. These overlapping markets will be a focal point in our pricing and diversion analysis.

```r
# Combine pre-, post-, and delta HHI into one table
hhi_classified <- hhi_delta %>%
  mutate(
    doj_flag = case_when(
      hhi_post < 1500 ~ "Green",
      hhi_post >= 1500 & hhi_post < 2500 & delta_hhi < 100 ~ "Yellow",
      hhi_post >= 2500 & delta_hhi >= 200 ~ "Red",
      TRUE ~ "Neutral"
    )
  )

# Count number of markets per DOJ category
doj_counts <- hhi_classified %>%
  count(doj_flag, name = "market_count")

doj_counts
```

```
## # A tibble: 4 x 2
##   doj_flag market_count
##   <chr>           <int>
## 1 Green               8
## 2 Neutral          5562
## 3 Red                69
## 4 Yellow            578
```

2.5 DOJ HHI Classifications and Implications

Using the 2010 Merger Guidelines, we classify each route in our dataset based on post-merger concentration and change in HHI (ΔHHI). These thresholds guide the DOJ in determining whether a merger may substantially lessen competition.

The classification framework is as follows:

- **Green**: Post-merger HHI < 1500 (unconcentrated)
- **Yellow**: HHI between 1500–2500 with ΔHHI < 100 (moderate concern)
- **Red**: HHI > 2500 with ΔHHI   200 (high concern — likely flagged)
- **Neutral**: Routes that don't fit any of the above categories

Our analysis reveals the following breakdown:

- **8 Green markets** (unconcentrated, likely to pass without concern)
- **578 Yellow markets** (moderate concentration, may warrant review)
- **69 Red markets** (highly concentrated with significant increase — likely candidates for further DOJ investigation)
- **5,562 Neutral markets** (concentrated but not flagged under standard criteria)

These findings suggest that while the merger would not affect competition on most routes, **a non-trivial number of Red-flagged markets (69 in total)** pose significant antitrust concerns and merit close scrutiny by enforcement agencies.

3 Merger analysis 2: IPPS and CEs

3.1 Estimate marginal costs and markups

3.1.1 Use your logit demand estimates from DC3. Compute the marginal cost of each airline company using

these demand estimates and assuming Nash-Bertrand pricing.

```r
# Step 1: Set your IV-based logit price coefficient from DC3
alpha_iv <- -1.984

# Step 2: Compute elasticity, Lerner index, and marginal cost for each observation
data_mc <- data %>%
  mutate(
    elasticity_iv = alpha_iv * (1 - ms),
    lerner_iv = -1 / elasticity_iv,
    mc_iv = mktfare * (1 - lerner_iv)
  )
# Step 3: Summarize marginal cost by airline (HA and AS only)
mc_summary <- data_mc %>%
  filter(rpcarrier %in% c("HA", "AS")) %>%
  group_by(rpcarrier) %>%
  summarise(
    avg_price = mean(mktfare, na.rm = TRUE),
    avg_elasticity = mean(elasticity_iv, na.rm = TRUE),
    avg_mc = mean(mc_iv, na.rm = TRUE),
    median_mc = median(mc_iv, na.rm = TRUE),
    .groups = "drop"
  )

mc_summary
```

```
## # A tibble: 2 x 5
##   rpcarrier avg_price avg_elasticity avg_mc median_mc
##   <chr>         <dbl>          <dbl>  <dbl>     <dbl>
## 1 AS             365.          -1.23   -Inf      76.8
## 2 HA             726.          -1.22   -Inf     113.
```

```r
# Clean: keep only valid MC estimates
data_mc_clean <- data_mc %>%
  filter(!is.infinite(mc_iv) & !is.na(mc_iv))

# Compute median MC for all carriers
mc_all_summary <- data_mc_clean %>%
  group_by(rpcarrier) %>%
  summarise(
    median_mc = median(mc_iv, na.rm = TRUE),
    n_routes = n(),
    .groups = "drop"
  ) %>%
  arrange(median_mc)

#mc_all_summary
```

3.1.2 Comparing Marginal Costs: Hawaiian and Alaska vs. Industry

To evaluate the strategic rationale behind the proposed merger, we compare marginal costs for Alaska Airlines (AS) and Hawaiian Airlines (HA) to those of other U.S. airlines using our logit-based demand model under Nash-Bertrand pricing.

Across all carriers, Alaska ranks in the **middle tier** with a median marginal cost of approximately **$106**. This places Alaska just below larger network carriers like American (AA), United (UA), and Delta (DL), but above low-cost carriers such as Spirit (NK), Frontier (F9), and Southwest (WN).

In contrast, Hawaiian Airlines exhibits a **median marginal cost of $186**, making it one of the **highest-cost carriers** in the dataset. This likely reflects HA's long-haul route structure, limited scale, and operational complexity tied to its Hawaii-based hub system.

These differences in cost structure suggest a potential **economic motivation** for the merger. If Alaska's more efficient operating model can be extended to Hawaiian's network, the combined firm could achieve meaningful cost savings. However, from an antitrust perspective, such efficiencies must be both **merger-specific** and **verifiable**. Given the large number of highly concentrated "red-flag" routes identified earlier, cost rationales alone may not be sufficient to justify the merger without clear consumer benefits.

```r
# Manually define median marginal costs
mc_as <- 106
mc_ha <- 186

# Assume post-merger MC is average of the two firms
mc_postmerger <- (mc_as + mc_ha) / 2
mc_postmerger
```

```
## [1] 146
```

3.1.3 Post-Merger Marginal Cost Assumption

To simulate the pricing impact of the merger, we must make an assumption about how marginal costs change under joint operations.

We assume that the **post-merger marginal cost is equal to the average of the pre-merger median marginal costs** of Alaska Airlines (AS) and Hawaiian Airlines (HA). This reflects a moderate efficiency gain, consistent with limited integration synergies but without assuming full operational alignment.

- Median marginal cost (AS): $106

- Median marginal cost (HA): $186

- **Assumed post-merger marginal cost**: **$146**

This assumption is conservative and lies between more aggressive scenarios (e.g., adopting Alaska's lower cost entirely) and more skeptical ones (e.g., no change or higher merged costs). It allows us to evaluate whether modest cost savings are sufficient to offset potential price increases due to reduced competition.

3.1.4 Assumption Justification: Post-Merger Marginal Cost

We assume that the post-merger marginal cost for both Hawaiian and Alaska Airlines equals the **simple average of their pre-merger median marginal costs**. This results in an assumed marginal cost of **$146**.

This assumption is reasonable for several reasons: - It reflects the possibility of **partial cost synergies** without assuming full operational integration. - It avoids extreme assumptions such as adopting Alaska's lower cost structure entirely or leaving costs unchanged. - It is **conservative from a merger simulation perspective** — allowing us to test whether moderate efficiencies would be enough to counteract potential price increases.

In practice, actual cost reductions may depend on integration timelines, union contracts, and network optimization — all of which are uncertain. Using an average provides a midpoint scenario for evaluating merger impact under Nash-Bertrand pricing behavior.

```
mc_postmerger <- (106 + 186) / 2
# [1] 146
```

3.1.5 Based on our assumption, we use a post-merger marginal cost of $146 for both Hawaiian and Alaska Airlines in all relevant simulations.

```
# Estimate Lerner index using median price and assumed post-merger MC
lerner_ha <- (725.71 - 146) / 725.71
lerner_as <- (364.72 - 146) / 364.72

lerner_ha  #  0.799
```

```
## [1] 0.7988177
```

```
lerner_as  #  0.600
```

```
## [1] 0.5996929
```

3.1.6 Estimated Lerner Index Based on Demand and MC Assumption

Using the Nash-Bertrand framework, we compute the Lerner index for each firm as:

$$L = \frac{p - c}{p}$$

Based on the median observed price for each firm and our assumed post-merger marginal cost ($146), we find:

- Hawaiian Airlines (HA): **Lerner Index 0.799**
- Alaska Airlines (AS): **Lerner Index 0.600**

These values imply that HA prices exceed marginal cost by nearly 80%, and AS by 60%. This reflects HA's current pricing structure relative to the assumed cost baseline, and highlights its **higher markup** behavior prior to merger. These indexes are inputs for simulating post-merger price changes and calculating compensating efficiencies.

3.2 Diversion ratios, IPPs, CEs

```r
# Filter to overlapping markets with both AS and HA
diversion_data <- data_mc %>%
  filter(rpcarrier %in% c("AS", "HA")) %>%
  group_by(mkt) %>%
  filter(n_distinct(rpcarrier) == 2) %>%
  ungroup()

# Pivot shares and price/mc side-by-side
diversion_pairs <- diversion_data %>%
  select(mkt, rpcarrier, ms, mktfare, mc_iv) %>%
  pivot_wider(
    names_from = rpcarrier,
    values_from = c(ms, mktfare, mc_iv),
    names_sep = "_"
  ) %>%
  mutate(
    diversion = ms_AS / (1 - ms_HA),
    lerner = (mktfare_HA - mc_iv_HA) / mktfare_HA,
    ce_required = (diversion * lerner) / (1 - diversion - lerner)
  )
```

```r
# Summary of CE required
ce_summary <- diversion_pairs %>%
  summarise(
    mean_ce = mean(ce_required, na.rm = TRUE),
    median_ce = median(ce_required, na.rm = TRUE),
    max_ce = max(ce_required, na.rm = TRUE),
    min_ce = min(ce_required, na.rm = TRUE)
  )

ce_summary
```

```
## # A tibble: 1 x 4
##   mean_ce median_ce max_ce min_ce
##     <dbl>     <dbl>  <dbl>  <dbl>
## 1   -1.57    0.0400   48.3  -474.
```

3.2.1 Required Compensating Efficiency (CE)

To evaluate whether potential cost savings from the merger are sufficient to prevent price increases, we compute the required **compensating marginal cost efficiency (CE)**. This metric estimates the minimum percent reduction in marginal costs needed to fully offset upward pricing pressure due to lost competition.

We use the following formula:

$$\text{CE} = \frac{\delta \cdot L}{1 - \delta - L}$$

where δ is the diversion ratio from HA to AS and L is the Lerner index of HA. Our calculations focus on routes where both firms operate.

Key results:

- **Median required CE**: **4.0%**

- **Maximum required CE: 48.3%**
- **Some values are negative or implausibly high**, suggesting that CE estimates can become unstable in markets with small diversion ratios or elasticity artifacts.

Despite this variability, the **median CE of 4.0%** indicates that **only modest cost reductions would be required** to offset competitive harm in overlapping markets. This provides a baseline against which to compare our earlier marginal cost assumption ($146), which implies a ~21.5% cost saving for Hawaiian (from $186 → $146). Since this exceeds the required CE in most cases, the merger could be defensible **if those savings are merger-specific and verifiable**.

```
diversion_pairs <- diversion_data %>%
  select(mkt, rpcarrier, ms) %>%
  pivot_wider(
    names_from = rpcarrier,
    values_from = ms,
    names_prefix = "share_"
  ) %>%
  mutate(
    diversion_ha_to_as = share_AS / (1 - share_HA),
    diversion_as_to_ha = share_HA / (1 - share_AS)
  )
diversion_summary <- diversion_pairs %>%
  summarise(
    mean_div_ha_to_as = mean(diversion_ha_to_as, na.rm = TRUE),
    median_div_ha_to_as = median(diversion_ha_to_as, na.rm = TRUE),
    mean_div_as_to_ha = mean(diversion_as_to_ha, na.rm = TRUE),
    median_div_as_to_ha = median(diversion_as_to_ha, na.rm = TRUE)
  )

diversion_summary
```

```
## # A tibble: 1 x 4
##   mean_div_ha_to_as median_div_ha_to_as mean_div_as_to_ha median_div_as_to_ha
##               <dbl>               <dbl>             <dbl>               <dbl>
## 1             0.172              0.0562             0.222              0.0444
```

3.2.2 Diversion Ratios Between Hawaiian and Alaska Airlines

To quantify substitutability between Hawaiian Airlines (HA) and Alaska Airlines (AS), we estimate **diversion ratios** under the logit demand framework. The diversion ratio captures the share of passengers who would switch from one airline to the other if their preferred carrier were no longer available.

Following the logit assumption, diversion ratios are calculated using the formula:

$$\delta_{A \to B} = \frac{s_B}{1 - s_A}$$

Where: - s_A = market share of the carrier losing the customer - s_B = market share of the alternative carrier

We restrict the analysis to markets where both HA and AS are present and find:

- **Mean diversion from HA to AS**: 17.2%

- **Median diversion from HA to AS**: 5.6%
- **Mean diversion from AS to HA**: 22.2%

- **Median diversion from AS to HA**: 4.4%

These relatively low diversion values suggest that although the firms do overlap, **they are not particularly close substitutes on most routes**. The small median diversion rates imply that **most customers would choose an alternative to both firms**, reinforcing the importance of the outside option and other competitors in those markets.

```r
# Add IPR calculations
diversion_pairs <- diversion_pairs %>%
  mutate(
    lerner_ha = (725.71 - 146) / 725.71,  # previously calculated
    lerner_as = (364.72 - 146) / 364.72,  # previously calculated

    ipr_ha = (diversion_ha_to_as * lerner_ha) / (1 - diversion_ha_to_as - lerner_ha),
    ipr_as = (diversion_as_to_ha * lerner_as) / (1 - diversion_as_to_ha - lerner_as),

    ipr_ha_pct = ipr_ha * 100,
    ipr_as_pct = ipr_as * 100
  )
ipr_summary <- diversion_pairs %>%
  summarise(
    mean_ipr_ha = mean(ipr_ha_pct, na.rm = TRUE),
    median_ipr_ha = median(ipr_ha_pct, na.rm = TRUE),
    mean_ipr_as = mean(ipr_as_pct, na.rm = TRUE),
    median_ipr_as = median(ipr_as_pct, na.rm = TRUE),
    max_ipr = max(c(ipr_ha_pct, ipr_as_pct), na.rm = TRUE),
    min_ipr = min(c(ipr_ha_pct, ipr_as_pct), na.rm = TRUE)
  )

ipr_summary
```

```
## # A tibble: 1 x 6
##   mean_ipr_ha median_ipr_ha mean_ipr_as median_ipr_as max_ipr min_ipr
##         <dbl>         <dbl>       <dbl>         <dbl>   <dbl>   <dbl>
## 1        14.6          14.5        40.1          1.39  25479. -10650.
```

3.2.3 Indicative Price Rise (IPR)

We simulate the potential price increases that could result from the Hawaiian-Alaska merger using the IPR formula developed by Shapiro (1995):

$$\text{IPR} = \frac{\delta \cdot L}{1 - \delta - L}$$

This estimates the percentage price increase in a given market based on the diversion ratio between the merging firms and the pricing power of the firm losing the sale (measured by its Lerner index).

Our findings show:

- For **Hawaiian Airlines** (HA), which has higher markups and faces diversion to AS:
  - **Mean IPR**: 14.6%
  - **Median IPR**: 14.5%
- For **Alaska Airlines** (AS), which generally has lower prices and smaller diversion to HA:
  - **Mean IPR**: 40.1% (skewed by outliers)
  - **Median IPR**: 1.4%
- **Maximum IPR observed**: 25,479%

- **Minimum IPR observed**: –10,650%

These extreme values result from highly unstable combinations of diversion and Lerner values in a small number of markets. In practical terms, the **median IPR values** provide a more meaningful signal. The 14.5% price increase projected for HA is particularly concerning from an antitrust perspective, as it exceeds the DOJ's typical concern threshold of **5%** by a wide margin.

This suggests that the merger could lead to substantial price increases in overlapping markets unless cost efficiencies are large, verifiable, and passed through to consumers.

3.2.4 Price Rise Summary Across Markets in 2024

Based on our merger simulation using diversion ratios and Lerner indices, we estimate the following distribution of price effects across overlapping markets:

- **Average price rise**: 27.4%
- **Median price rise**: 7.9%
- **Maximum price rise**: 25,479%
- **Minimum price rise**: –10,650.8%

While the maximum and minimum values are distorted by numerical instability in a few markets, the **median price rise of nearly 8%** and the **average rise of 27%** indicate substantial upward pricing pressure in 2024. These results strongly suggest that, without significant cost efficiencies, the merger is likely to lead to consumer harm in key overlapping routes.

3.2.5 Average Required Compensating Efficiency (CE)

Using diversion ratios and Lerner indices, we calculate the compensating efficiency (CE) required to offset any post-merger price increases. The CE represents the percentage reduction in marginal cost necessary to ensure that prices do not rise following the merger.

Our findings show that:

- The **median required CE** is **4.00%**
- The **average CE** is **–1.57%**, but this figure is skewed by implausible outliers
- The **maximum CE required** across any route is **48.3%**

These results indicate that **only modest efficiencies are needed**, on average, to justify the merger on consumer welfare grounds. Given our earlier assumption of a post-merger marginal cost reduction of ~21.5% for Hawaiian, this exceeds the required threshold in nearly all cases.

However, it's important to note that not all CE values are economically meaningful; a few markets show extreme or negative requirements, reflecting volatility in the IPR formula under certain share and markup combinations. We rely primarily on the **median CE** as a robust benchmark.

3.2.6 Pricing Impact and Merger Recommendation

To assess whether the merger is likely to raise or lower prices, we compare our assumed cost efficiencies to the compensating efficiency (CE) required to neutralize price increases.

We assumed a **post-merger marginal cost of $146**, which reflects a **21.5% cost reduction** from Hawaiian Airlines' median pre-merger marginal cost of $186. This assumption captures potential synergies from route consolidation, operational streamlining, or technology integration under Alaska Airlines' more efficient structure.

Our estimated **median required CE** is only **4.0%**, meaning that relatively minor efficiency gains would be sufficient to prevent consumer harm in overlapping markets. Since our cost assumption implies a much larger savings, the model suggests that the merger could, in principle, result in **stable or even lower prices**.

However, this optimistic outcome relies on the assumption that cost savings are: 1. **Merger-specific** (i.e., not achievable without the merger), 2. **Realistically implementable**, and 3. **Passed through to consumers**, rather than captured as higher margins.

Moreover, our **median Indicative Price Rise (IPR)** for Hawaiian routes is **14.5%**, which exceeds the DOJ's 5% concern threshold. This indicates that, **absent efficiency pass-through**, the merger is likely to **raise prices in critical overlapping markets**.

3.2.6.1 Recommendation: Based on the model, the merger **has the potential to reduce prices**, but **only if the assumed cost efficiencies are realized and shared with consumers**. If those efficiencies are uncertain or overstated, then the projected price increases — particularly in Hawaiian's high-markup routes — pose a substantial risk to consumer welfare.

Conclusion:
As the plaintiff team, we recommend that the merger **not be approved unless verifiable, merger-specific efficiencies are clearly documented and enforceable**. The burden of proof should remain on the merging firms to demonstrate that the benefits outweigh the risks of reduced competition.

4 References