STAT 654

Marketing Effectiveness Analysis

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Agenda

1. Objectives
2. Background & Business Questions
3. Nonlinear Model Analysis
4. Insights & Recommendations

Objectives

Objectives

- Analysis on marketing performance on one of oral anticoagulant drugs, and insights on the specific values of key marketing tactics.
- Estimations on marketing contributions and ROIs of key marketing tactics.
- Discussions on optimization of the budget under different scenarios.
- Addressing a number of specific business questions.

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Background

Business Questions

Background

- A large Pharmaceutical company is interested in marketing performance on one of its oral anticoagulant drugs.
- The business is highly competitive market and it is expected that the marketing drives a significant portion of the total sales.
- The stakeholders think that marketing drives from 25% to 50% of the total business.
- A large portion of the marketing budget is targeted towards Direct-To-Consumer (DTC) advertising.
- DTC_TV and DTC_Display are two of the large spend categories.
- The largest marketing activity that targets the prescribers is the detailing.

Background

- While for detailing and DTC display, it is believed that the shape of the response curve is diminishing returns to scale, many believe that DTC TV may have an S-shaped response curve.
- Additionally, many think that sustained competitive DTC TV advertisement has hurt the business significantly and poses a continuous risk for growth.

Financial Information

- The drugs has a comparatively high gross profit margin of 70%
- The price of one prescription is about $300
- The marketing cost data:

Tactic	Unit	Cost per Unit
TV	GRP	$2,500.00
PDEs	Count(Thounsands)	$5,500.00
Display	Impresstion(millions)	$72,000.00

Business questions

- What are the historical contributions of DTC TV, DTC Display and Detailing? I.e., how much incremental business and profit have they generated?
- What are the sales and profit ROIs of DTC TV, DTC Display and Detailing?
- Generate the sales and GP (Gross Profit) response curves of DTC TV, DTC Display and Detailing.

- How much should the company spend to maximize the net profit next month?

- The company is contemplating to allocate $360,000 to marketing next month. They plan to allocate equally among DTC TV, Detailing and DTC Display. How should this fund be allocated among the three tactics to maximize the net profit? How much additional GP and net profit can be realized by this optimal reallocation? Assume no additional constraints on the spend level for the three tactics.
- Same as a) but the company wants to impose ±25% constraints on the spend levels of each of the three tactics.
- Same as a) but the budget size is $600,000.

- How much has the competitive DTC TV hurt the business?
- What is the influence of UR on Sales?

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Nonlinear Model Analysis

Nonlinear Model

- Nonlinear Model

$$y = f(x, \beta) + \varepsilon$$

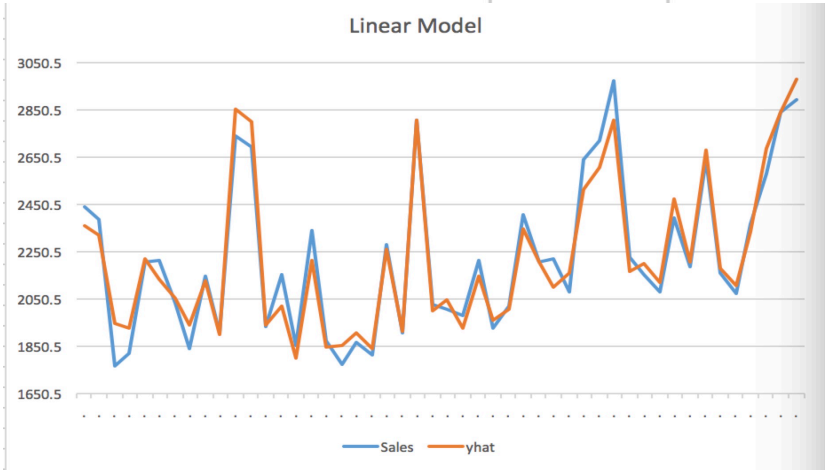
- Data: Monthly data spanning over four years: 2011-2014 are to be used for the analysis.
- Variables:

Variable	Description	Unit
Month	Month	Integer representing the first day of the month
Sales	Total number of scripts (prescriptions)	Thousands
Formulary_Status	Number of lives covered by insurance	Millions
Comp_DTC_TV	Total Gross Rating Points (GRPs) of TV advertisement of key competitors	Number of GRPs
Nov_Ind	Indicator for the month of November	0/1 Variable
Dec_ind	Indicator for the month of December	0/1 Variable
TV	Gross Rating Points (GRPs) of own DTC TV advertisement	Number of GRPs
PDEs	Sales force visits to prescribers; Primary Detail Equivalents (PDEs); each primary detail = 1; each secondary detail = 0.5; each tertiary detail = 0.1)	Thousands
DTC_Display	On-line Display Impressions	Millions of impressions
UR	Unemployment Rate	Percent Unemployment

Nonlinear Model

- Linear Model:

Parameter Estimates						
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variance Inflation
Intercept	1	1508.73096	92.74811	16.27	<.0001	0
Formulary	1	41.82768	7.01112	5.97	<.0001	1.12497
DTC_TV	1	-0.41607	0.11381	-3.66	0.0008	3.65422
TV	1	4.30378	0.35351	12.17	<.0001	3.32006
PDEs	1	12.00214	2.09733	5.72	<.0001	1.15513
Display	1	68.30121	34.10914	2	0.0522	1.16841
UR	1	-5.85931	12.88949	-0.45	0.6519	1.12199
Nov_Ind	1	359.09986	49.06269	7.32	<.0001	1.28467
Dec_Ind	1	364.47564	48.9605	7.44	<.0001	1.27932



- R_sqr=0.9446
- MAPE=2.68%

Nonlinear Model

- Nonlinear Model:
- Assume Comp_DTC_TV: logarithmic transformations;

  TV, PDEs, DTC_Display: Power
- Since detailing and DTC_Display was believed that the shape of response curve is diminishing returns to scale; DTC_TV may have an S-shaped response curve. That is to say, power must be less than 1.

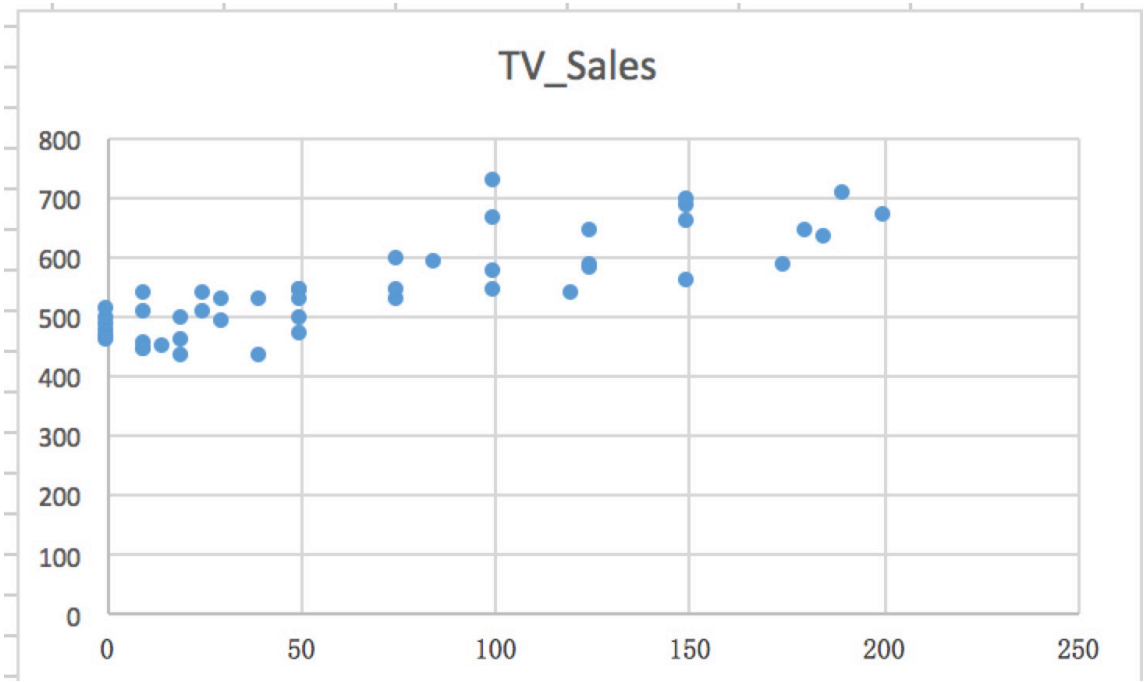
Assume power 0.1 0.3 0.5 0.7 0.9					
			TV	PDEs	Display
Power 0.1	0.1				
25%			177.465465	111.1286383	134.8154
50%			354.9309299	222.2572765	269.6307
Power 0.3	0.3				
25%			76.14814195	63.04352104	129.7544
50%			152.2962839	126.0870421	259.5087
Power 0.5					
25%	0.5		65.348371	71.52945645	249.7667
50%			65.348371	71.52945645	249.7667
Power 0.7	0.7				
25%			14.02007154	20.28940903	120.1952
50%			28.04014309	40.57881806	240.3904
Power 0.9	0.9				
25%			6.015831858	11.51022639	115.683
50%			12.03166372	23.02045278	231.366
		Min	6	11.5	115.7
		Max	354.9	222.3	269.6

Nonlinear Model

- Nonlinear Model:
- Assume Comp_DTC_TV: logarithmic transformations;

  TV: Gompertz

  PDEs, DTC_Display: logarithmic transformations



- Approximately S-shaped
- Assume
  - Belta 1=700
  - When x=0, Belta 2=0.43
  - When x=100, Belta 3=0.01

Nonlinear Model

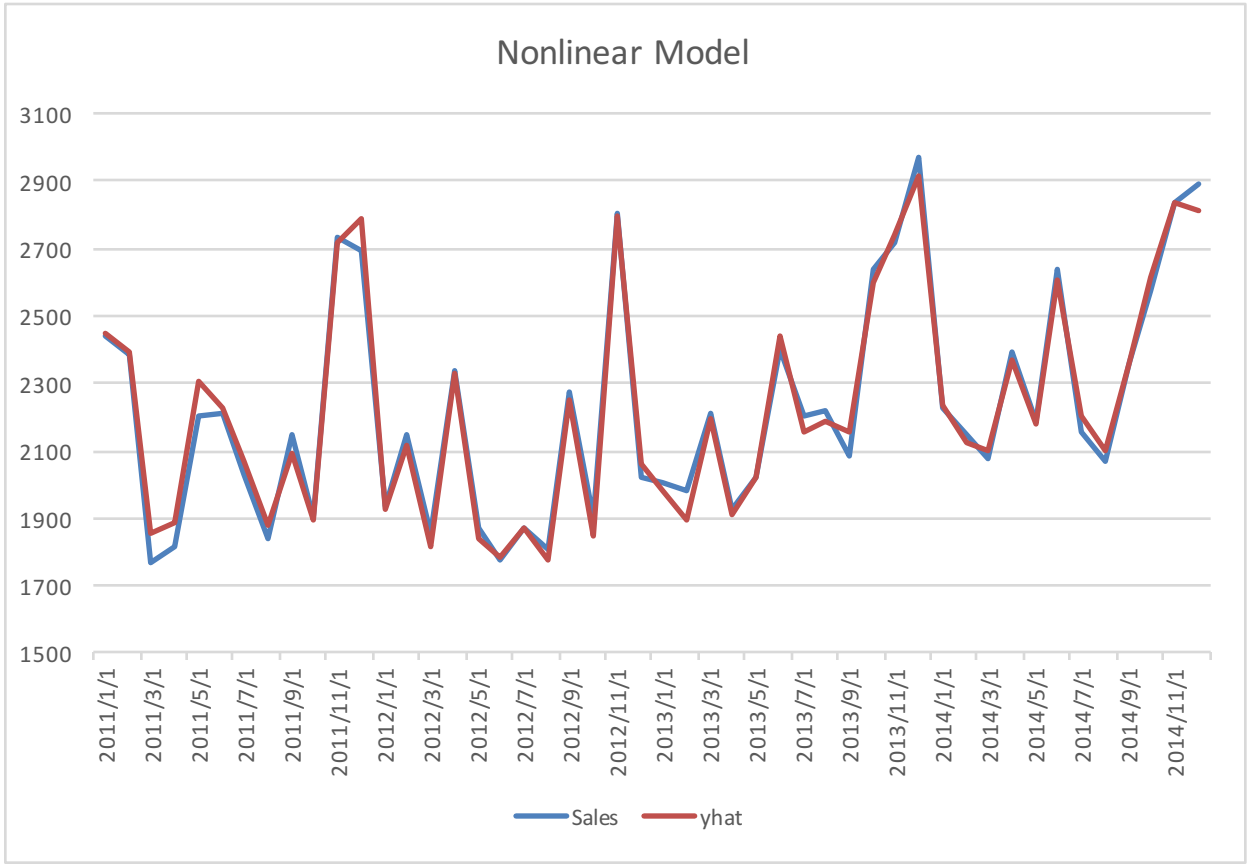
- Nonlinear Model:

Parameter	Estimate	Approx Std Error	Approximate 90% Confidence Limits	
B_Int	1549.4	158.6	1281.8	1816.9
B_Formulary	46.6983	4.0501	39.8653	53.5312
B_UR	-11.8355	7.489	-24.4701	0.799
B_Nov_Ind	369.8	28.3399	322	417.6
B_Dec_Ind	368.1	27.7505	321.2	414.9
B_DTC_TV	-76.1788	22.6251	-114.3	-38.0082
B1_TV	577.7	39.546	511	644.4
B2_TV	7.05	2.2062	3.3279	10.7721
B3_TV	0.0423	0.00662	0.0311	0.0535
B_PDEs	195.1	19.1765	162.8	227.5
B_Display	116.5	22.4503	78.6698	154.4

$$y = 1549.4 + 46.6983 * (Formulary) - 11.8355 * (UR) + 369.8 * (Nov_{Ind}) + 368.1 * (Dec_{Ind}) - 76.1788 * log(DTC_{TV}) + 195.1 * \log(PDEs) + 116.5 * \log(Display) + 577.7 * \exp(-7.05 * \exp(-0.0423 * (TV)))$$

Diagnostic

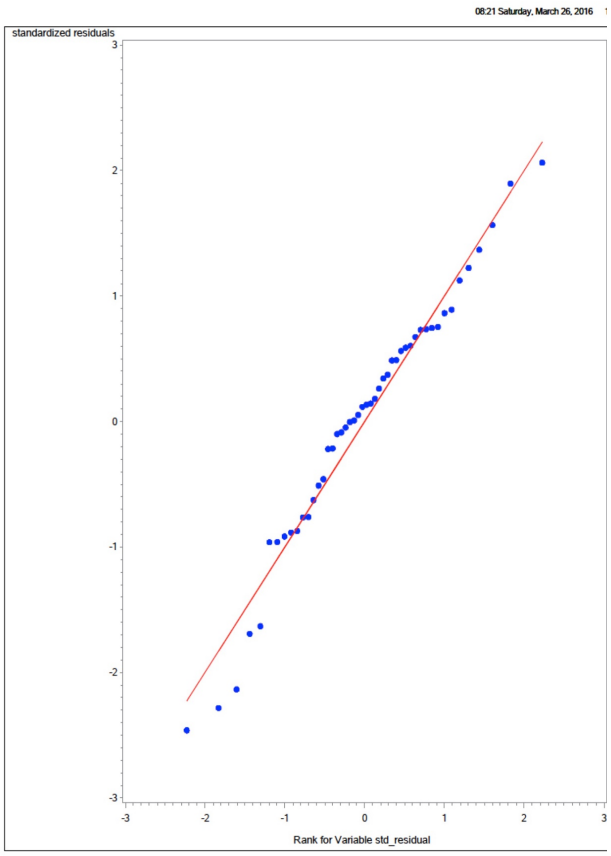
- Model fit:

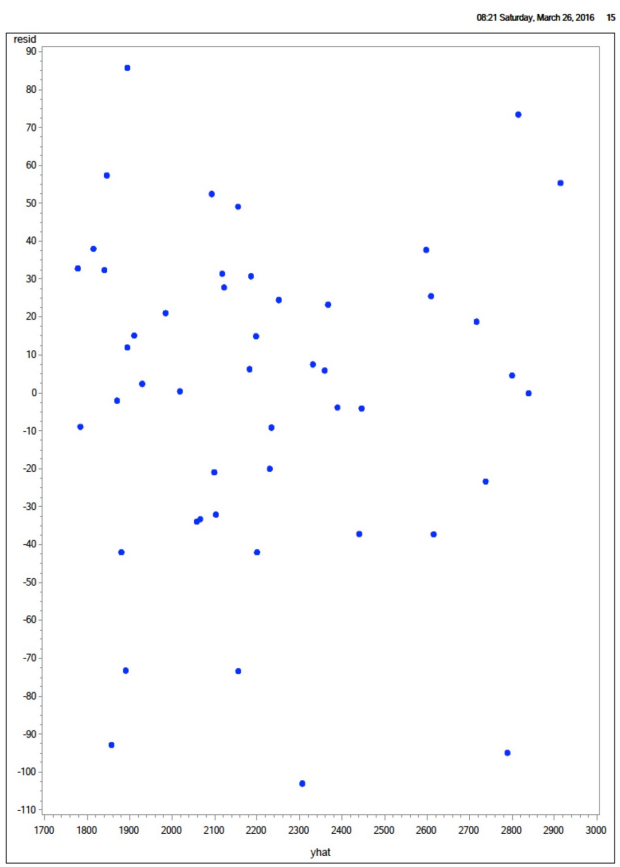


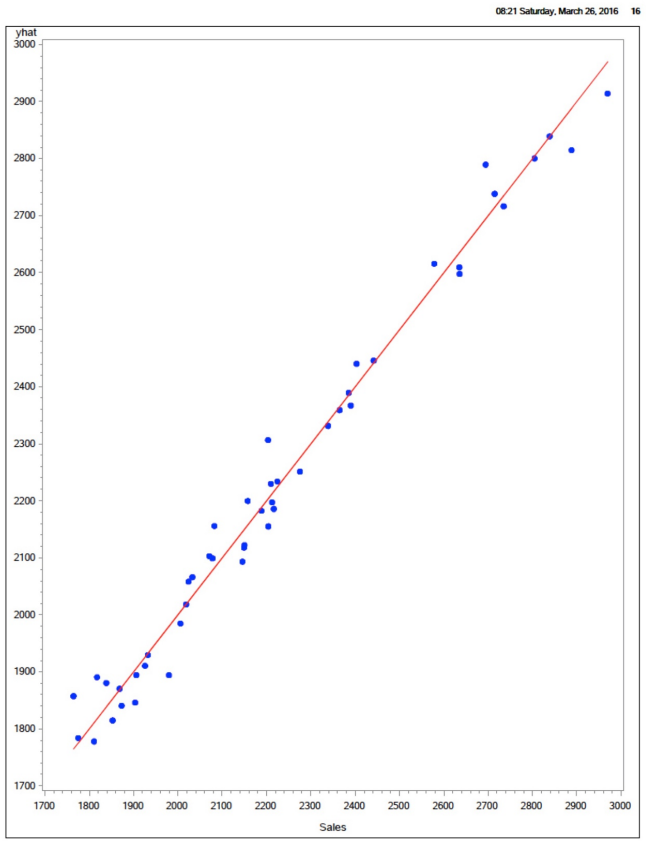
- R^2: 0.98306
- MAPE: 1.517
- DW: 1.64

Diagnostic

- Residual Plot:

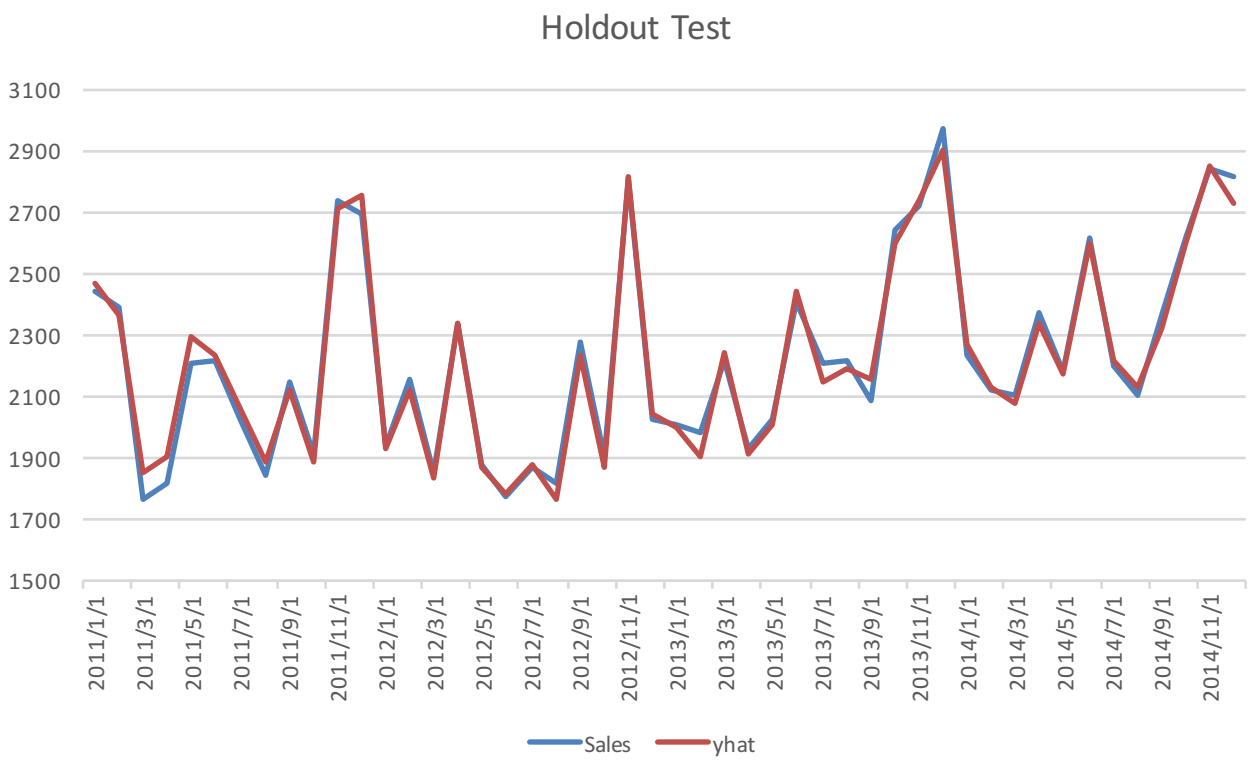






Diagnostic

- Holdout Test:



- R^2: 0.9867
- MAPE: 1.0732
- DW: 1.642

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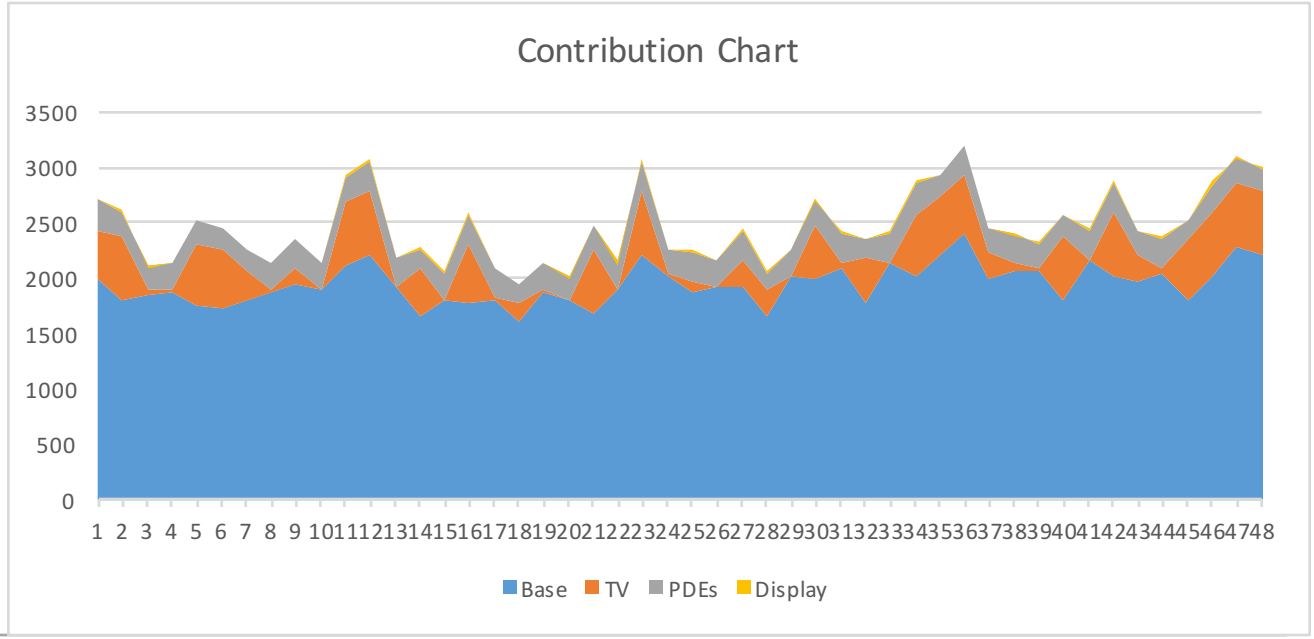
Insights and Recommendation

Marketing Contributions

- Marketing drove around 21% of sales in 2011-2014
- Focused on own DTC TV advertisement drove most contribution of the three marketing tactics followed by PDEs and Display.

Contributions – 2011-14

	Sales	Percent
Base	93218.9357	79.05%
TV	13177.6455	11.17%
PDEs	11195.4914	9.49%
Display	332.928803	0.28%
Total	117925.001	100%

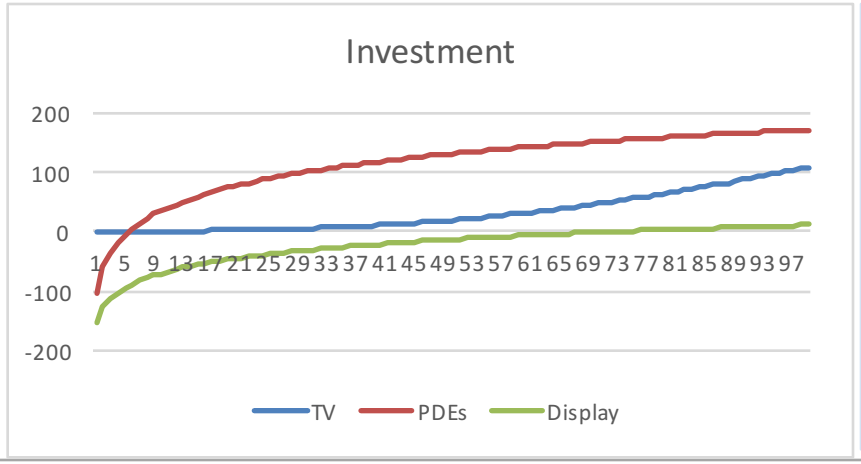


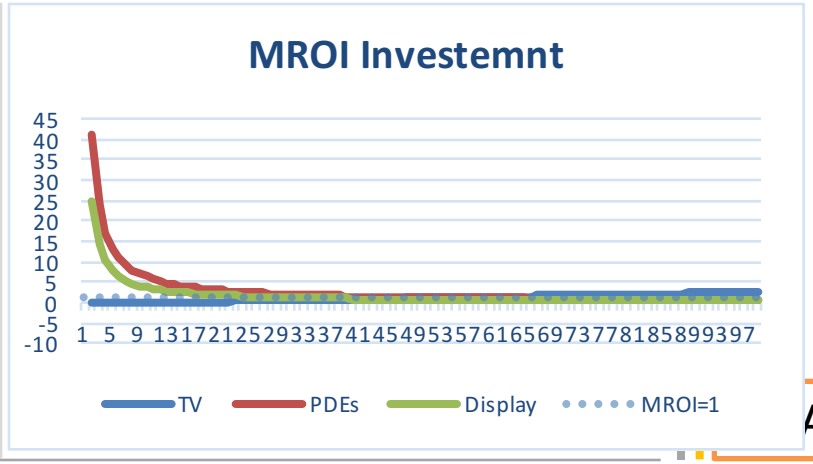
Marketing ROIs and Response Curves

- Overall, the marketing returned above the break-even (ROI = 2.918)
- Display shows below break-even ROI, but TV and PDEs show health average ROIs
- TV shows a lot of potential for profitable increase in investment

Marketing Average ROIs – 2011-2014

	Spend(1000s)	Sales(1000s)	Gross Profit(1000s)	GP ROI
TV	$8,250.00	$13,177.65	$9,224.35	1.11810325
PDEs	$4,492.95	$11,195.49	$7,836.84	1.74425355
Display	$4,184.67	$332.93	$233.05	0.05569147
Total	$16,927.62	$24,706.07	$17,294.25	2.91804827





Recommendations on Optimizing Fixed Market Budget

- The company is contemplating to allocate $360,000 to marketing next month. They plan to allocated equally among DTC_TV, Detailing and DTC_Display.

	Investment	Unit Purchases	Profit(1000's)
TV	$120,000.00	48.00	$160.27
PDEs	$120,000.00	21.82	$182.84
Display	$120,000.00	1.67	$18.09
Total	$360,000.00		$361,200.17

- We recommend the following re-allocation to improve the return from ~$361K to ~$497K GP (i.e. ~$136K GP increase a month)

	Investment	Units Purchases	Profit (1000's)
TV	$236,979.11	94.79	$355.85
PDEs	$77,037.44	14.01	$156.56
Display	$45,983.45	0.64	$15.88
Total	$360,000.00		$496,521.65

- This re-allocation can result in estimated **additional $1,632K of Gross Profit** with the same budget over the next 12 months.

Recommendations on Optimizing Market Budget

- The company is contemplating to allocate $360,000 equally among these three tactics, and the company wants to impose ±25% constraints on the spend levels of each of the three tactics.

	Investment	Unit Purchases	Profit(1000's)
TV	$120,000.00	48.00	$160.27
PDEs	$120,000.00	21.82	$182.84
Display	$120,000.00	1.67	$18.09
Total	$360,000.00		$361,200.17

- We recommend the following re-allocation to increase the budge size from $360K to $450K a month.

	Investment	Unit Purchases	Profit(1000's)
TV	$150,000.00	60.00	$231.66
PDEs	$150,000.00	27.27	$196.08
Display	$150,000.00	2.08	$25.99
Total	$450,000.00		$453,729.39

- This re-allocation can result in estimated **additional $30K of Gross Profit** with the budget size of $450,000 over the next 12 months.

Recommendations on Optimizing Market Budget

- Budget Size is $600,000.

	Investment	Unit Purchases	Profit(1000's)
TV	$200,000.00	80.00	$318.40
PDEs	$200,000.00	36.36	$213.14
Display	$200,000.00	2.78	$36.18
Total	$600,000.00		$567,722.26

- We recommend the following re-allocation to improve the return from ~$568K to ~$612K GP (i.e. ~$44K GP increase a month)

	Investment	Unit Purchases	Profit(1000's)
TV	$295,316.46	118.13	$385.57
PDEs	$190,769.03	34.69	$210.34
Display	$113,914.51	1.58	$16.25
Total	$600,000.00		$612,156.20

- This re-allocation can result in estimated **additional $528K of Gross Profit** with the same budget over the next 12 months.

Additional Insights

- Q: How much has the competitive DTC TV hurt the business?
- A: According to the nonlinear model, B_DTC_TV (coefficient) equals to -76.1788, which means that the increase of competitive DTC TV will decrease this drug's sales.

- Q: What is the influence of UR on sales?
- A: B_UR equals to -11.8355, which means the influence of UR on sales is negative. With the increase of UR, the sales will decrease.

Thank You!