

Optimizing Advertising Budget Allocation

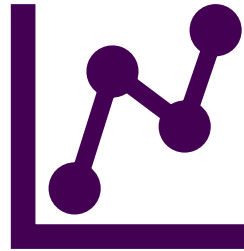
KENDRA MOSHOLDER 8/18/2025

Project Objective

- The goal of this project is to determine the most effective way to allocate a fixed advertising budget across TV, Radio, and Newspaper channels to maximize sales. Marketing budgets are limited, and allocating funds to the wrong channel reduces ROI. By analyzing past advertising and sales data, I identified which channels drive results and how to distribute spending for maximum impact.

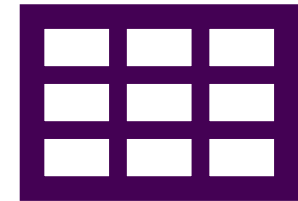
Data Set

Context: Represents a small to mid-sized business with an annual revenue of ~\$1M–1.5M. This makes the simulated \$100k budget realistic in terms of scale.



Source: Advertising dataset (commonly used in marketing analytics case studies).

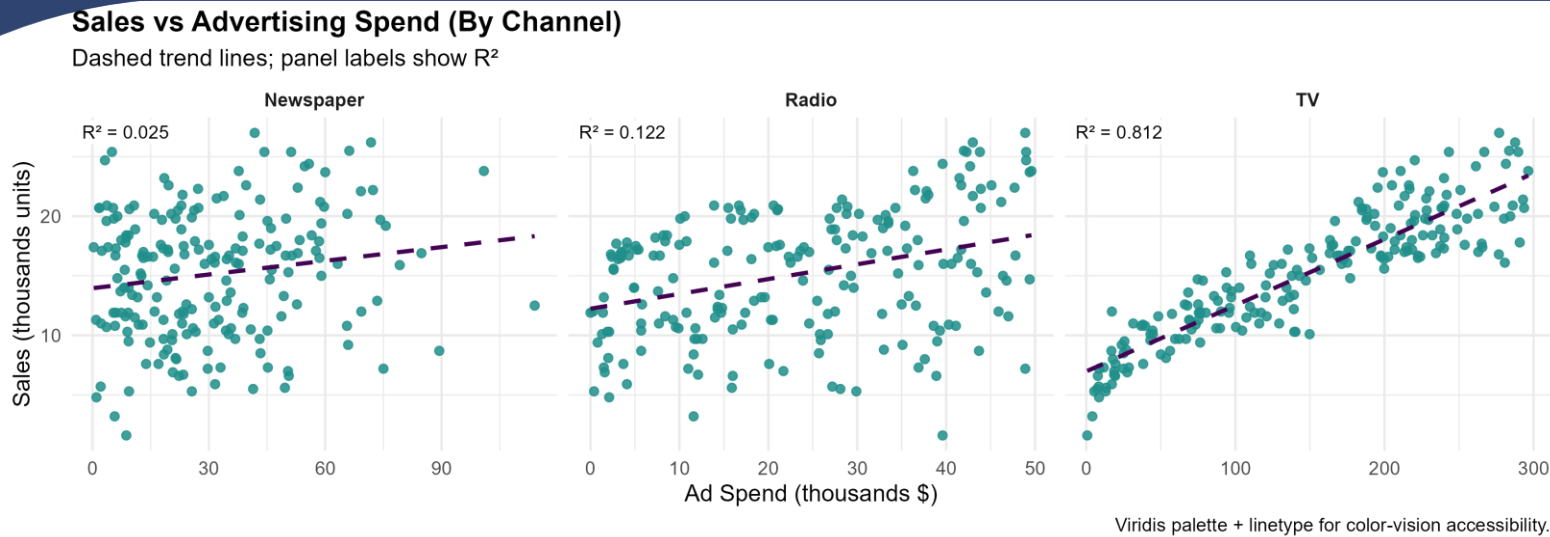
Size: 200 rows, 4 columns.



Variables:

- TV advertising spend (in thousands \$)
- Radio advertising spend (in thousands \$)
- Newspaper advertising spend (in thousands \$)
- Sales (in thousands of units sold)

Initial Data Insights & First Prediction Model



Initial scatterplots showed that:

- TV spending had the strongest positive relationship with sales.
- Radio spending had a moderate relationship with sales.
- Newspaper spending showed little to no relationship.

To confirm these findings, I ran a linear regression using all three channels.

Results:

TV → statistically significant predictor of sales.

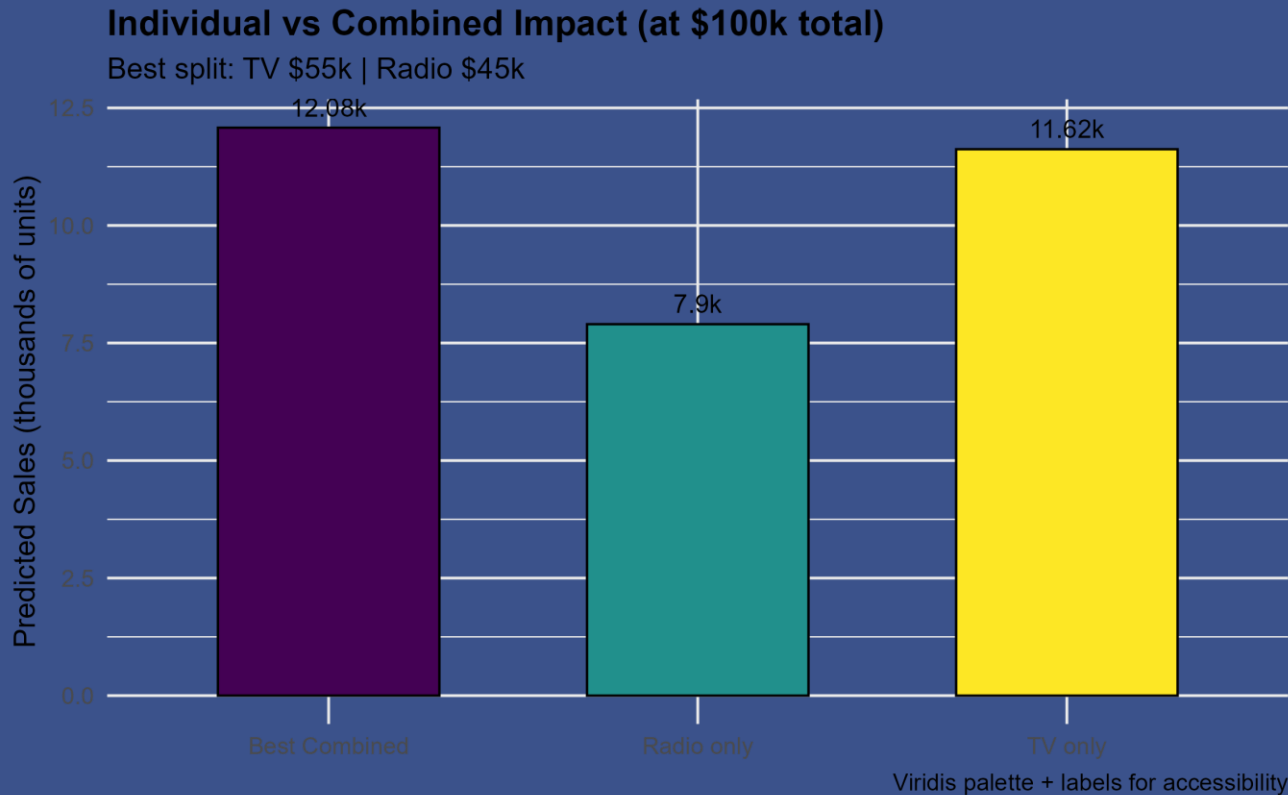
Radio → statistically significant predictor of sales.

Newspaper → not significant.

The model explained ~90% of the variation in sales (Adjusted $R^2 = 0.90$).

This gave me a clear direction: focus on TV and Radio, exclude the Newspaper from allocation decisions.

Individual vs Combined Impact



I compared scenarios for \$100k spend:

- **TV only:** 100k on TV predicted ~11.6k units sold.
- **Radio only:** Capped at 50k (the max observed in the dataset), predicted ~7.9k units sold.
- **Best combined:** 55k TV + 45k Radio predicted ~12.1k units sold.

This confirmed that TV and Radio reinforce each other. The interaction term in the regression was statistically significant, meaning multichannel campaigns perform better than single-channel.

Maximizing Sales with \$100k

To simulate budget allocation, I tested every possible TV/Radio split (in \$5k increments) within the dataset's observed range. The heatmap shows predicted sales at each split.

The best mix is ~55% TV, 45% Radio.

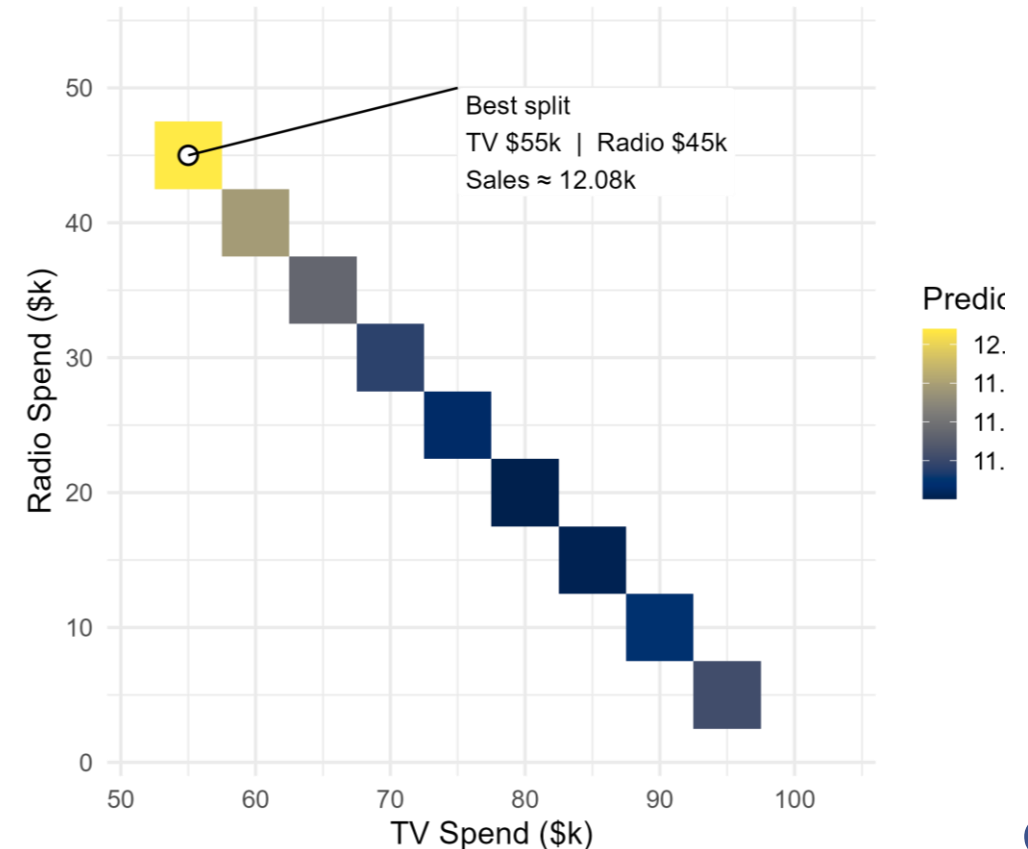
This allocation maximizes predicted sales at ~12.1k units.

Newspaper is excluded since it had no measurable impact.

This result demonstrates how optimization can directly guide marketing decisions to achieve better ROI.

Maximizing Sales with \$100k

Best mix near TV \$55k / Radio \$45k (Newspaper excluded)



Data Limits & Next Steps

Data set didn't include higher spending levels → can't test for diminishing returns

Newspaper spend was not predictive here, but still valuable to track

No data on online/digital marketing channels

The dataset only includes Radio spending up to ~50k. Predictions beyond this range are less reliable.

Recommendations

Allocate

- Based on the analysis, I recommend allocating the \$100k budget across TV and Radio, with an optimal split near 55% TV and 45% Radio.

Digital

- Incorporate digital marketing data in future studies to ensure recommendations reflect modern advertising strategies.

Re-evaluate

- If the business increases budgets beyond \$100k, additional data should be collected to test for saturation points.

Key Insights

This project demonstrates my ability to:

- **Translate a business problem into a data-driven question.**
- **Use regression modeling and simulation to evaluate options.**
- **Communicate results through clear visuals and actionable recommendations.**

By combining curiosity with strategic thinking, I ensured that data analysis not only answers technical questions but also supports business decisions that maximize value.