Doodle study solution

Adventure Works Cycles – Analysis of drivers of decline in Profits

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Data Exploration : Main data sets :

Checking variable description, values & data types

S.No.	Variable Name	Total Count	Having null values	Data Type
1	SalesOrderNumber	41,884	non-null	object
2	OrderDate	41,884	non-null	datetime64[ns]
3	DueDate	41,884	non-null	object
4	ShipDate	41,884	non-null	object
5	Sales_Person	41,884	non-null	object
6	Sales_Region	41,884	non-null	object
7	Sales_Province	41,884	non-null	object
8	Sales_City	41,884	non-null	object
9	Sales_Postal_Code	41,884	non-null	int64
10	Customer_Code	41,884	non-null	object
11	Customer_Name	41,884	non-null	object
12	Customer_Region	41,884	non-null	object
13	Customer_Province	41,884	non-null	object
14	Customer_City	41,884	non-null	object
15	Customer_Postal_Code	41,884	non-null	object
16	LineItem_Id	41,884	non-null	int64
17	Product_Category	41,884	non-null	object
18	Product_Sub_Category	41,884	non-null	object
19	Product_Name	41,884	non-null	object
20	Product_Code	41,884	non-null	object
21	Unit_Cost	41,884	non-null	float64
22	UnitPrice	41,884	non-null	float64
23	UnitPriceDiscount	41,884	non-null	float64
24	OrderQty	41,884	non-null	int64
25	Unit_Freight_Cost	41,884	non-null	float64
26	Overall_cost	41,884	non-null	float64
27	Overall_freight_cost	41,884	non-null	float64

Feature Engineering & Other calculations:

- **Calculation of additional variables –**

  o Cost = Unit Cost * Order Qty

  o Freight cost = Unit Freight Cost * Order Qty

  o Sales Price = Unit Price * Order Qty

  o Discount = Unit Price Discount * Order Qty

  o Total cost = Cost + Freight cost

  o Total Revenue = Sales Price – Overall discount

  o Profit = Sales Price – Total cost

- **Aggregation of quantitative variables as per order month & year**

- **Verification of duplicates in dataset(No duplicates found)**

- **Timeline of data :** 07/2005 to 06/2008

Objective: Analyze sales data to identify drivers of the declining profits in recent few months.

Month on month Profit
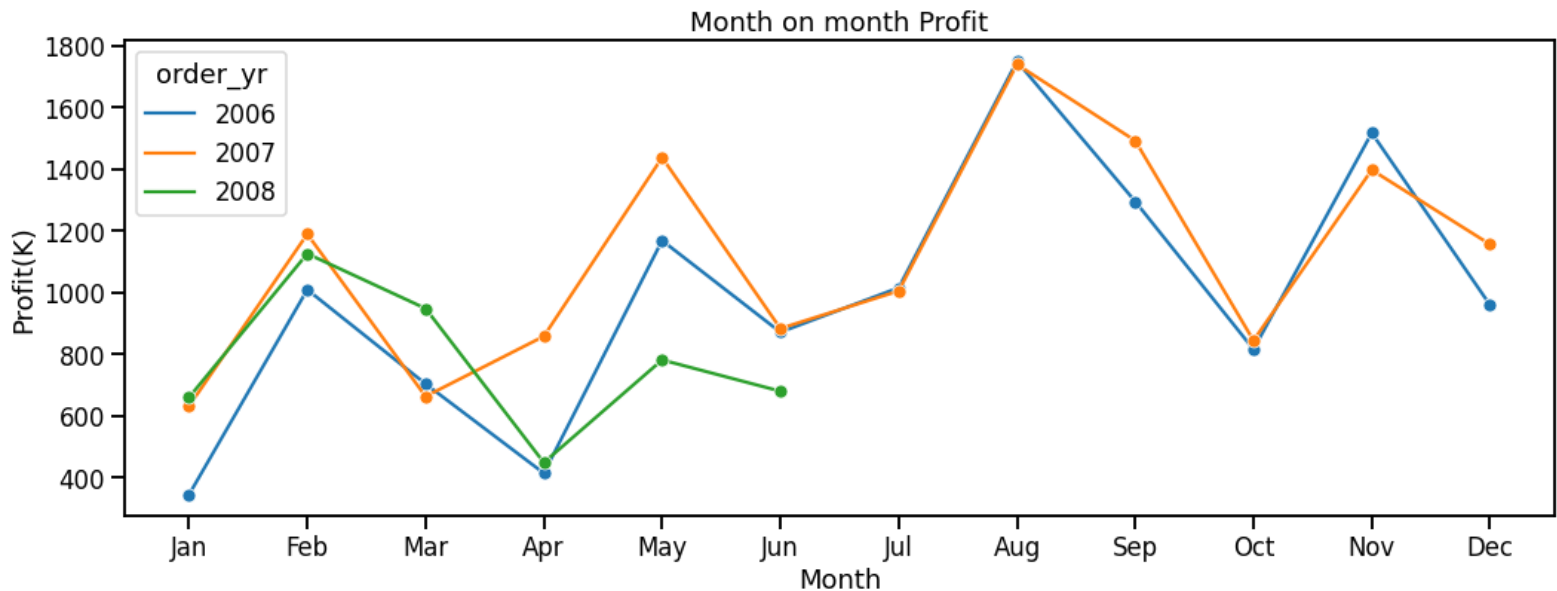
Month	Profit (Thousand)		Growth %
	2007	2008	
Jan	631.16	659.54	4.50%
Feb	1,188.86	1,125.47	-5.33%
Mar	662.53	947.74	43.05%
Apr	857.62	448.09	-47.75%
May	1,437.15	780.90	-45.66%
Jun	882.79	679.47	-23.03%
Total	5,660.12	4,641.21	-18.00%

Table 1.1

	Year (Jan to Jun)		
	2006	2007	2008
Profit (K)	4,508.6	5,660.1	4,641.2
Growth (%)	-	25.5%	-18.0%

Table 1.2

- Above chart shows month on month profit values for year – (2006, 2007 & 2008).
- In latest year i.e. 2008, data is available till Jun month only. (Green line in line chart)
- Profit for the months in 2008 is declining compared to 2007.
- If we compare Q1, Q2 of 2008 (Jan`08 to Jun`08), there is overall decline of **18%** in Profits.
- However, In 2007, for Q1,Q2 overall growth was **25.5%.**

- There is heavy decline in profits in Apr, May, Jun`08 (Q2) particularly. Hence, a further **deep dive analysis is performed on Q2`08** to find drivers of this decline.
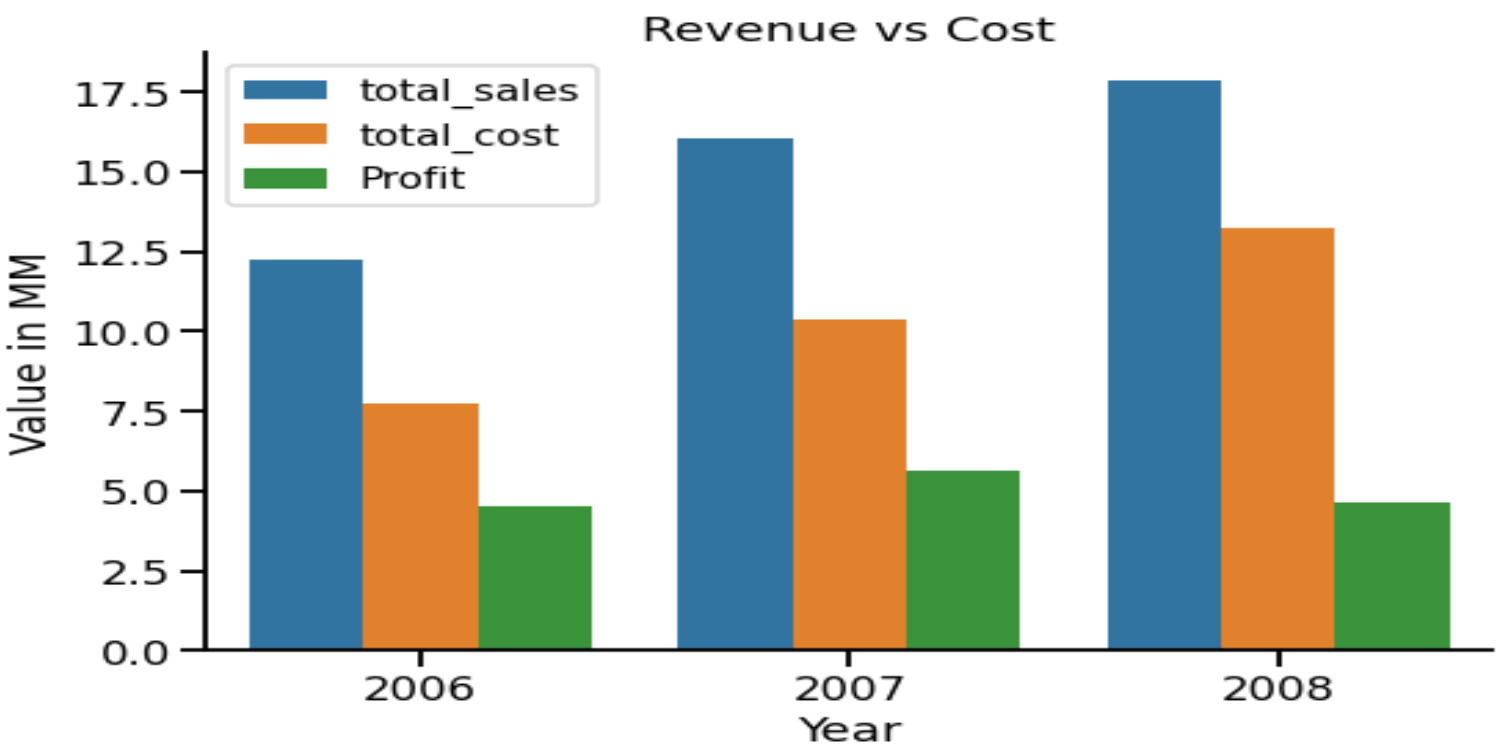
Profit Trends

101MM	67MM	34MM	-18%
Total Revenue	Total Cost	Total Profit	Growth
(Jul`05 to jun`08)	(Jul`05 to jun`08)	(Jul`05 to jun`08)	(`08 vs `07; Jan to Jun)

Comparing year on year Sales, Cost & profit for Q1, Q2 :

Revenue vs Cost

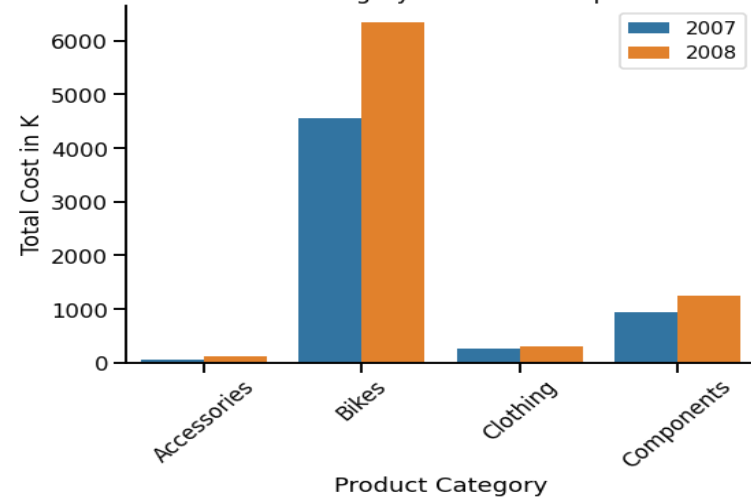|	In Millions (Jan to June)		
Year	Total Sales	Total Cost	Profit
2006	12.23	7.72	4.51
2007	16.06	10.40	5.66
2008	17.86	13.22	4.64

- There is growth in sales from `07 to `08 by 11.2% (from 16 MM to 17.86 MM).
- However, significant **increase of cost in year '08** is causing the decline in overall profit.

Comparison of Q2 performance : 2007 Vs 2008 as per Product categories
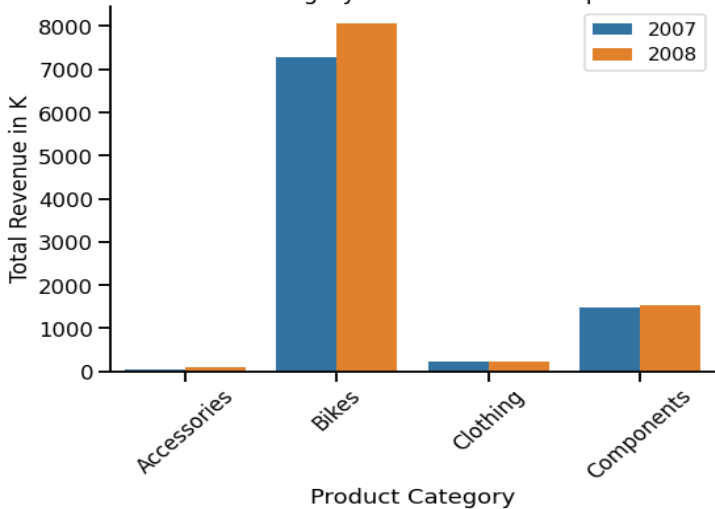(Apr - Jun'17) Vs (Apr - Jun'18)

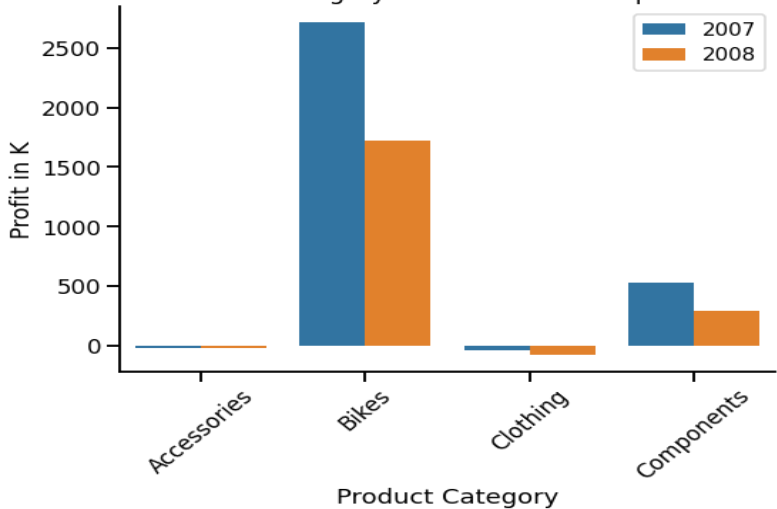## Total Cost

Product Category wise cost comparison

Product Category	Q2 2007 (K)	Q2 2008 (K)	Diff in %
Accessories	61.76	123.97	101%
Bikes	4566.2	6342.45	39%
Clothing	263.50	312.10	18%
Components	948.47	1241.67	31%

Total Revenue

Product Category wise Revenue comparison

Product Category	Q2 2007 (K)	Q2 2008(K)	Diff in %
Accessories	39.73	100.51	153%
Bikes	7277.37	8061.08	11%
Clothing	226.75	233.84	3%
Components	1473.68	1533.22	4%

Profits

Product Category wise Revenue comparison

Product Category	Q2 2007 (K)	Q2 2008 (K)	Diff in %
Accessories	-22.02	-23.45	-6%
Bikes	2711.12	1718.63	-37%
Clothing	-36.75	-78.26	-113%
Components	525.21	291.54	-44%

- Increase in total cost in Q2 2008 for all the product categories. Highest surge observed in product category – Accessories.

- Highest loss observed in Product category clothing – 113% in Q2'2018 as compared to Q2'2017.

Comparison of Q2 performance : 2007 Vs 2008 as per Product sub categories
(Apr - Jun'17) Vs (Apr - Jun'18)

Products sold in Q2 2008 as well as Q2 2007

Product Category	Product Sub Category	Profits		Growth/reduction in Profits
		Q2 2007	Q2 2008	
Accessories	Helmets	-12,751.71	-13,432.64	-5%
Bikes	Mountain Bikes	12,57,055.70	7,48,321.64	-40%
Bikes	Road Bikes	14,54,069.95	5,03,790.69	-65%
Clothing	Caps	-10,584.00	-11,742.34	11%
Clothing	Gloves	-29,048.51	-8,605.36	-70%
Clothing	Jerseys	-16,349.76	-47,491.68	-190%
Clothing	Shorts	110.87	4,143.88	3638%
Components	Handlebars	1,637.45	310.62	-81%
Components	Mountain Frames	2,43,271.75	1,65,386.97	-32%
Components	Road Frames	1,93,575.45	56,330.45	-71%
Total		**31,02,950.27**	**18,38,941.79**	**-41%**

The above numbers indicate that the products which were sold in Q2 2008 are having lower profits as compared to Q2 2007 for most of the categories (Except Clothing - shorts). Overall, there is a reduction of 41% in the profits in Q2 2008 as compared to Q2 2007.

Product Category	Product Sub Category	Profits
Accessories	Locks	-4,100.77
Accessories	Pumps	-5,173.66
Clothing	Bib-Shorts	10,158.05
Clothing	Tights	8,962.78
Components	Forks	8,620.06
Components	Headsets	3,496.62
Components	Wheels	74,612.49
Total		96,575.57

Also, there are 7 product subcategories which have been discontinued in Q2 2008 leading to the elimination of profits of 96,575.

Comparison of Q2 performance : 2007 Vs 2008 as per Sales Regions
(Apr - Jun'17) Vs (Apr - Jun'18)

Total Cost :

Sales Region	Q2 2007	Q2 2008	Difference
France	355843.399	959390.71	170%
United States	5484152.94	7060820.36	29%

Total Revenue :

Sales Region	Q2 2007	Q2 2008	Difference
France	548753.235	1170633.93	113%
United States	8468805.87	8758037.81	3%

Profits:

Sales Region	Q2 2007	Q2 2008	Difference
France	192909.836	211243.22	10%
United States	2984652.92	1697217.46	-43%

- Company is able to make profits in France despite of significant increase in cost in Q2'2018.

- 43% loss observed in United states in Q2'2018.

Comparison of Q2 performance : 2007 Vs 2008 as per Sales Regions, Province, City Postal codes and Sales Person
(Apr - Jun'17) Vs (Apr - Jun'18)

Profits:

Sales Region	Sales_Province	Sales_City	Sales_Postal_Code	Sales Person	Q2 2007	Q2 2008	Difference	Difference in %
France	Gironde	Bordeaux	33000	Ranjit Varkey Chudukatil	192909.8	211243.2	18333.4	10%
United States	California	San Francisco	94109	Shu Ito	326176.9	172026.9	-154150.0	-47%
United States	Massachusetts	Cambridge	2139	Tete Mensa-Annan	161978.3	129942.4	-32035.9	-20%
United States	Michigan	Detroit	48226	Michael Blythe	626627.8	280312.5	-346315.3	-55%
United States	Minnesota	Duluth	55802	Jillian Carson	665528.5	243371.3	-422157.3	-63%
United States	Oregon	Portland	97205	Pamela Ansman-Wolfe	56128.8	132030.9	75902.1	135%
United States	Tennessee	Memphis	38103	Tsvi Reiter	345224.2	198604.9	-146619.3	-42%
United States	Utah	Nevada	84407	Linda Mitchell	609133.6	350356.3	-258777.3	-42%
United States	Washington	Bellevue	98004	David Campbell	165106.7	127599.9	-37506.8	-23%
United States	Washington	Redmond	98052	Stephen Jiang	28748.1	62972.4	34224.3	119%

- Only 1 salesperson allocated to France region Vs 9 salesperson for United States.

Top/bottom performer as per sales region –

- Highest profit observed in United states in Portland (97502) lead the salesperson - Pamela Ansman-Wolfe (135%) in Q2 2018.

- Highest loss observed in United states in Duluth (55802) by the salesperson - Jillian Carson (-63%) in Q2 2018.

Top Customer performance comparison:

Customer Name	Profits		Difference in %
	Q2 2007	Q2 2008	
Sheet Metal Manufacturing	57,531	15,359	-73.30%
Mail-Order Outlet	56,899	9,147	-83.92%
Outdoor Equipment Store	55,962	17,357	-68.98%
Casual Bicycle Store	54,660	14,542	-73.40%
Fitness Toy Store	53,129	13,165	-75.22%

- In above table, you see comparison between Q2 profits of top customers by profit in year `07 .
- For 'Sheetal Metal Manufacturing', profit dropped by 73% in Q2`08 from Q2`07; Similarly for 'Mail-Order Outlet', the drop is whooping 83%
- These are the top 5 profit contributors are declining significantly in Q2`08.
- Discussion with these customers or related sales representative would help find reasons behind decline and scope for re-bound in remaining part of the year.

Highlights & Conclusion

- There is overall decline of 18% in year 2008 compared to 2007 in Jan to Jun duration.

- Significant decline in month of Apr, May & Jun of `08 (Q2).

- Significant jump in the cost for year `08, potentially causing the decline in profits; Product category – 'Accessories' has highest surge in cost (101%).

- Sub product – 'Jersey' has the highest decline in profits (-190%).

- Highest decline (-63%) is seen under sales person – 'Jillian Carson'.

- France is a profitable country with only one sales person managing the sales, thus there is a scope for expanding the sales operations in France.

- Further research in the Product, sub-product type, Region, Province where profit decline is seen along with discussion with the concerned sales managers may help get the performance up in coming months.