Optimize your marketing spend with Julia!

Introduction

Motivation

"Half the money I spend on advertising is wasted; the trouble is I don't know which half."
- John Wanamaker, 19th century

Today?

- Global Ad Spend >$700bn (2021, estimate)
- Privacy-conscious consumers

Solution? Media mix modelling (MMM)!

- Quantify the benefits of your marketing activities
- Re-allocate marketing spend to maximize revenues

Challenges:

- Insufficient data
- Underspecified problem

Implementation:

- Bayesian Latent Variable Regression + Bayesian Decision Theory
- Pure Julia (DataFrames.jl + TableTransforms.jl + Turing.jl + Metaheuristics.jl and more)

Detailed methodology, practical tips and other resources can be found in the associated repository

Practical Example

Setting

- A local business using 3 marketing channels (total spend $10,000):
    - TV ads ($5,000)
    - Google Search Ads ($2,500)
    - Facebook Ads ($2,500)

Key Questions:

- What is marketing's **contribution towards revenues**?
- How to **re-allocate marketing $$$s** across TV, Search, Facebook to maximize revenues?

Marketing 101

ROAS (Return on Ad Spend) = Contributed revenue / Ad spend

Example: ROAS of 2.0x means that we captured twice as much revenue as we spent on ads, ie, 100% return

mROAS (marginal ROAS) = the additional revenue for the next $1 spent on ads given our existing spending

Example: mROAS of 2.0x @ $1,000 means that spending $1,001 would earn +$2 extra

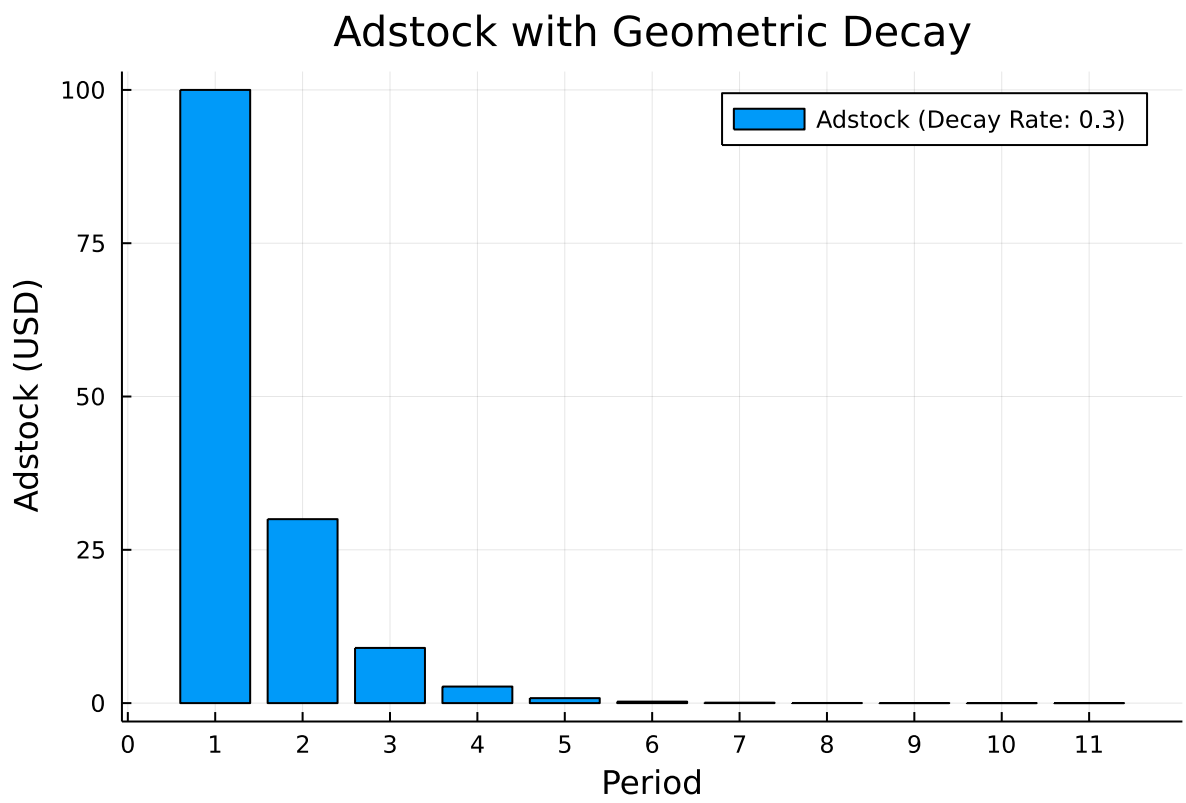
Adstock ("lagged effects")

To capture the lagged effects of marketing spend (ie, seeing conversion revenues in the subsequent periods)

Formula (Geometric Decay): $A_t = X_t + A_{t-1} * \theta$ where X_t is the ad spend in period t and θ is the Decay Rate

Example: Ad Spend of $100 with $\theta = 0.3$ will lead to an effect equivalent to $30 in the next period

Decay Rate (θ): 0.3



Saturation ("diminishing returns")

To capture when the effect of Ad spend depends on its magnitude

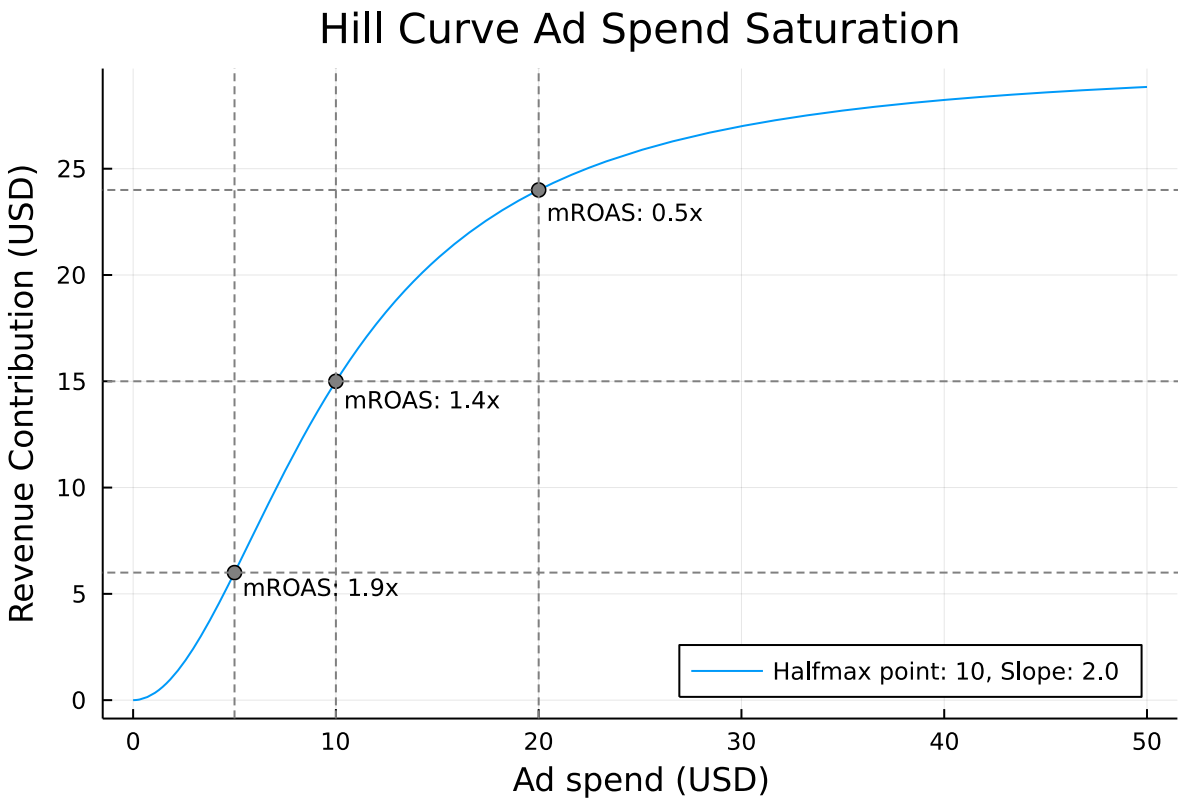
Formula (Hill Curve): $\beta_{max} * \frac{A^n}{A^n+K_{0.5}^n}$ where β_{max} is the maximum effect, A = Ad spend, n = Hill coeficient ("slope"), and $K_{0.5}$ = Halfmax concentration point is the spend where effect is equal to 0.5

Example: When $10 -> $11 creates +$1.4 of Conversion Revenue (mROAS = 1.4x) versus $20 -> $21 creates +$0.5 of Conversion Revenue (mROAS = 0.5x). This is often referred to as diminishing returns

Maximum effect (β_{max}): 30

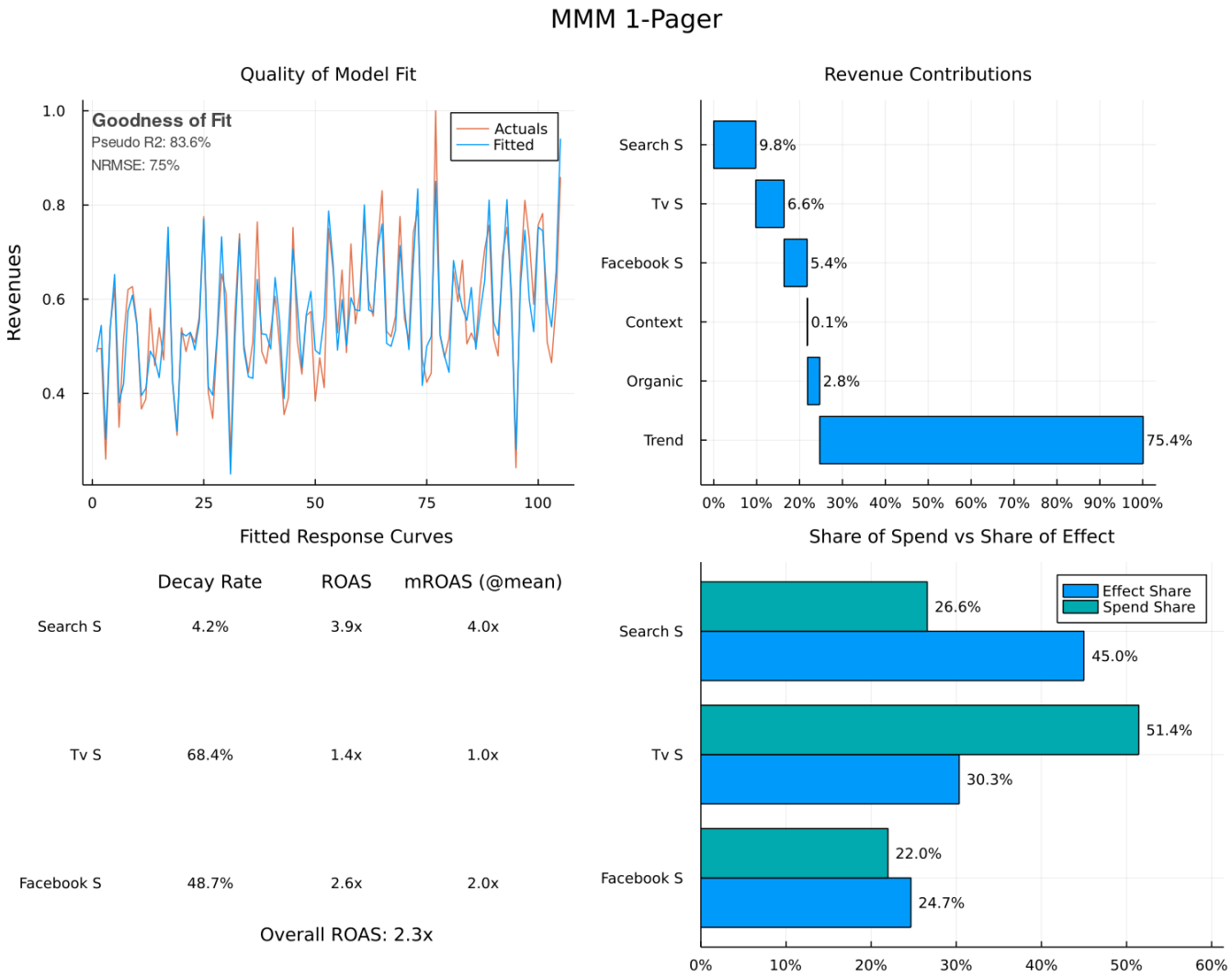
Halfmax conc. point ($K_{0.5}$): 10

Slope (n): 2.0



Results

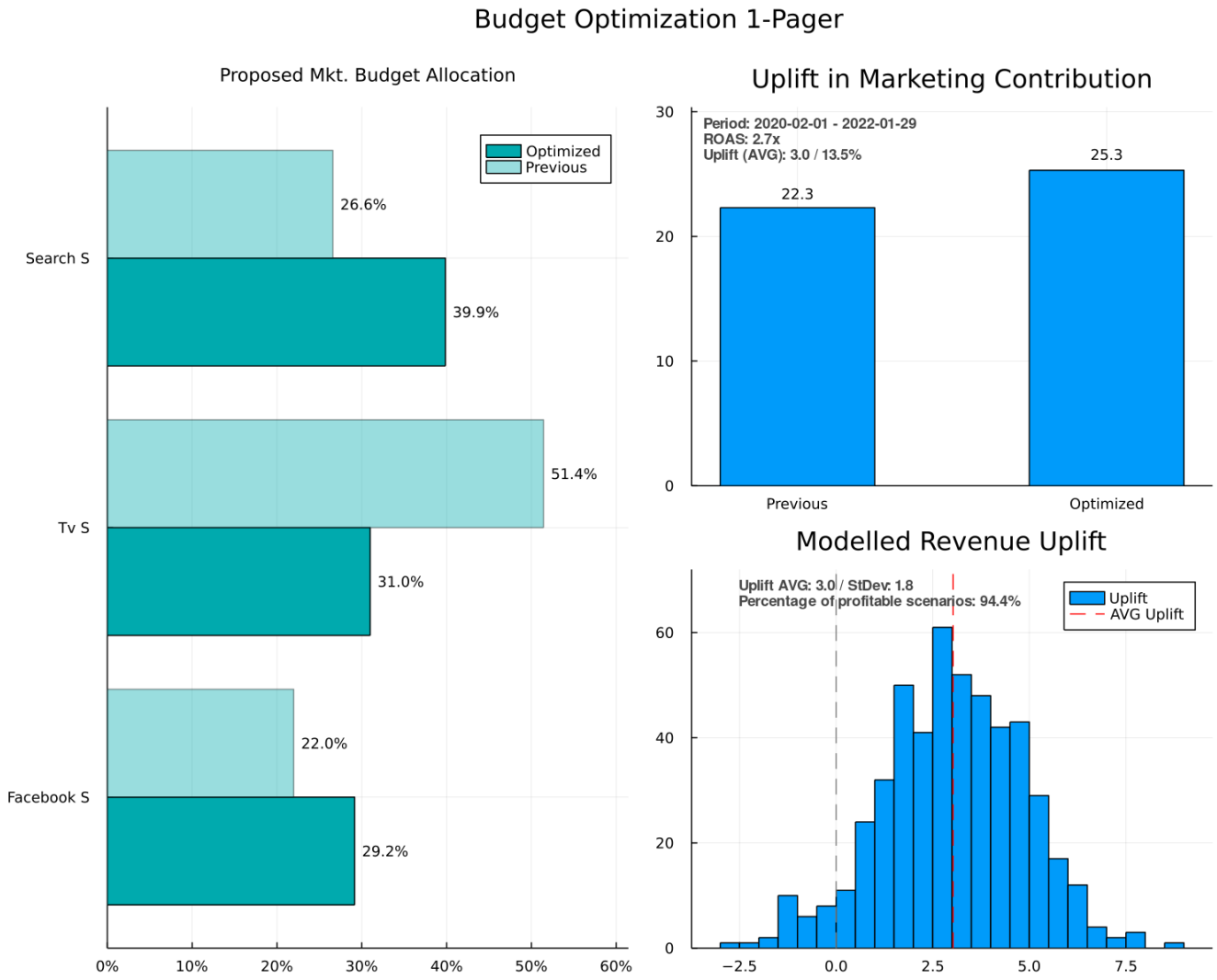
Fitted Model 1-Pager Reveal: 5



	Decay Rate	ROAS	mROAS (@mean)
Search S	4.2%	3.9x	4.0x
Tv S	68.4%	1.4x	1.0x
Facebook S	48.7%	2.6x	2.0x

Optimization

Optimization 1-Pager Reveal: 4



Thank you!

Any questions?

This practical example, tips and tricks and additional resources can be found at the associated repository!