

Marketing Effectiveness Results

A large Pharmaceutical Company

April 2, 2018 Jiwan Hwang

Agenda

I.

Objectives

II.

Background and Business Questions

III.

Approach

IV.

Review of Insights and Recommendations

i. Historical Contributions and ROIs

ii. Recommendations on Optimizing Investment Allocations

iii. Additional Insights

V.

Appendix

Objectives

The objectives of today's meeting are to provide:

- Insights and recommendations on the incremental value generated by key marketing tactics
- Estimates of historical contributions and ROIs of marketing tactics
- Recommendations on improving marketing budget allocations in the future
- Insights on a number of specific business questions

Agenda

I. Objectives

II. Background and Business Questions

III. Approach

IV. Review of Insights and Recommendations

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- iii. Additional Insights

V. Appendix

Background and Business Questions

Background

- A large Pharmaceutical Company is interested in marketing performance of its oral anticoagulant drugs.
- The business is highly competitive and it is believed that marketing drives a significant portion of the total sales.
- Some Stakeholders think that marketing drives 50% or others do 20% of the total business.
- Macroeconomics indicator such as unemployment rate has a significant influence

Business Questions

- What are the Historical contribution of DTC TV, DTC Display and Detailing?
- What are the sales and profit ROIs of DTC TV, DTC Display and Detailing?
- What do the sales and gross profit response curves of DTC TV, DTC Display and Detailing look like?
- How much should the company spend to maximize the net profit next month?
- How much has the competitive DTC TV hurt the business?
- What is influence of unemployment rate on Sales?

Financial Information

Gross Profit Margin

- Blended GPM = 70% is used

Spend Data

- Historical Cost Per Unit numbers are expected to be valid for the next year

	Unit	Cost Per Unit
TV	GRP	\$ 2,500
DPE(Detail)	Count(thousnad)	\$ 5,500
Display	Impressions(million)	\$ 72,000

Agenda

I. Objectives

II. Background and Business Questions

III. Modeling

IV. Review of Insights and Recommendations

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ii. Recommendations on Optimizing Investment Allocations

iii. Additional Insights

V. Appendix

Modeling – Initial values and transformation

- Test additive formulation:

Initial values :

- If the variables has linear relationship (including log transformation) with the response variable in additive model,
Use the parameters from results of naive linear regression.
- If the variables need power transformation,
Calculate the range of parameters assuming 20%-50% contribution from marketing and return proportional to spend size for the three tactics and using range of 0.25-1 for the power.
- For Log transformation, Variable + 1 can be applied.
- For Power transformation, Variable +0.01 can be applied.

Modeling : Initial values and transformation (Excel)

Initial Value Calcs				
1. Assume 20-50% contribution from marketing				
2. Assume return proportional to spend size for the three tactics				
3. Use range 0.25-1 for the power				
Total Spend		\$ 8,250,000	\$ 3,909,400	\$ 2,711,950
Percent Spend		55%	26%	18%
20% return		11.1%	5.3%	3.6%
50% return		27.7%	13.1%	9.1%
Log				
20%			112.909669	
50%			282.2741724	
Power	0.25			
20%		94	65	94
50%		234	163	235
Power	0.5			
20%		33	33	100
50%		81	83	250
Power	0.75		k	
20%		11	17	106
50%		28	42	266
Power	1.0			
20%		3.920	9	113
50%		10	22	282

Modeling : Additive Nonlinear regression Model

- Test additive formulation:
- First try model: 1 log transformation and 3 power transformation

$$Sales * 300 =$$

$$\begin{aligned} & \beta_0 + \beta_1 * Formul_{Status} + \beta_2 * UR + \beta_3 * Nov_{Ind} + \beta_4 * Dec_{Ind} + \beta_5 * \text{Log}(Comp_{DTC_TV} + 1) \\ & + \beta_6 * TV^{\alpha_6} + \beta_7 * PDE^{\alpha_7} + \beta_8 * DTC_Display^{\alpha_8} \end{aligned}$$

$$Sales * 300 =$$

$$\begin{aligned} & 1273 + 120.1 * Formul_{Status} - 48.42 * UR + 357.6 * Nov_{Ind} + 418.1 * Dec_{Ind} - 34 * \text{Log}(Comp_{DTC_TV} + 1) \\ & + 25.42 * (TV + 0.01)^{0.6552} + 65.05 * PDE^{0.6077} + 95.63 * DTC_Display^{1.336} \end{aligned}$$

Cannot accept this regression because the power parameter of DTC_Display is > 1 (< 1 , Diminishing return to scale)

Second and final model: 2 log transformation and 2 power transformation

$$Sales * 300 =$$

$$\begin{aligned} & \beta_0 + \beta_1 * Formul_{Status} + \beta_2 * UR + \beta_3 * Nov_{Ind} + \beta_4 * Dec_{Ind} + \beta_5 * \text{Log}(Comp_{DTC_{TV}} + 1) \\ & + \beta_6 * (TV + 0.01)^{\alpha_6} + \beta_7 * PDE^{\alpha_7} + \beta_8 * \text{Log}(DTC_Display) \end{aligned}$$

$$Sales * 300 =$$

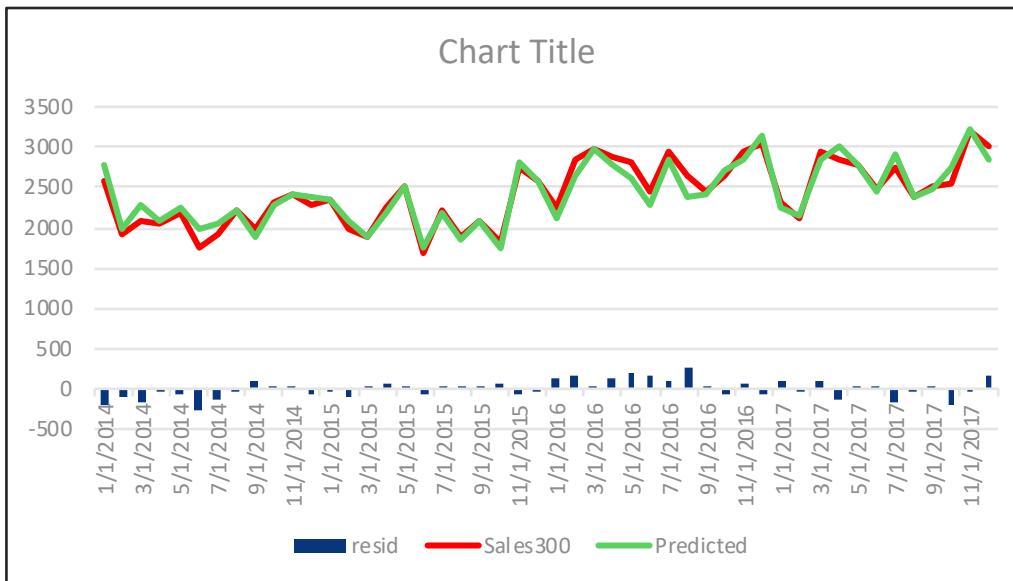
$$\begin{aligned} & 1166.2 + 120 * Formul_{Status} - 46.83 * UR + 361.8 * Nov_{Ind} + 412 * Dec_{Ind} - 33.3 * \text{Log}(Comp_{DTC_{TV}} + 1) \\ & + 24.04 * (TV + 0.01)^{0.6659} + 65.47 * PDE^{0.6086} + 289.1 * \text{Log}(DTC_Display) \end{aligned}$$

Modeling : MAPE, R^2 , Durbin Watson Test, and AvP

- $MAPE, R^2$ and Durbin Watson

	MAPE	R-Square	1st Order Autocorr.	DW Statistics	DW + p-value	DW - p-value
Naive	4.14%	90.28%	0.262	1.408	0.0147	0.9826
Linear(incl. log)	4.17%	90.33%	0.284	1.351	0.0101	0.9899
Nonlinear	3.52%	92.02%	0.324	1.231	0.0027	0.9973

- Actual vs Predicted



Agenda

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III. Approach

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- iii. Additional Insights

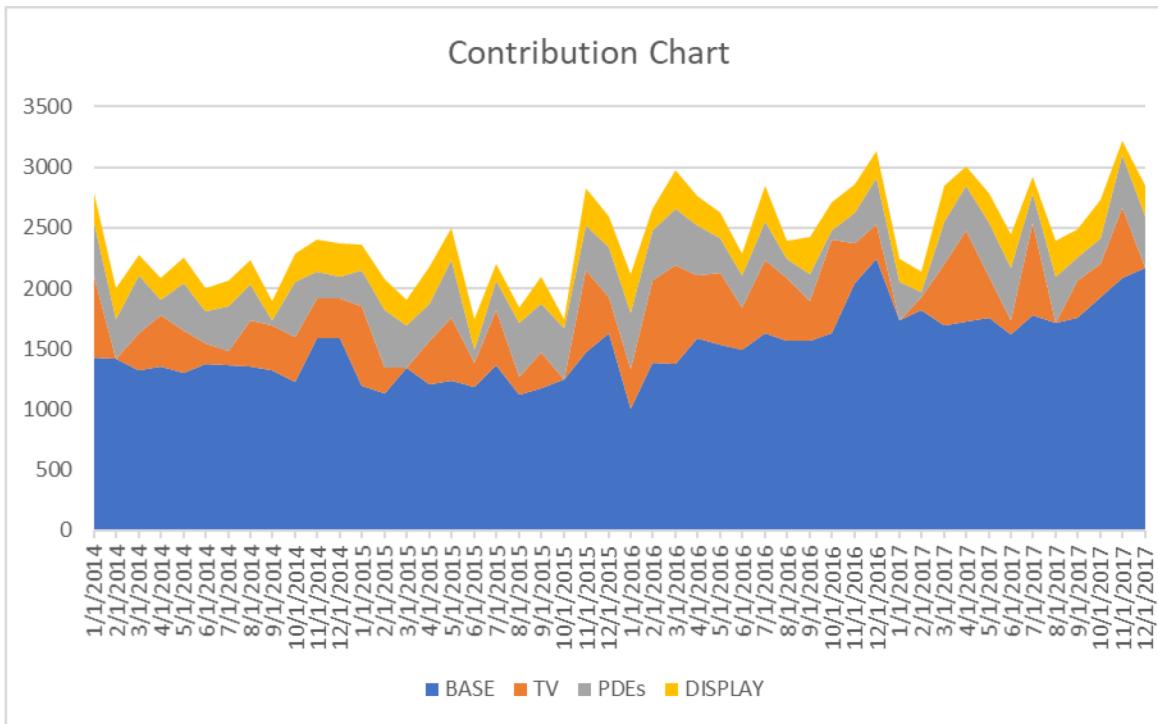
V. Appendix

Marketing Contributions

- Marketing drove ~37.6% of sales in 2014-17
- TV drove most contribution of the three marketing tactics followed by PDE and Display

Contributions : 2014-17

	Sales	% Sales
Base	\$ 72,711	62.4%
TV	\$ 17,537	15.0%
PDE	\$ 15,469	13.3%
Display	\$ 10,889	9.3%
Total	\$ 116,605	



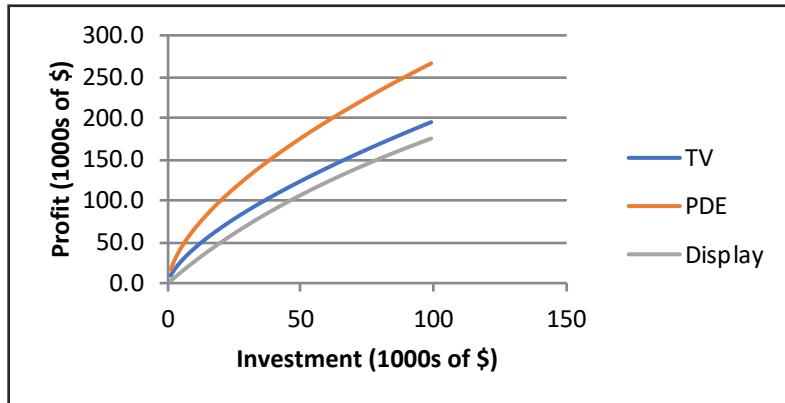
Marketing ROIs and Response Curves

- Overall, the marketing returned above the break-even ($ROI = 1.87$) .
- All TV, PDE and Display show healthy average ROIs but TV is the lowest among three.
- PDE shows a lot of potential for profitable increase in investment.

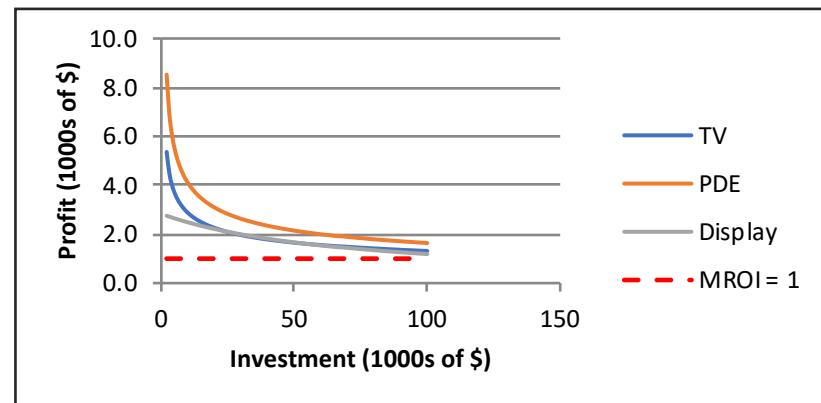
Marketing Average ROIs (2014-2017)

	Spend (1000s)	Sales (1000s)	Gross Profit (1000s)	GP ROI
TV	\$ 8,250	\$ 17,537	\$ 12,276	1.49
PDEs	\$ 3,909	\$ 15,469	\$ 10,828	2.77
Display	\$ 4,271	\$ 10,889	\$ 7,622	1.78
Total	\$ 16,430	\$ 43,895	\$ 30,726	1.87

Gross Profit Response Curves



Marginal ROI Curves



Recommendations on Optimizing Marketing Investment

- The company is planning to spend about \$360K for next month, allocating equally among DTC TV, DPE, and DTC Display.
- We recommend the following re-allocation to improve the return from \$687K to \$728K GP

	Investment
TV	\$ 120,000
PDE	\$ 120,000
Display	\$ 120,000



	Investment
TV	\$ 118,242
PDE	\$ 150,000
Display	\$ 91,758

Profit return :
687K -> 728K

- This re-allocation can result in estimated **additional \$41K of Gross Profit** with the same budget over the next 12 months.
- The company is planning to spend about \$600K for next month, allocating equally among DTC TV, DPE, and DTC Display.
- We recommend the following re-allocation to improve the return from \$989K to \$1,007K GP

	Investment
TV	\$ 200,000
PDE	\$ 200,000
Display	\$ 200,000



	Investment
TV	\$ 200,000
PDE	\$ 250,000
Display	\$ 150,000

Profit return :
989K -> 1,007K

- This re-allocation can result in estimated **additional \$18K of Gross Profit** with the same budget over the next 12 months.

Additional Insights

- The competitive DTC TC :
1% increase in the competitive DTC TV decreases 0.33 (= parameter coefficient/100) of the average Sales Amount (= no. of Sales * \$300).
 - Unemployment Rate :
1 unit increase in unemployment rate decreases 46.83 of the average Sales Amount (= no. of Sales * \$300) for my nonlinear mode which assumes UR has linear relationship with Sales.

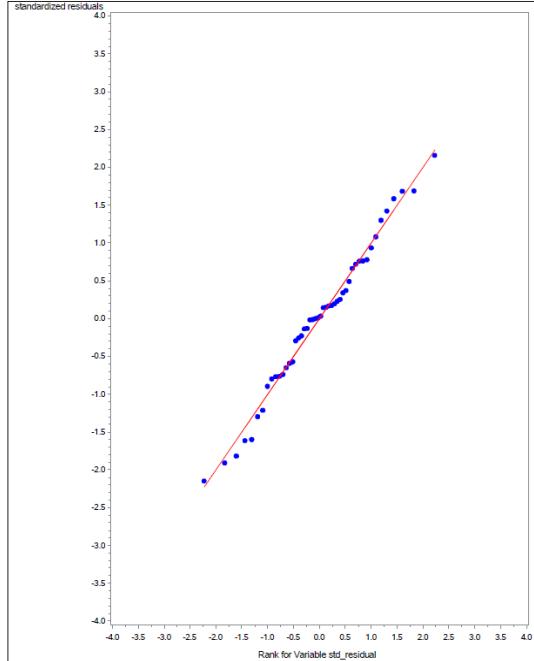
However, we can set up its initial values as below using power transformation and find its coefficient.

	UR								
MIN	3.10								
MEAN	4.96								
MEDIAN	4.85								
MAX	6.80								
STD	0.99								
	Power	1	1	1	1	2	2	2	2
	% Sales	10	20	30	40	10	20	30	40
	Coeff	-65.656	-131.313	-196.969	-262.625	-6.632	-13.264	-19.896	-26.528

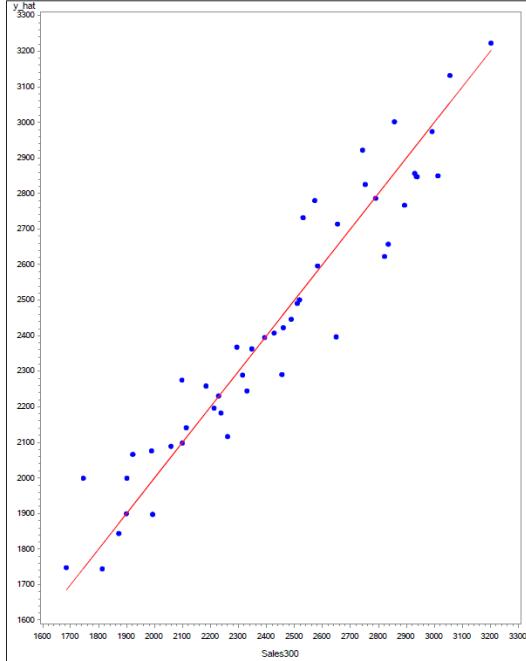
Agenda

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- IV. Review of Insights and Recommendations
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 - ii. Recommendations on Optimizing Investment Allocations
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- V. Appendix

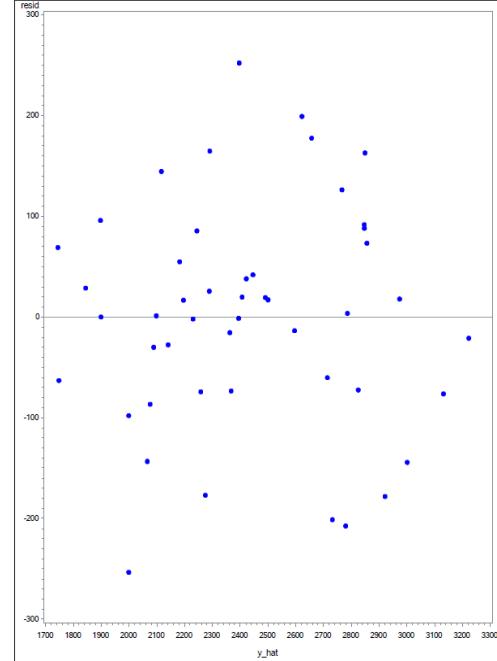
Model Diagnostic : Plots (Residual Analysis)



<Q-Q Plot>



<Actual vs. Predicted Values>



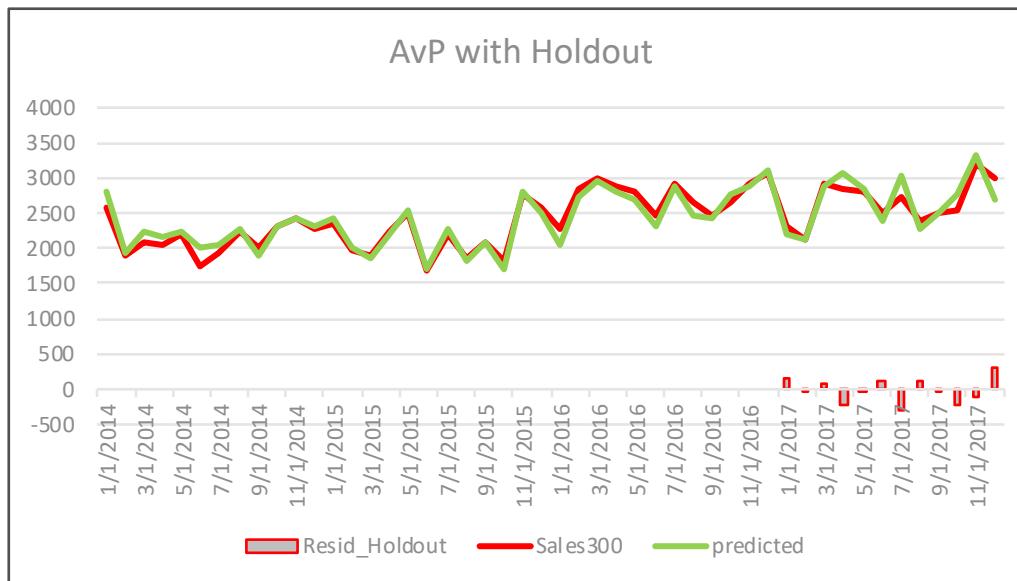
<Residual vs. Predicted Values>

Model Diagnostic : Holdout Test

- Holdout model test

Holdout MAPE : 5.11

- Actual vs Predicted



The end

- Thank you
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