# Week 1: Modeling Business Decisions in Low-Uncertainty Settings

- The First Example: Advertising Campaign at Hudson Readers Inc.
- How to Build an Optimization Model: Decisions Variables, Objective Function, Constraints

**Session 1**

- Optimizing with Solver
- Alternative Data Inputs
- Bringing in Risk Considerations: Managing Investments at Epsilon Delta Capital

# Week 1: Modeling Business Decisions in Low-Uncertainty Settings

- The First Example: Advertising Campaign at Hudson Readers Inc.
- How to Build an Optimization Model: Decisions Variables, Objective Function, Constraints
- Optimizing with Solver **Session 2**
- Alternative Data Inputs
- Bringing in Risk Considerations: Managing Investments at Epsilon Delta Capital

# Searching for the Best Spending Plan: A Model

- Combining the **decision variables**, **objective function** and **constraints** together, we can express our model as

Maximize $0.05*A_{SI} + 0.04*A_{SC} + 0.02*A_{EI} + 0.03*A_{EC}$

subject to

$A_{SI} + A_{SC} + A_{EI} + A_{EC} \leq 195$ (advertising budget)

$0.05*A_{SI} + 0.02*A_{EI} \geq 3$ (net sales increase in India)

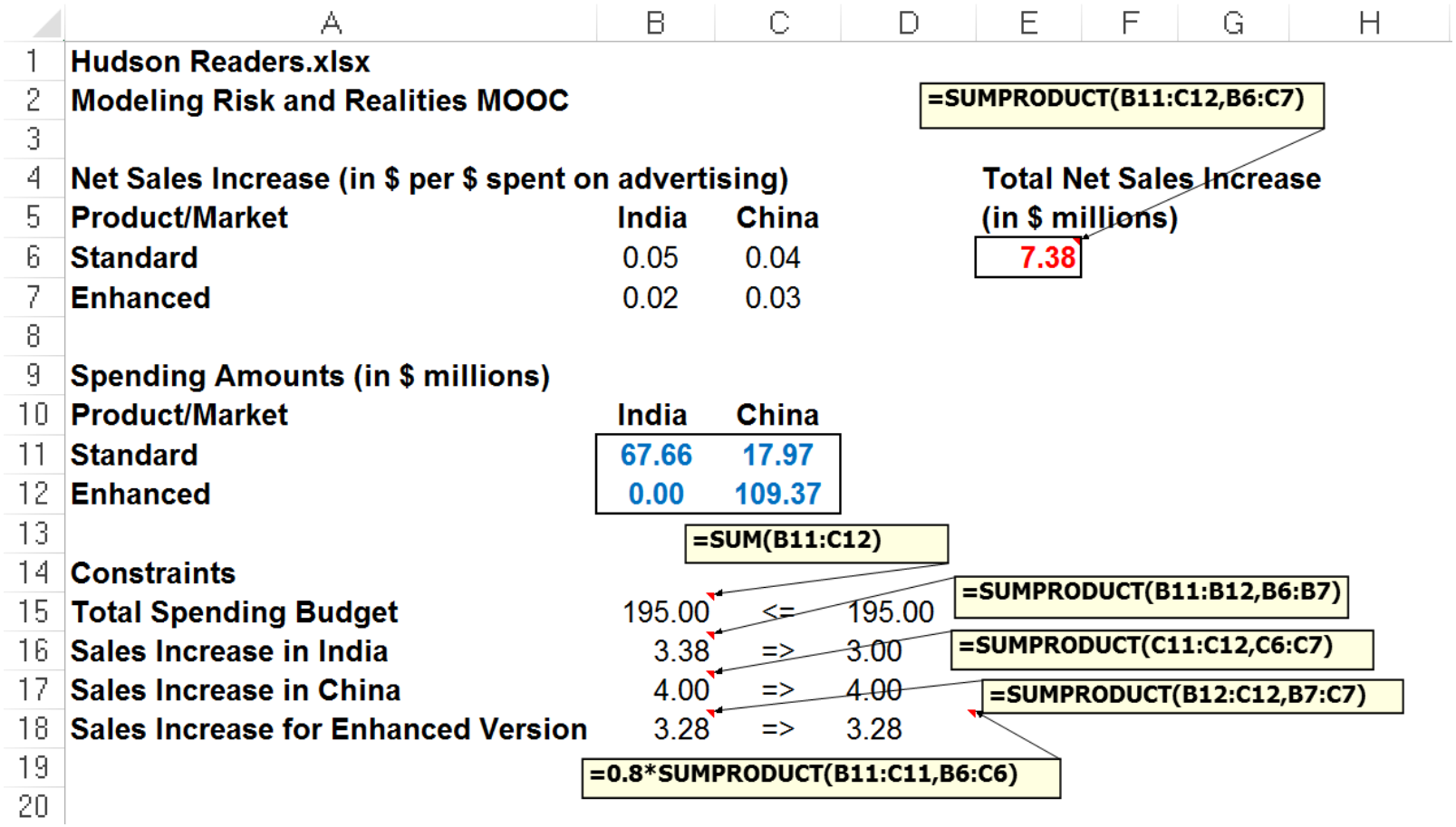
$0.04*A_{SC} + 0.03*A_{EC} \geq 4$ (net sales increase in China)

$0.02*A_{EI} + 0.03*A_{EC} \geq 0.8*(0.05*A_{SI} + 0.04*A_{SC})$

(Standard vs. Enhanced net sales increase)

$A_{SI}, A_{SC}, A_{EI}, A_{EC} \geq 0$ (non-negative advertising spending)

# Optimal Spending Plan




- See Hudson Readers.xlsx

# Optimal Spending Plan: A Closer Look

- See Hudson Readers.xlsx
- The entire advertising budget of $195 million is used up
- The maximum possible total net sales increase HRI can realize using this budget is $7.38 million
- The advertising budget is allocated as follows (values are rounded to 0.1%):

| **Spending %** | **India** | **China** |
|---|---|---|
| **Standard** | 34.7 | 9.2 |
| **Enhanced** | 0.0 | 56.1 |

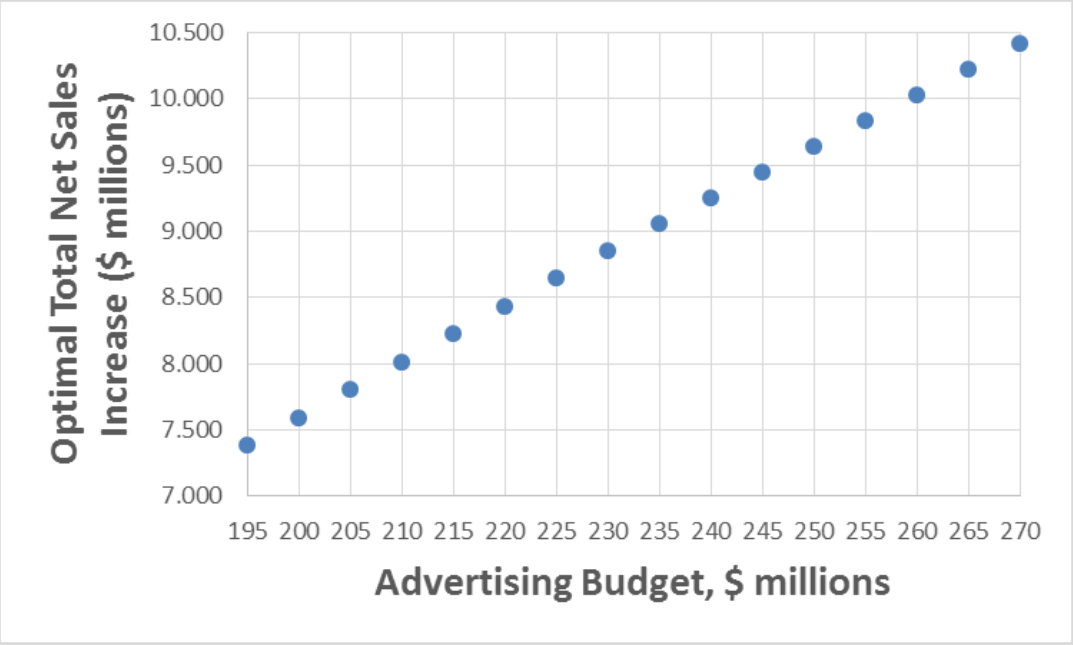
# What About Different Values of Advertising Budget?

- See Hudson Readers.xlsx, Sheet “Analysis”
- For advertising budget of $200 million, the maximum possible total net sales increase HRI can realize using this budget is $7.59 million
- The advertising budget of $200 million is allocated as follows (values are rounded to 0.1%):

| **Spending %** | **India** | **China** |
|---|---|---|
| **Standard** | 35.9 | 7.8 |
| **Enhanced** | 0.0 | 56.2 |

# How Far Do Your Advertising $ Go: Total Net Sales Increase as a Function of Advertising Budget

- See Hudson Readers.xlsx, Sheet “Analysis”




- You can obtain this data by manually changing the value of the advertising budget and re-optimizing the problem, or you can automate the process using Excel Add-in SolverTable (check here http://kelley.iu.edu/albright/free_downloads.htm)

# How Far Do Your Advertising $ Go: Total Net Sales Increase as a Function of Advertising Budget

0.0422 = (7.594 – 7.383)/(200-195)

- See Hudson Readers.xlsx, Sheet "Analysis"

| Budget ($ millions) | Optimal Total Net Sales Increase ($ millions) | Extra Optimal Net Sales Increase/Extra Budget |
|---|---|---|
| 195.000 | 7.383 | |
| 200.000 | 7.594 | 0.0422 |
| 205.000 | 7.805 | 0.0422 |
| 210.000 | 8.016 | 0.0422 |
| 215.000 | 8.227 | 0.0422 |
| 220.000 | 8.438 | 0.0422 |
| 225.000 | 8.648 | 0.0422 |
| 230.000 | 8.859 | 0.0422 |
| 235.000 | 9.064 | 0.0410 |
| 240.000 | 9.257 | 0.0386 |
| 245.000 | 9.450 | 0.0386 |
| 250.000 | 9.643 | 0.0386 |
| 255.000 | 9.836 | 0.0386 |
| 260.000 | 10.029 | 0.0386 |
| 265.000 | 10.221 | 0.0386 |
| 270.000 | 10.414 | 0.0386 |

0.0386 = (10.414 – 10.221)/(270-265)

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- See Hudson Readers.xlsx, Sheet “Analysis”

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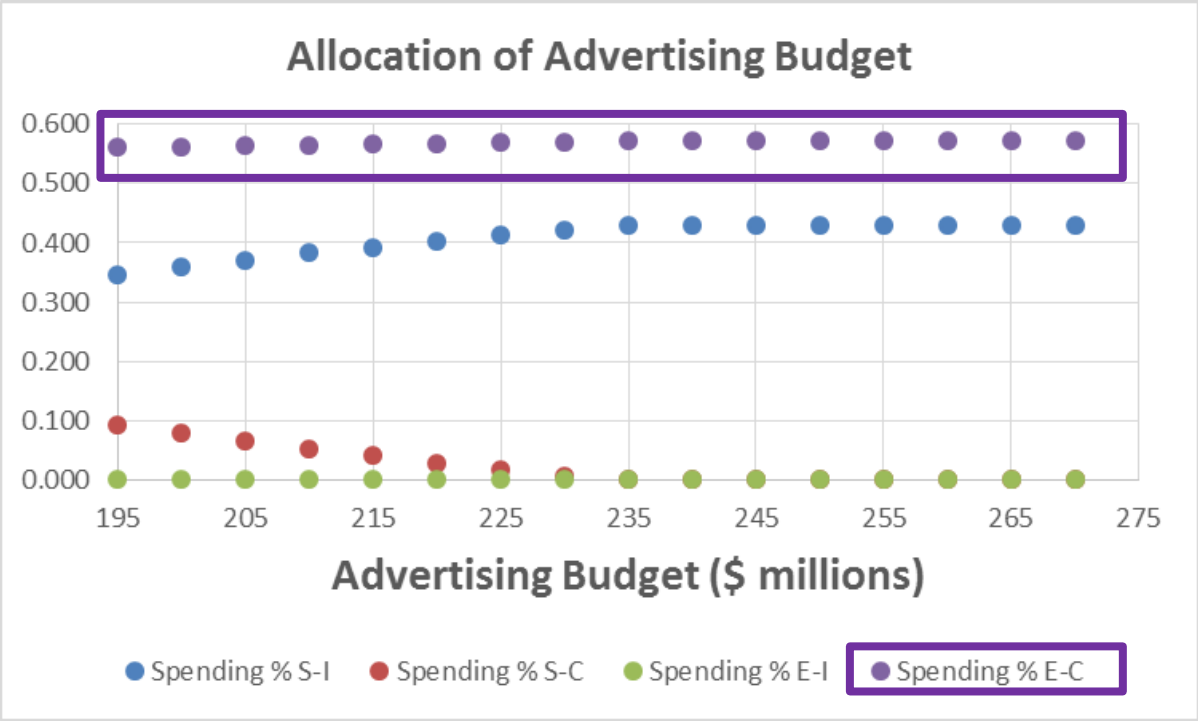
- The impact of increased budget drops from 4.22c to 3.86c on a $

# How is the Advertising Budget Allocated?

- See Hudson Readers.xlsx, Sheet “Analysis”




- Advertising of the Enhanced version in China remains stable around 56%-57% across the range of budget values between $195 and $270 million

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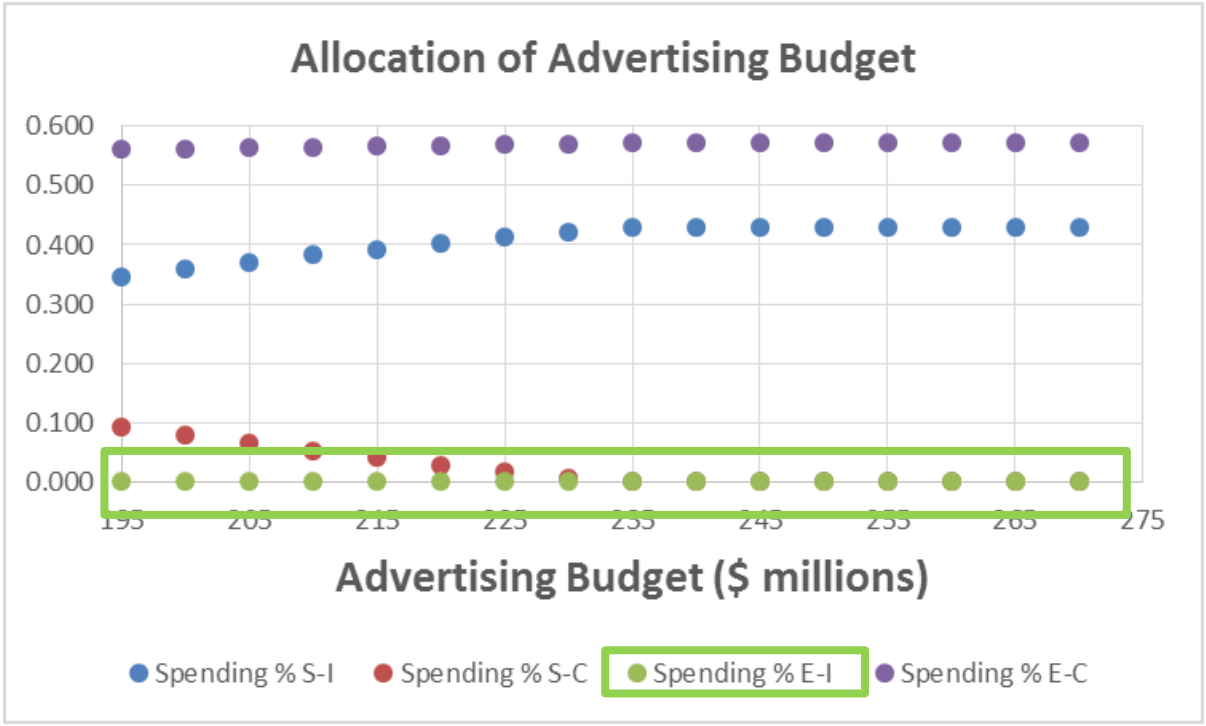


- Advertising of the Enhanced version in India remains unattractive across the same range of budget values

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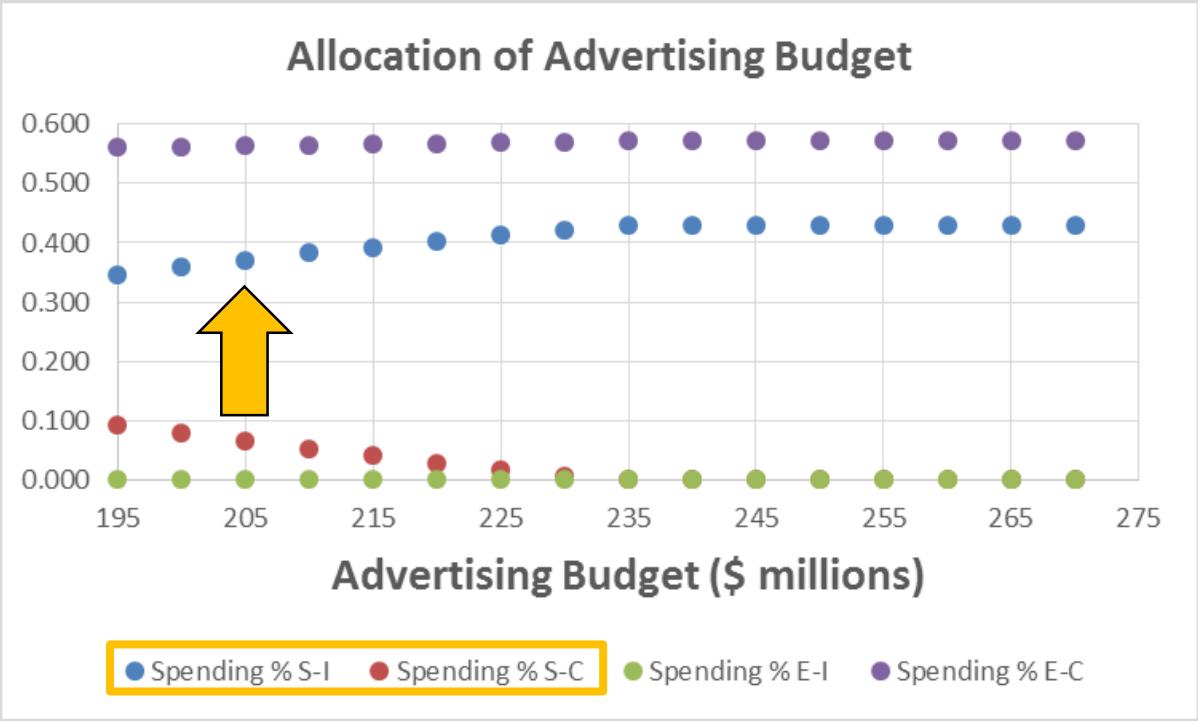
- See Hudson Readers.xlsx, Sheet “Analysis”




- The share of advertising of the Standard version shifts from China to India for the same range of budget values