Memo on Fueling Sales at EuroPet

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Introduction:

EuroPet, an Europe-based corporation whose core business is the sale of fuel to retail customers, is suffering from fierce market competition. Because of the consistent underperformance of EuroPet's C-stores, the management begins to question the effectiveness of the company's large investments in advertising on its C-stores. This puts Blanchard, an executive who worked in the retail marketing department of the EuroPet S.A., under pressure to deliver quantitative proof of the effectiveness of the marketing campaign. If Blanchard was unable to prove that the company's return on investment of advertising had been satisfactory, the management would cut the budget for advertising permanently. This memo attempts to help Blanchard measure the effectiveness of his marketing strategies in a quantitative way and compare the rate of return found to the benchmark set by the department.

Agenda:

The memo will first summarize and explain the dataset provided by Blanchard. Then, it will go through a process of statistical testing that is required by the case as well as answering all Blanchard's questions. Also, the memo will attempt to measure the effectiveness of the advertising campaign as well as diagnose errors and verify some of the assumptions. Finally, a recommendation would be presented to Blanchard as to how he should communicate the results to his supervisor.

Overview and Background:

EuroPet S.A. is a multinational company operating gas stations in many European countries. Recently, the company is experiencing slumping sales in at the c-stores. As the case described, there are 3 different types of EuroPet c-stores: Europet Compact, which comprises 45% of all EuroPet sales, EuroPet Regular which accounts for 35% of all Europet's stores, and finally, Europet One-Stop which is the remaining of the business. Traditionally, Europet's main competitors had been supermajor energy companies such as PetroAmerica, InterOil, and RoyalScandia. More recently, other "home-branded" gas stations, operated by different supermarkets had been winning market share. Despite taking a low fuel price position similar to that of the supermarkets, EuroPet had been unable to retain its market share. This trend therefore

put a lot of questions on the effectiveness of EuroPet's advertising campaigns since some of EuroPet's competitors such as MarcheLocal and Metra hardly advertise at all. Hence, Blanchard is now urgently asked to quantitatively test the effectiveness of the marketing campaign. The way Blanchard attempts to carry out the test is to use all EuroPet's c-stores in Marseille, France, as a sample to draw inference on the actually effectiveness of the campaign. The details for testing the effectiveness are already planned out by Blanchard and the variables he collected data on are well described in the case as well, the end goal is to compare the overall benefits of advertising to the advertising costs and use that comparison to make judgement.

Analysis:

1) The memo first summarizes the variables that Blanchard collected data on:

Variable	Obs	Mean	Std. Dev.	Min	Max
week	101	26.57426	15.29859	1	52
sales	101	23063.73	2450.545	18969	28451
tv	101	41.27723	69.62383	0	225
radio	101	80.4703	99.89847	0	260
fuelvolume	101	62852.76	2327.311	56259	68549
fuelprice	101	115.5148	8.289507	101.46	133.67
temp	101	17.9505	6.503839	9.1	30.7
prec	101	11.34059	6.784898	0	30.3
holiday	101	.4653465	.5012855	0	1
visits1or2	101	5.641584	2.809031	0	12.5

2) After running a regression simply between sales and fuelvolume, one gets the following
results:

Source	SS	df	MS		Number of obs	=	101
					F(1, 99)	=	59.52
Model	225483863	1	225483863		Prob > F	=	0.0000
Residual	375033230	99	3788214.45		R-squared	=	0.3755
					Adj R-squared	=	0.3692
Total	600517094	100	6005170.94		Root MSE	=	1946.3

sales	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
fuelvolume	.6452134	.0836302	7.72	0.000	.479273	.8111537
_cons	-17489.71	5259.953	-3.33	0.001	-27926.6	-7052.822

According to the results, the relationship between sales and fuelvolume is statistically
significant.

b) and c) one can summarize the estimates as the following:

Fuel volume	56259(min)	68549(max)	62852.76(average)
Sales	21323	24950	23210
Expected sales	18809.35	26739	23055
Prediction Interval	(17640, 19978)	(25710, 27768)	(22679, 23454)

d) The results seem to suggest that 1 liter increase in average volume of fuel sold per
Europet facility tend to lead to a 0.645 euros increase in the sales, holding all other
variables constant. Certainly, at this point, it is very hard to conclude any causal
relationship.

3) Now, if one runs the regression of sales against TV and radio GRPs, one will obtain
the following:

Source	SS	df	MS		Number of obs	=	101
					F(2, 98)	=	16.72
Model	152750117	2	76375058.3		Prob > F	=	0.0000
Residual	447766977	98	4569050.79		R-squared	=	0.2544
					Adj R-squared	=	0.2391
Total	600517094	100	6005170.94		Root MSE	=	2137.5

sales	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
tv	12.19268	3.874428	3.15	0.002	4.504002	19.88135
radio	5.1953	2.700266	1.92	0.057	-.1632904	10.55389
_cons	22142.39	275.0176	80.51	0.000	21596.62	22688.15

a) As one can observe at the first glance, that both coefficients are statistically significant by setting the alpha to be 10%
b) An estimate for sales at TV=40, radio=80 is 23045.59
c) Prediction interval
d) In order to verify the effectiveness of both radio and TV, it is important to do an investment versus sales comparison. So we need to multiply our TV data by 300 and radio data by 25, since 300 and 25 are average prices for each specific unit of TV and radio respectively. So, after transforming the data, we get the following results:

Source	SS	df	MS		Number of obs	=	101
					F(2, 98)	=	16.72
Model	152750117	2	76375058.3		Prob > F	=	0.0000
Residual	447766977	98	4569050.79		R-squared	=	0.2544
					Adj R-squared	=	0.2391
Total	600517094	100	6005170.94		Root MSE	=	2137.5

sales	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
actualtv	.0406423	.0129148	3.15	0.002	.0150133	.0662712
actualradio	.207812	.1080107	1.92	0.057	-.0065316	.4221556
_cons	22142.39	275.0176	80.51	0.000	21596.62	22688.15

As expected, the statistical significance has not changed for any of the variables as one only scaled both variables by a constant. The results seem to suggest that, holding all other variables constant, 1 euro of TV ads creates only 40cents of sales and 1 euro of radio ads only creates 20 cents of sales. TV seem to be more effective than radio.

4). To address Tyler's concern, one can now run a regression with the previous 2 variables as well as temperature and get the following results:

Source	SS	df	MS		Number of obs	=	101
					F(3, 97)	=	27.23
Model	274512622	3	91504207.5		Prob > F	=	0.0000
Residual	326004471	97	3360870.84		R-squared	=	0.4571
					Adj R-squared	=	0.4403
Total	600517094	100	6005170.94		Root MSE	=	1833.3

sales	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
tv	11.2975	3.326251	3.40	0.001	4.695815	17.89919
radio	.1646305	2.462097	0.07	0.947	-4.721951	5.051212
temp	189.0806	31.41349	6.02	0.000	126.7335	251.4277
_cons	19190.06	544.2592	35.26	0.000	18109.86	20270.27

As one can see, the coefficient of radio becomes insignificant as one adds temperature as predictor variable, while the statistical significance of TV remains while the magnitude becomes slightly smaller. Although this is not a vigorous proof, Tyler's point appear to be justified. That is the effect of radio advertising is largely captured by the variations in temperature.

b) According to the following table, TV advertising still appears to be profitable given the mf is still 3.

The net impact of ads on sales would be 3*11.2975/300=1.13, which is greater than 1, this implies that every euro of ads investment generates and overall of 1.13 euros in sales.

Source	SS	df	MS		Number of obs	=	101
					F(2, 98)	=	41.26
Model	274497596	2	137248798		Prob > F	=	0.0000
Residual	326019498	98	3326729.57		R-squared	=	0.4571
					Adj R-squared	=	0.4460
Total	600517094	100	6005170.94		Root MSE	=	1823.9

sales	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
actualtv	.038072	.0091539	4.16	0.000	.0199065	.0562376
temp	189.7936	29.39769	6.46	0.000	131.4549	248.1324
_cons	19185.39	537.0023	35.73	0.000	18119.73	20251.05

c) In order for the ads to be profitable, the coefficient of TV has to be greater than 10.

5)

a) By adding all variables in the dataset, one can obtain the following regression results:

Source	SS	df	MS			
Model	475986887	7	67998126.7			
Residual	124530207	93	1339034.48			
Total	600517094	100	6005170.94			

				Number of obs	=	101
				F(7, 93)	=	50.78
				Prob > F	=	0.0000
				R-squared	=	0.7926
				Adj R-squared	=	0.7770
				Root MSE	=	1157.2

sales	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
actualtv	.0193464	.0074538	2.60	0.011	.0045446	.0341483
actualradio	.0395573	.0721512	0.55	0.585	-.1037207	.1828354
fuelprice	94.63102	16.04708	5.90	0.000	62.76469	126.4973
temp	102.9219	22.57573	4.56	0.000	58.091	147.7528
prec	-157.0899	19.28362	-8.15	0.000	-195.3833	-118.7964
holiday	973.9246	253.7414	3.84	0.000	470.0446	1477.805
visits1or2	-134.004	46.03008	-2.91	0.005	-225.4107	-42.59743
_cons	12050.08	1975.985	6.10	0.000	8126.166	15973.99

Final equation: Sales = 12050+94.63Fuelprice+102.92Temp-157.09precipitation+973.92*holiday-134visits

To interpret this final equation: one would say: holding all other variables constant,

- 1 euro increase in fuel price leads to 94.63 euros increase in sales
- 1 degree increase in temperature leads to 102.92 euros increase in sales
- 1 millimeter increase in precipitation leads to 157.09 decrease in sales
- If the week contains holidays, the week would generate 973.92 euros more sales than in weeks where there is no holidays
- 1 more rating in survey response leads to a decrease of 134 euros in sales.

One does not include TV and radio ads in the equation since they are not statistically significant given the 10% requirement. Therefore, if one uses this equation, TV and radio ads are not effective. Nevertheless, there's problem with this equation. The variable visits is certainly a variable one needs to question on. First, this variable is generate through survey, which is already subject to many possible bias. Secondly, the sign of the variable appears to be wrong, more visits should lead to more sales, not less. Therefore, one should run a regression without visits. Furthermore, the holiday variable is not very precise since it is a dummy variable that would take the value 1 if there was at least one day of public or school holiday, and 0 otherwise. However, it is hard to classify holidays as some are more important than the others. Also, a long weekend with a free Monday is certainly different than a spring break for the entire week. For all these reasons, one can exclude holiday from the regression as well, just for now, and obtain the following results:

b)

Source	SS	df	MS		Number of obs	=	101
					F(5, 95)	=	53.60
Model	443348487	5	88669697.5		Prob > F	=	0.0000
Residual	157168606	95	1654406.38		R-squared	=	0.7383
					Adj R-squared	=	0.7245
Total	600517094	100	6005170.94		Root MSE	=	1286.2

sales	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
actualtv	.0241759	.0081524	2.97	0.004	.0079914	.0403605
actualradio	-.067871	.0760727	-0.89	0.375	-.2188944	.0831524
fuelprice	107.1787	17.16494	6.24	0.000	73.10199	141.2554
temp	146.2489	23.11486	6.33	0.000	100.3601	192.1377
prec	-175.852	20.87838	-8.42	0.000	-217.3009	-134.4032
_cons	9889.203	2015.379	4.91	0.000	5888.171	13890.24

Now as one can see, the coefficient of TV becomes significant again, however, the number is too small to be profitable, notice that the "actualtv" variable is (tv/300)

6) Now, in order to clarify Blanchard's concerns, one can add holiday back into the regression and obtain the following results:

Source	SS	df	MS		Number of obs	=	101
					F(6, 94)	=	53.57
Model	464638239	6	77439706.5		Prob > F	=	0.0000
Residual	135878855	94	1445519.73		R-squared	=	0.7737
					Adj R-squared	=	0.7593
Total	600517094	100	6005170.94		Root MSE	=	1202.3

sales	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
actualtv	.018909	.007743	2.44	0.016	.0035352	.0342829
actualradio	-.0141586	.0724725	-0.20	0.846	-.1580545	.1297372
fuelprice	107.3331	16.04481	6.69	0.000	75.47578	139.1905
temp	119.0435	22.73959	5.24	0.000	73.89347	164.1935
prec	-168.6587	19.60567	-8.60	0.000	-207.5862	-129.7311
holiday	1010.525	263.3138	3.84	0.000	487.709	1533.341
_cons	9765.059	1884.133	5.18	0.000	6024.068	13506.05

The results suggest holiday does have a significant influence on the weekly sales, however, this is not a vigorous proof of the causal relationship between holiday and sales.

Conclusion:

Brief, after running the procedure required by Blanchard, one arrives at very inconclusive results regarding the effectiveness of EuroPet's advertising campaign. However, if one assumes that the variables that Blanchard has collected were all very important, one could say the effectiveness of ads is statistically significant, however not profitable since they are not sufficient to make a positive return on investment.