# Assignment 3: Part-1

How is sales related to week numbers?

There exists a non-linear relationship between sales and time period which showcases a dynamic and diminishing return effects because of factors like TV and Radio ads. Sales are increasing in the longer run but in the small intervals it shows a decay effect after 2.5 weeks whenever we invested the decay coefficient takes a dip and that is the time we again invest in ads.
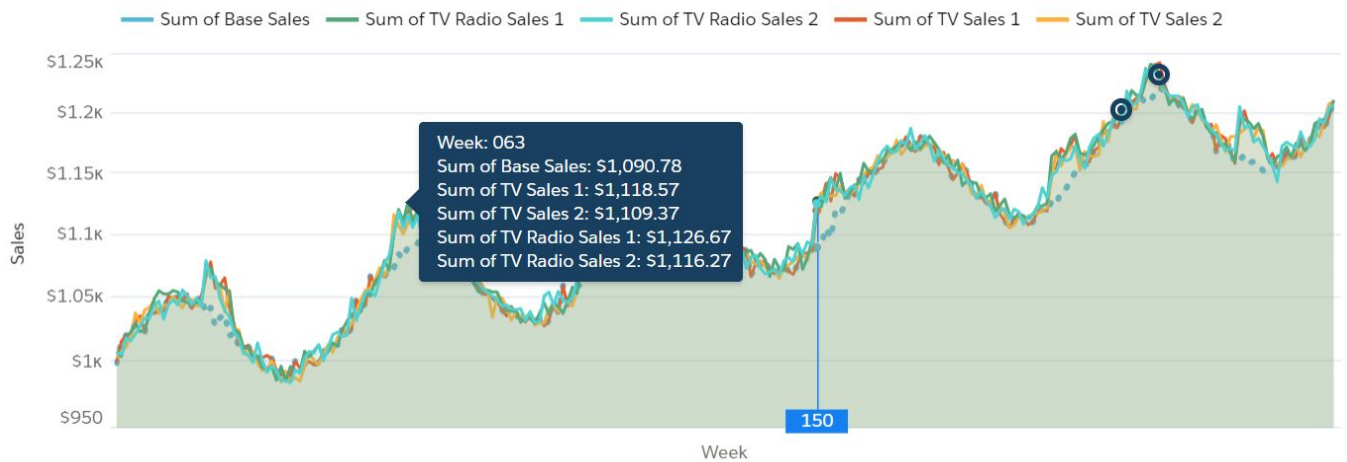
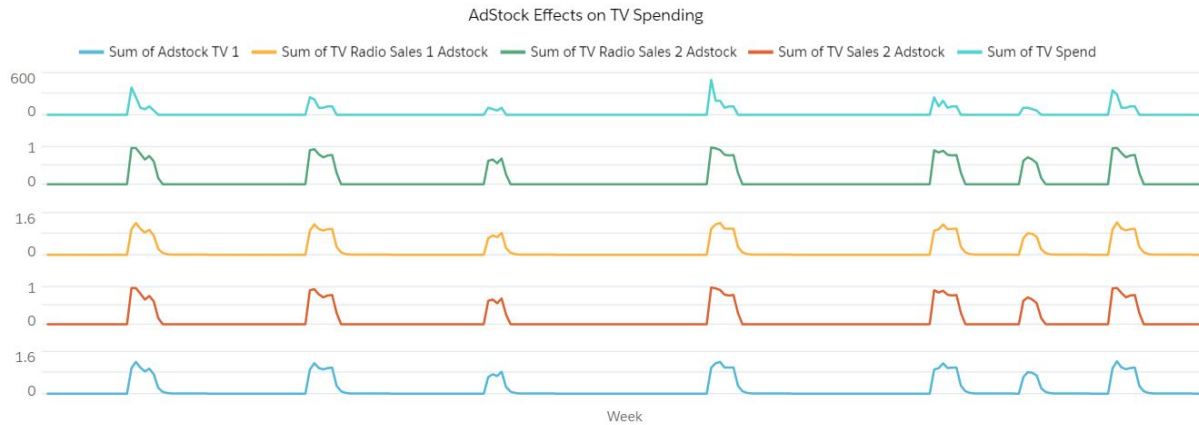# How does TV spending effect sales?Can you quantify it?

TV spending is definitely benefitting the "Sales". From our analysis, we observe there is both an increase in the longer run and decay effect once the Adstock decay coefficient starts dipping in TV spending intervals. Though it is nonlinearly related, overall there is an increase because of the awareness and publicity created by the ads resulting in Increase in Sales. Yes we can quantify the sales as given in the below graphs.
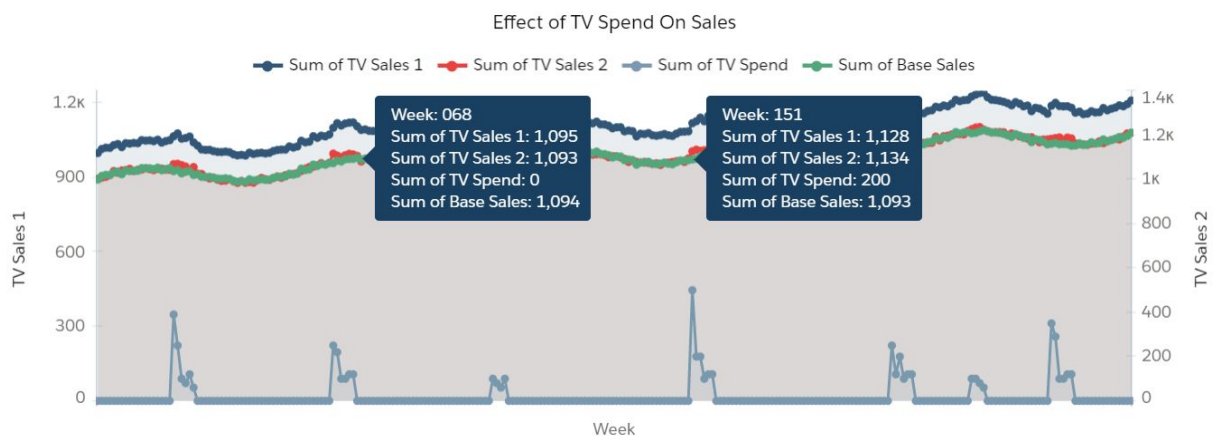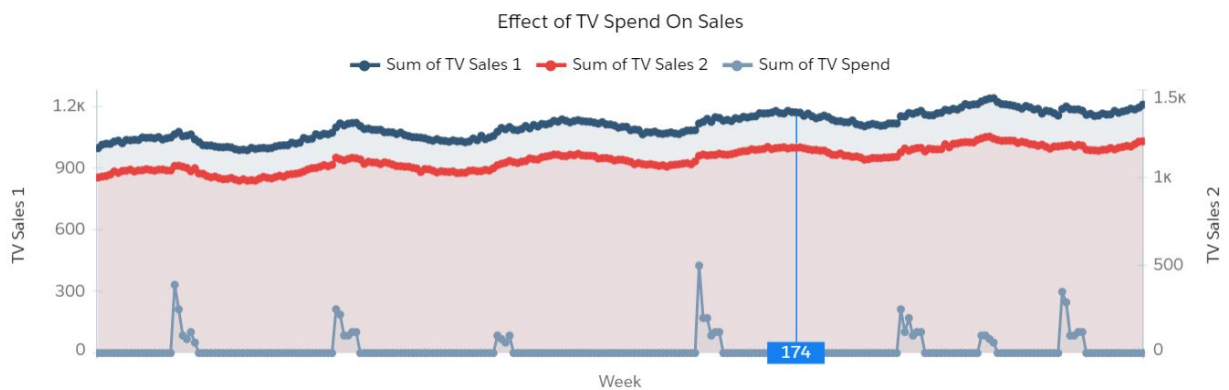
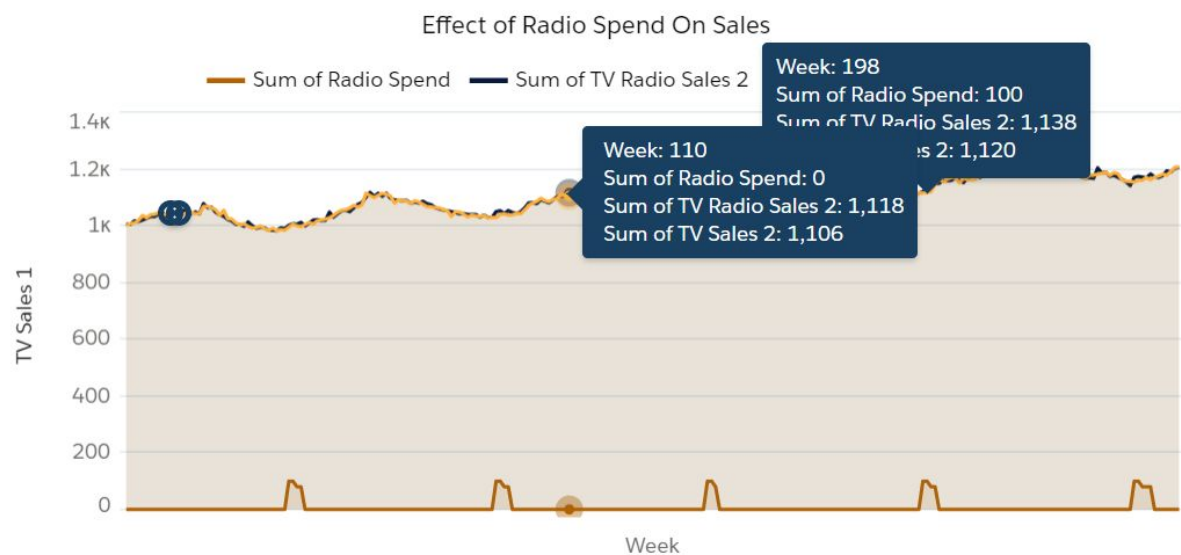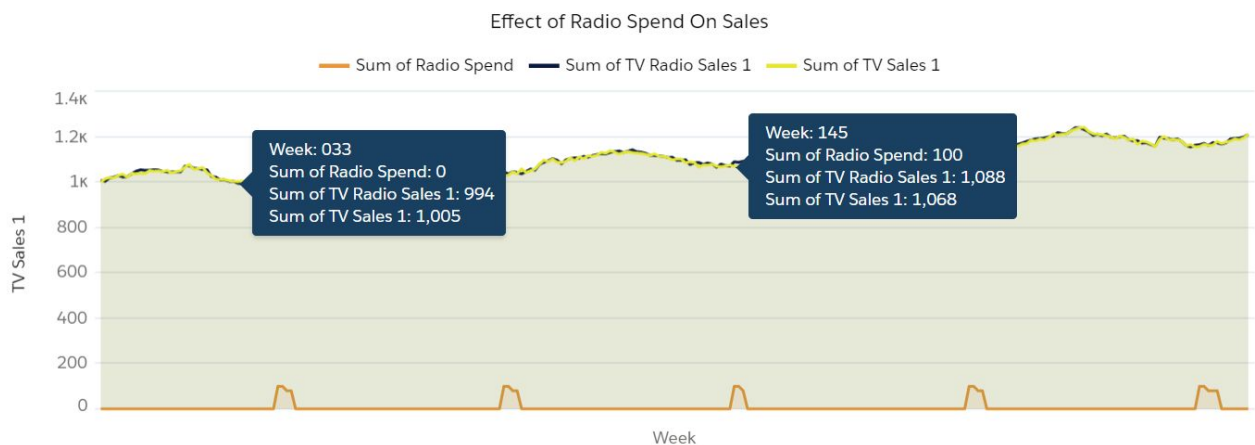| Week	Base Sales	TV Sales 1	TV Sales 2	TV Spend	Diff_Sales1_base	Diff_Sales2_base
Total	42,255.57	43,335.54	43,174.23	5,820	1,079.98	918.66
020	1,037.44	1,066.83	1,069.45	390	29.39	32.01
021	1,042.15	1,078.5	1,070.61	250	36.36	28.46
022	1,027.55	1,057.42	1,064.62	100	29.87	37.07
023	1,034.51	1,059.99	1,057.99	80	25.48	23.48
024	1,037.2	1,065.81	1,038.93	120	28.61	1.73
025	1,020.18	1,042.3	1,055.92	60	22.12	35.73
060	1,073.44	1,100.98	1,116.52	250	27.54	43.07

Are there any adstock effects for TV ad spending?

Yes, there are adstock effects for TV ad spending. There is a carry over effect from the previous week affecting sales positively, while decrease in the sales is observed due to the diminishing effects of ads and that is the time we again invest in TV spending.


AdStock Effects on TV Spending

How does radio spending effect sales? Can you quantify it?

There exists a combined effect of both TV and Radio ads on TV Radio Sales 1, which includes both TV spending and Radio spending alongwith adstock model 1. To quantify stand alone radio spending effect on sales, we need information if the sale happened because of "TV Advertisement" or "Radio Advertisement".

Effect of Radio Spend On Sales

— Sum of Radio Spend — Sum of TV Radio Sales 1 — Sum of TV Sales 1

Week: 033
Sum of Radio Spend: 0
Sum of TV Radio Sales 1: 994
Sum of TV Sales 1: 1,005

Week: 145
Sum of Radio Spend: 100
Sum of TV Radio Sales 1: 1,088
Sum of TV Sales 1: 1,068

Effect of Radio Spend On Sales

— Sum of Radio Spend — Sum of TV Radio Sales 2

Week: 198
Sum of Radio Spend: 100
Sum of TV Radio Sales 2: 1,138
es 2: 1,120

Week: 110
Sum of Radio Spend: 0
Sum of TV Radio Sales 2: 1,118
Sum of TV Sales 2: 1,106

Are there any adstock effects for radio ad spending?

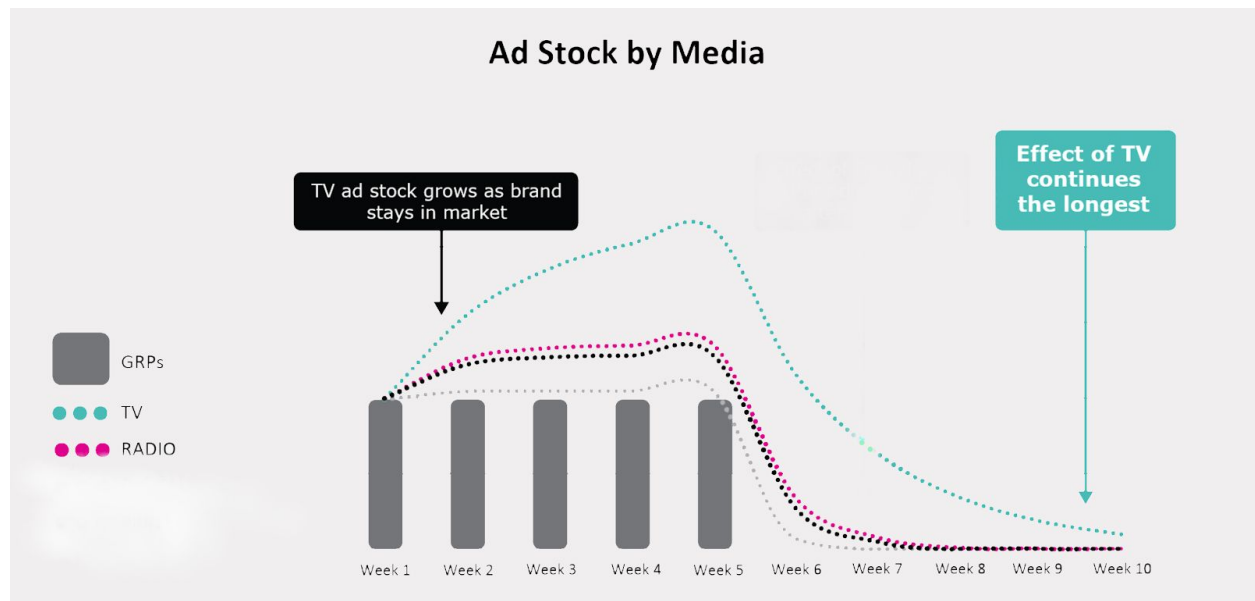No, there is not much significant adstock effect for radio ad spending in the given data.

AdStock Effects on Radio Spending
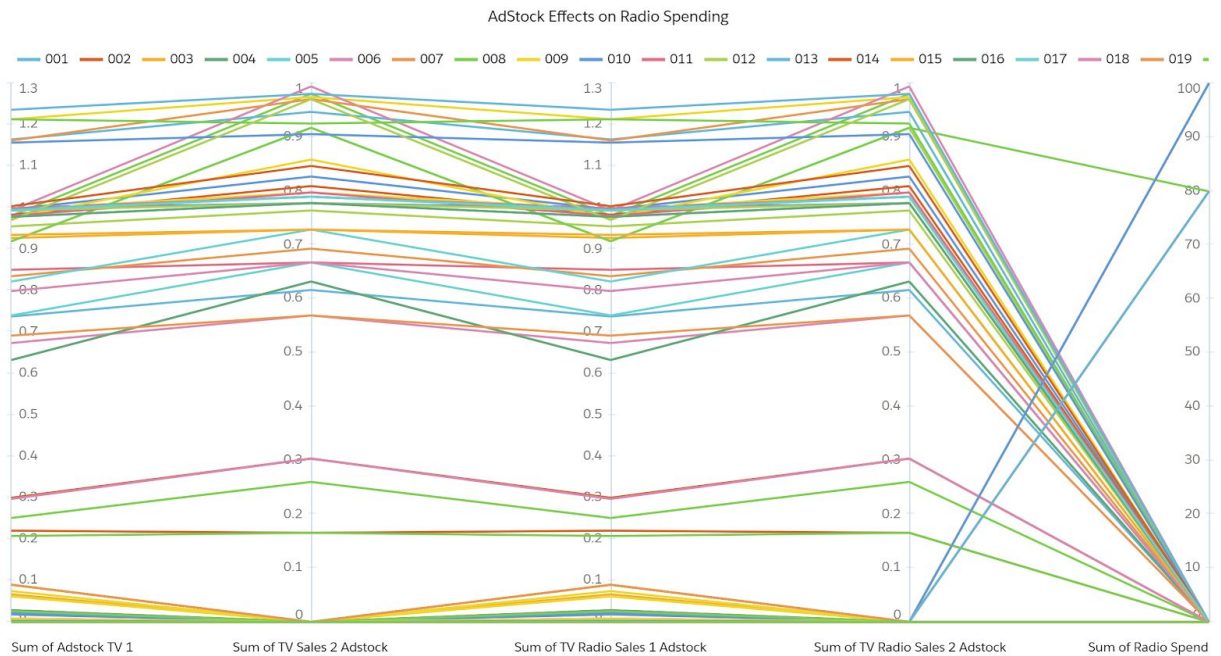
#	Week	Adstock TV 1	TV Radio Sales 1 Adstock	TV Radio Sales 2 Adstock	TV Sales 2 Adstock	Radio Spend
1	200	0.92	0.92	0.92	0.92	80
2	249	0.008	0.008	0	0	100
3	250	0.0024	0.0024	0	0	100
4	251	0.00072	0.00072	0	0	80
5	252	0.00022	0.00022	0	0	80
6	253	0.000065	0.000065	0	0	80

Effect of Temperature on TV Sales 1

Moreover, it is also observed that upto a certain level, the sales are dependent on the temperature factor as well.

Temperature Effect On TV Sales 1
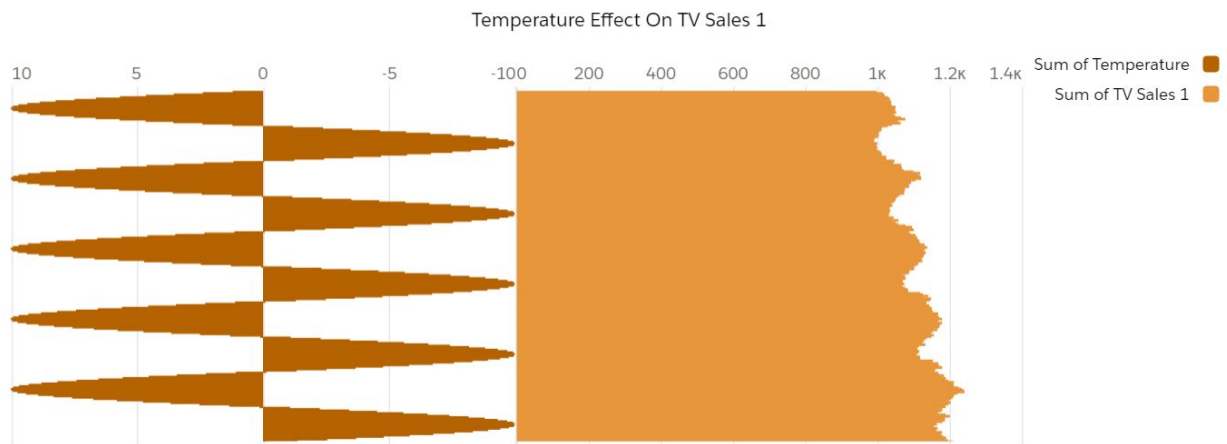
Conclusion

References

Introduction to Algorithmic Marketing - ILYA KATSOV

https://mpra.ub.uni-muenchen.de/7683/4/Adstock

https://towardsdatascience.com/market-mix-modeling-mmm-101-3d094df976f9

https://sites.google.com/site/2015pcsu/data-science/marketing-mix-modeling-to-find-the-best-advertising-route

https://en.wikipedia.org/wiki/Advertising_adstock