ANA605_Final Exam_APA Report

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Dilomatox Marketing Budget Analysis

The purpose of this analysis is to identify an appropriate budget proposal for next year's marketing and advertising expenditure for the Dilomatox brand. This analysis will use weekly product revenue and advertising expense data for Dilomatox, and its chief competitor Zoraffil, provided by the CFO and senior budget committee. Statistical methods and models will be developed to better understand the relationship between product revenues and advertising expenses for both product types. The Dilomatox model will be employed to review the proposed initial marketing budget, to evaluate the requested $11 million CFO and senior budget committee forecasted marketing expense decrease, and to finally propose an appropriate marketing budget for next year.

The Aforementioned Marketing Budget Proposals

1. Initial Marketing Budget Proposal

The marketing team has recently submitted a proposed budget for the advertising and marketing expenditure for the upcoming year to support a 10% annual revenue growth for Dilomatox. A summary of that budget along with this year's forecast (forecasted since your fiscal year has not been complete yet) is below:

DILOMATOX – Proposed Marketing Budget

	Proposed Budget (Next Year)	Current Forecast (This Year)	% Change
Advertising and Marketing Spend (total)	$64,250,000	$56,860,000	+13%
Product Revenue	$1,164,471,000	$1,058,610,000	**+10%**
Marketing Spend as % of Revenue	5.52%	5.37%	

2. CFO and Senior Budget Committee Marketing Expense Decrease

The senior budgeting committee reviewed the marketing budget proposal, and the CFO sent a summary of her team's findings. The CFO explained that she will not support the proposed marketing budget increase, because the main competitor Zoraffil is forecasted to spend 8.5% less on advertising and marketing expenditures, but is on target to earn 7.5% more revenue. Furthermore, the CFO recommended the marketing budget be reduced to 4.57% of revenue to match what Zoraffil has achieved. To achieve this goal, the CFO has asked for a reduction in the proposed marketing budget of $11 million, which would put the reduced marketing budget at $53.25 million.

CURRENT YEAR FINANCIAL FORECASTS

	Dilomatox	Zoraffil	% Change
Advertising and Marketing Spend (total)	$56,860,000	$52,040,000	-8.5%
Product Revenue	$1,058,610,000	$1,138,510,000	+7.5%
Marketing Spend as % of Revenue	5.37%	**4.57%**	

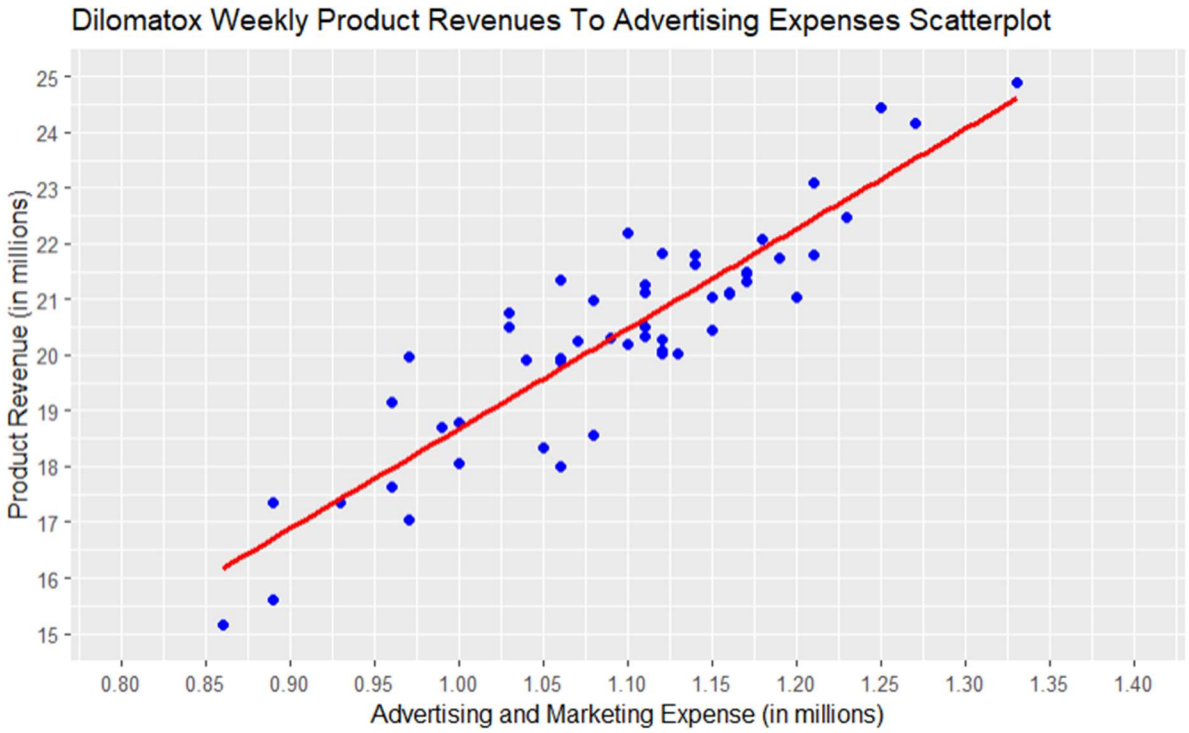
Examine the Relationship between Product Revenues and Advertising Expenses for Dilomatox and Zoraffil

1. Correlation Tests between Dilomatox Product Revenues and Advertising Expenses

Pearson's r correlation = 0.900 (rounded approximation)

```
Pearson's product-moment correlation
data:  DilomRev and DilomAdv
t = 14.578, df = 50, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.8308437 0.9414715
sample estimates:
      cor
0.8997394
```

Scatterplot of Weekly Product Revenues vs. Advertising Expenses for Dilomatox



Correlation Summary for Dilomatox

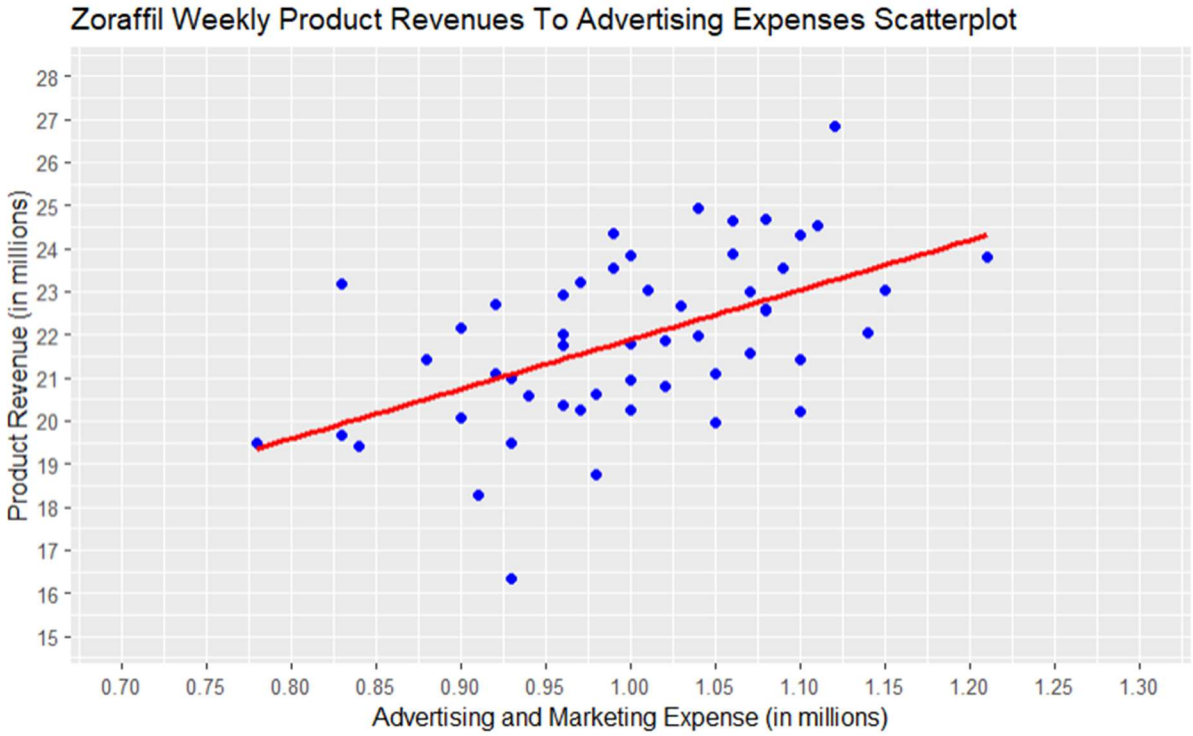
The Pearson's r correlation of 0.900 and the scatterplot above indicate a high level of correlation between the weekly product revenues and advertising expenses for Dilomatox.

2. Correlation Tests between Zoraffil Product Revenues and Advertising Expenses

Pearson's r correlation = 0.525 (rounded approximation)

```
Pearson's product-moment correlation
data:  ZorRev and ZorAdv
t = 4.3568, df = 50, p-value = 6.555e-05
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.2937106 0.6976010
sample estimates:
      cor
0.5245651
```

Scatterplot of Weekly Product Revenues vs. Advertising Expenses for Zoraffil



Correlation Summary for Zoraffil

The Pearson's r correlation of 0.595 and the scatterplot above indicate a moderate level of correlation between the weekly product revenues and advertising expenses for Zoraffil.

3. Product Revenue Descriptive Statistics and Graphical Comparison

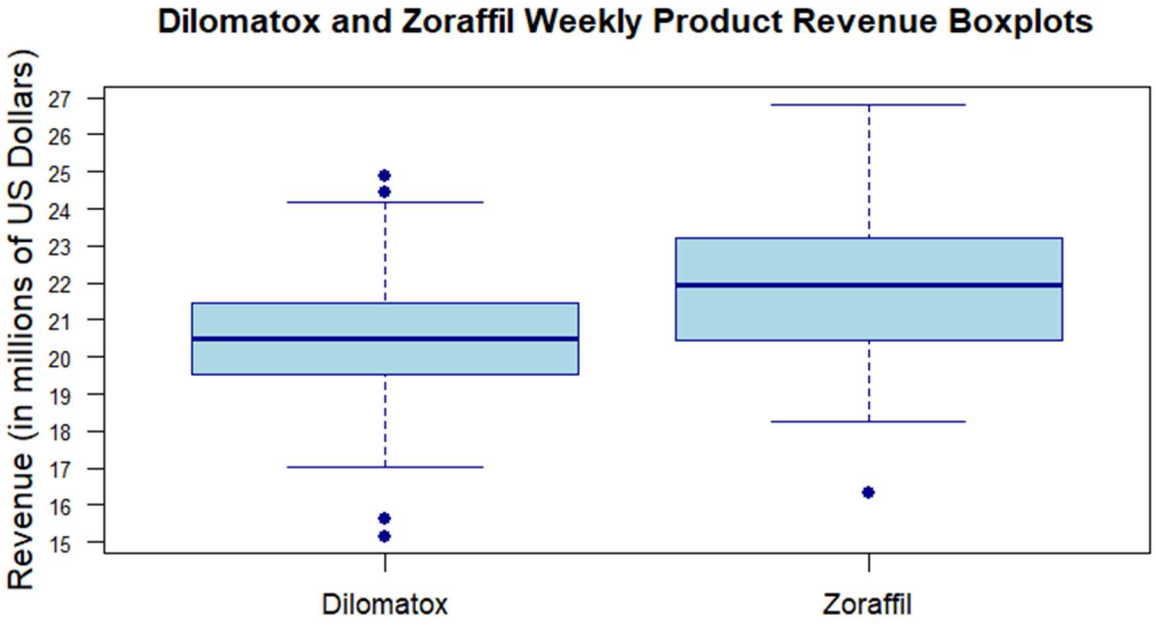
Weekly Product Revenue Descriptive Statistics for Dilomatox (in millions of US Dollars)

min <dbl>	Q1 <dbl>	median <dbl>	Q3 <dbl>	max <dbl>	mean <dbl>	sd <dbl>	n <int>
15.15	19.695	20.475	21.47	24.89	20.35788	1.983078	52

Weekly Product Revenue Descriptive Statistics for Zoraffil (in millions of US Dollars)

min <dbl>	Q1 <dbl>	median <dbl>	Q3 <dbl>	max <dbl>	mean <dbl>	sd <dbl>	n <int>
16.32	20.5225	21.92	23.1875	26.82	21.89442	1.969769	52

Weekly Product Revenue Boxplot Diagram



Weekly Product Revenue Comparative Summary

Dilomatox and Zoraffil weekly product revenue distributions showed some normality, and similar standard deviations. As expected, Zoraffil weekly product revenues exceeded those of Dilomatox by an average of $1.45 million.

4. Advertising Expenses Descriptive Statistics and Graphical Comparison

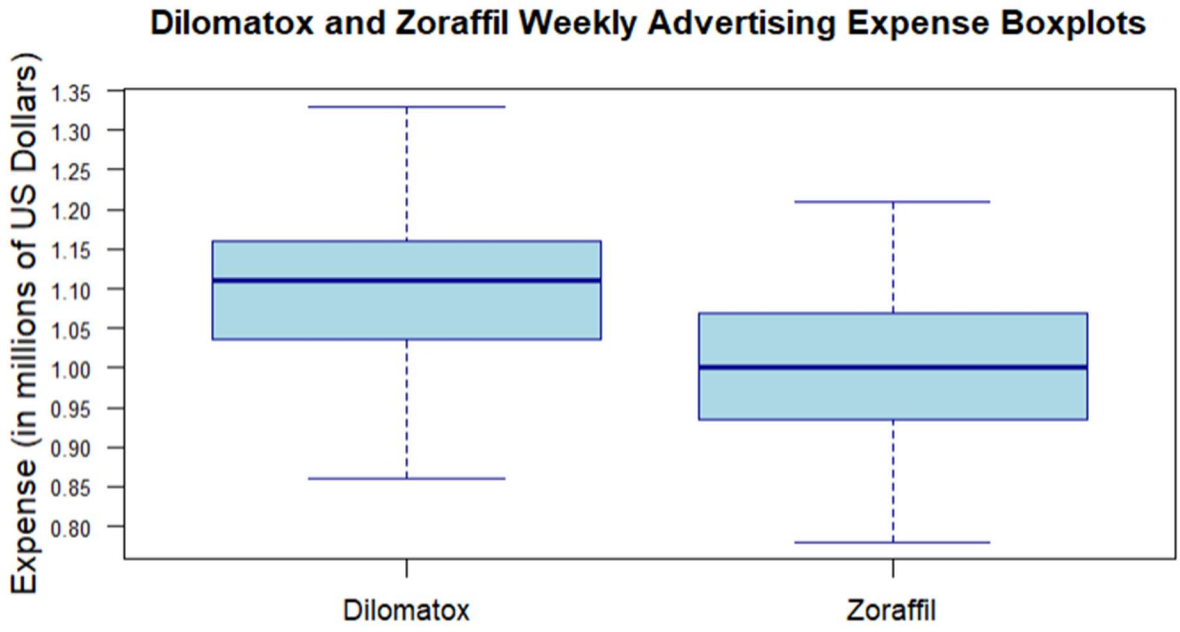
Advertising Expenses Descriptive Statistics for Dilomatox (in millions of US Dollars)

min <dbl>	Q1 <dbl>	median <dbl>	Q3 <dbl>	max <dbl>	mean <dbl>	sd <dbl>	n <int>
0.86	1.0375	1.11	1.16	1.33	1.093462	0.0994669	52

Advertising Expenses Descriptive Statistics for Zoraffil (in millions of US Dollars)

min <dbl>	Q1 <dbl>	median <dbl>	Q3 <dbl>	max <dbl>	mean <dbl>	sd <dbl>	n <int>
0.78	0.9375	1	1.07	1.21	1.000769	0.08983309	52

Weekly Advertising Expenses Boxplot Diagram



Weekly Advertising Expenses Comparative Summary

Dilomatox and Zoraffil weekly advertising expense distributions were much the same with similar standard deviations. As expected, Dilomatox weekly advertising expenses exceeded those of Zoraffil by an average of $92.7 thousand.

Develop Linear Regression Models between Product Revenues and Advertising Expenses for Dilomatox and Zoraffil

1. Model for Estimating Product Revenues from Advertising Expenses for Dilomatox

Suggested Model for Estimation $Y_i = b_0 + b_1(X_i) + e_i$

Y = Product Revenues (in millions of US Dollars)
X = Advertising Expenses (in millions of US Dollars)
b_0 = Intercept Coefficient (for product revenues when advertising expenses equal zero)
b_1 (slope) = Coefficient of Expected Change (for product revenues per every million of advertising expenses)

Dilomatox Linear Regression Model

```
Call:
lm(formula = DilomRev ~ DilomAdv, data = final_data)

Coefficients:
(Intercept)     DilomAdv
     0.7432      17.9382

 Analysis of Variance Table (Type III SS)
 Model: DilomRev ~ DilomAdv

                            SS df      MS       F   PRE     p
 ----- --------------- | ------- -- ------- ------- ----- -----
 Model (error reduced) | 162.362  1 162.362 212.510 .8095 .0000
 Error (from model)    |  38.201 50   0.764
 ----- --------------- | ------- -- ------- ------- ----- -----
 Total (empty model)   | 200.562 51   3.933

                2.5 %   97.5 %
(Intercept) -1.970313  3.45671
DilomAdv    15.466588 20.40973
```

$$DilomRev_i = 0.7432 + 17.9382(DilomAdv_i) + e_i$$

Dilomatox Linear Regression Model Assessment

The model is significant, due to a *p-value* of .0000 being far less than the required *alpha* standard of 0.05 and the *b1* 95% confidence interval of 15.47 to 20.41 does not include zero. Regarding the *F-Ratio*, the model explains almost 213 times the variance from the empty model for the Dilomatox revenue outcome variable. Regarding the *PRE*, the model explains 81% of the variation in the empty model for the Dilomatox revenue outcome variable. In summation for

Dilomatox, advertising expenses seem to have a significant bearing on product revenues, and this model should work for our estimation purposes.

2. Model for Estimating Product Revenues from Advertising Expenses for Zoraffil

Suggested Model for Estimation $Y_i = b_0 + b_1(X_i) + e_i$

Y = Product Revenues (in millions of US Dollars)
X = Advertising Expenses (in millions of US Dollars)
b_0 = Intercept Coefficient (for product revenues when advertising expenses equal zero)
b_1 (slope) = Coefficient of Expected Change (for product revenues per every million of advertising expenses)

Zoraffil Linear Regression Model

```
Call:
lm(formula = ZorRev ~ ZorAdv, data = final_data)

Coefficients:
(Intercept)       ZorAdv
      10.38        11.50

 Analysis of Variance Table (Type III SS)
 Model: ZorRev ~ ZorAdv

                            SS df     MS      F   PRE     p
 ----- --------------- | ------- -- ------ ------ ----- -----
 Model (error reduced) |  54.450  1 54.450 18.982 .2752 .0001
 Error (from model)    | 143.429 50  2.869
 ----- --------------- | ------- -- ------ ------ ----- -----
 Total (empty model)   | 197.879 51  3.880

               2.5 %   97.5 %
(Intercept) 5.055738 15.71115
ZorAdv      6.199430 16.80483
```

$$ZorRev_i = 10.38 + 11.50(ZorAdv_i) + e_i$$

Zoraffil Linear Regression Model Assessment

The model is significant, due to a *p-value* of .0001 being far less than the required *alpha* standard of 0.05 and the *b1* 95% confidence interval of 6.2 to 16.8 does not include zero. Regarding the *F-Ratio*, the model explains almost 19 times the variance from the empty model for the Zoraffil revenue outcome variable. Regarding the *PRE*, the model explains 27.5% of the

variation in the empty model for the Zoraffil revenue outcome variable. In summation for Zoraffil, advertising expenses have some bearing on product revenues, but this model would need at least one other significant variable to work for estimation purposes.

Utilize Dilomatox Model to Estimate Product Revenue from Advertising Expense

$$DilomRev_i = 0.7432 + 17.9382(DilomAdv_i) + e_i$$

DILOMATOX – Initial and Model Marketing Budget Comparison

	Model Budget (Next Year)	Initial Forecast (Next Year)
Advertising and Marketing Spend (total)	**$64,874,280**	**$64,250,000**
Product Revenue	$1,164,471,000	$1,164,471,000
Marketing Spend as % of Revenue	5.57%	5.52%

According to the model estimation, the estimated model advertising and marketing budget was fairly close to the initial forecasted marketing and advertising budget, only a $624,280 increase.

DILOMATOX – Reduced Marketing Budget Product Revenue Estimation

	Reduced Budget (Next Year)	Current Forecast (This Year)	% Change
Advertising and Marketing Spend (total)	$53,250,000	$56,860,000	-6.3%
Product Revenue	$955,952,350	$1,058,610,000	-9.7%
Marketing Spend as % of Revenue	5.57%	5.37%	

According to the model estimation, Dilomatox would get a $3,610,000 advertising and marketing expense reduction at a potential $102,657,650 product revenue reduction, accruing a potential net loss of $99,047,650 next year.

DILOMATOX – Model Estimated Marketing Budget from Targeted Product Revenue

	Model Budget (Next Year)	Current Forecast (This Year)	% Change
Advertising and Marketing Spend (total)	**$64,874,280**	$56,860,000	+14.1%
Product Revenue	$1,164,471,000	$1,058,610,000	+10%
Marketing Spend as % of Revenue	5.57%	5.37%	

According to the model estimation, Dilomatox would get a $8,014,280 advertising and marketing expense increase with a potential $105,861,000 product revenue increase, accruing a potential net profit of $97,846,720 next year.

Summation

Currently, the marketing team is looking for ways to reduce costs associated with normal advertising strategies. Though it is an unwelcome task, given their primary responsibilities, I believe every department should engage in this type of activity periodically as a part of continuous improvement. I would very much like to thank the CFO for providing this data, and think it was revealing. It helped us understand the relationship between weekly product revenues and advertising expenses for Dilomatox and its chief competitor Zoraffil.

Regarding the relationship between weekly product revenues and advertising expenses, Dilomatox showed a significantly higher correlation (.900) than Zoraffil (.595). Regarding the linear models using product revenue as an outcome variable and advertising expense as an explanatory variable, both models showed that advertising expense was related to product revenues, but the Dilomatox model explained approximately three times more variation (81%) in product revenue than the Zoraffil model (27.5%). The *F-Ratio* for the Dilomatox model (213) was about eleven times greater than that of the Zoraffil model (19).

Dilomatox product revenues have a strong relationship with its advertising expenses, and Zoraffil product revenues have a modest relationship with its advertising expenses. There must be other significant factors that go into the Zoraffil product revenue generation, and advertising expenses only account for approximately one fourth of it. With that in mind, the idea of trying to match Dilomatox's marketing spend as a percentage of product revenue to Zoraffil leaves something to be desired (see the *DILOMATOX – Reduced Marketing Budget Product Revenue Estimation* table). Given the strong relationship between product revenues and advertising expenses with Dilomatox, it seems only logical that an appropriate increase in next year's advertising and marketing expenditure budget would do much to improve product revenue (see the *DILOMATOX - Model Estimated Marketing Budget from Targeted Product Revenue* table).