INTRO

This document serves as a complement to the *AdventureWorks_sql_project_queries.sql* file which includes all the code for queries written on the data. The goal is to provide screenshots of query output as a way of showing that the code works, and adding brief comments on the output itself where I see fit. If anyone is reading this, thank you for taking the time!

August 2025 Update: Visualizations using Power BI added where necessary for ease of interpretability from output and additional commentary / business implications added as well

A note on the data:

This Data is from the Microsoft AdventureWorks database and contains data on a bike store with the following tables:

- Calendar
- Customers
- Products
- Product Categories
- Product Subcategories
- Sales (From 2020, 2021 and 2022)
- Returns Data (2020, 2021, 2022
- Territories

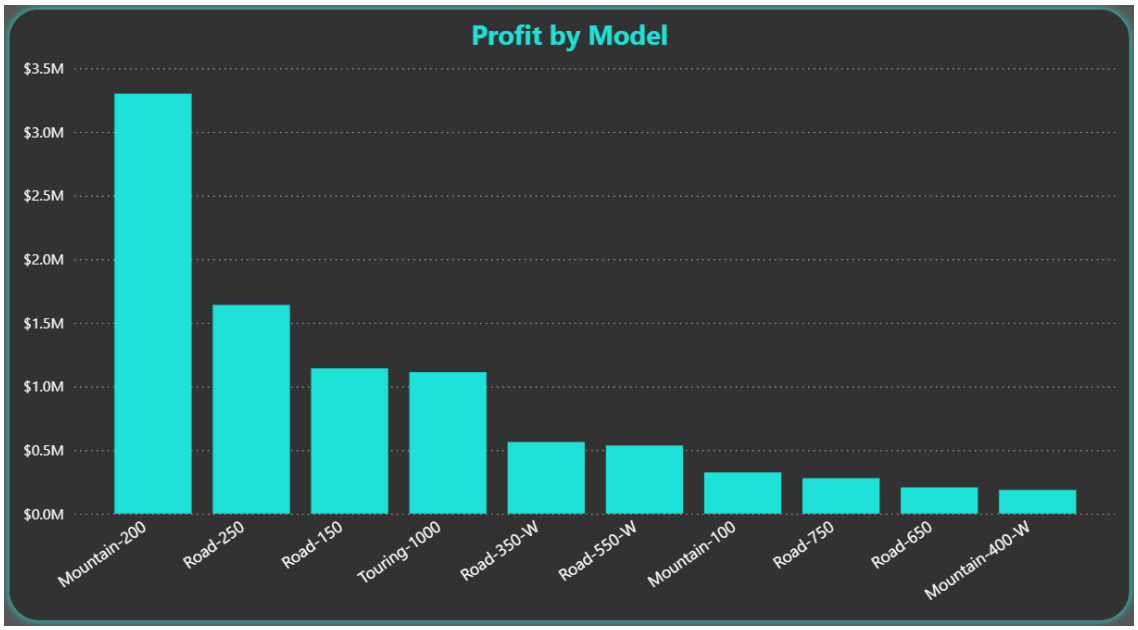
This project focuses on the answering of questions that require more complex queries. Though some may be more general, my analyses are very adaptable to the hypothetical client's needs and to more specific questions. Comments and conclusions are also limited to what can be inferred from the data

Questions, Output and Comments:

1. Top 10 Products by Total Profit

	model_name character varying (50)	total_profit text	profit_ranking bigint
1	Mountain-200	3,301,095.68	1
2	Road-250	1,640,671.19	2
3	Road-150	1,142,464.35	3
4	Touring-1000	1,112,328.88	4
5	Road-350-W	563,435.28	5
6	Road-550-W	536,122.51	6
7	Mountain-100	324,534.14	7
8	Road-750	279,196.05	8
9	Road-650	206,457.27	9
10	Mountain-400-W	186,396.28	10

Visualized:

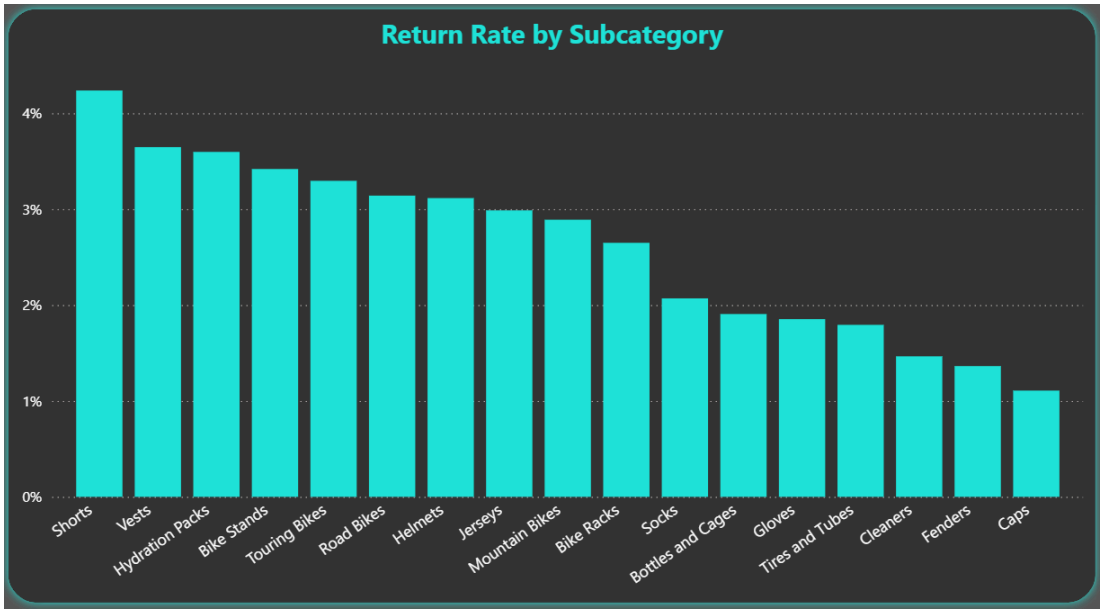


The Mountain-200 Model far exceeds the rest in terms of profit, with the Road-XXX models being a popular choice as well throughout

2. Return Rate by Product Subcategory

	subcategory_name character varying (50)	return_rate text
1	Shorts	4.237%
2	Vests	3.647%
3	Hydration Packs	3.597%
4	Bike Stands	3.419%
5	Touring Bikes	3.296%
6	Road Bikes	3.141%
7	Helmets	3.116%
8	Jerseys	2.987%
9	Mountain Bikes	2.890%
10	Bike Racks	2.649%
11	Socks	2.070%
12	Bottles and Cages	1.907%
13	Gloves	1.853%
14	Tires and Tubes	1.794%
15	Cleaners	1.465%
16	Fenders	1.364%
17	Caps	1.108%

Visual:



Shorts are returned most often as people most likely order the wrong size and replace them. A google search will indicate that bike store return rates vary from 8% to 10% (and between 20-30% for e-commerce in general) so in comparison to that, AdventureWorks seems to be doing quite well.

3. **For each Country and Region, compute Total Sales, Number of (unique) customers and Average Order Quantity (Output for the follow-up query which includes output for the original query and sales per customer):**

	country character varying (50)	region character varying (50)	total_sales text	unique_customers text	avg_order_quantity text	sales_per_customer text
1	Australia	Australia	7,416,456.20	3,480	1.45	2,131.17
2	Canada	Canada	1,769,245.81	1,499	1.58	1,180.28
3	France	France	2,362,643.32	1,705	1.50	1,385.71
4	Germany	Germany	2,524,679.97	1,675	1.50	1,507.27
5	United Kingdom	United Kingdom	2,902,562.09	1,822	1.51	1,593.06
6	United States	Central	3,143.06	8	1.50	392.88
7	United States	Northeast	6,401.57	8	1.48	800.20
8	United States	Northwest	3,095,074.47	3,075	1.51	1,006.53
9	United States	Southeast	11,585.62	10	1.44	1,158.56
10	United States	Southwest	4,822,794.70	4,134	1.50	1,166.62

Visual (Matrix was the best way to present quantitative metrics of varying scales):

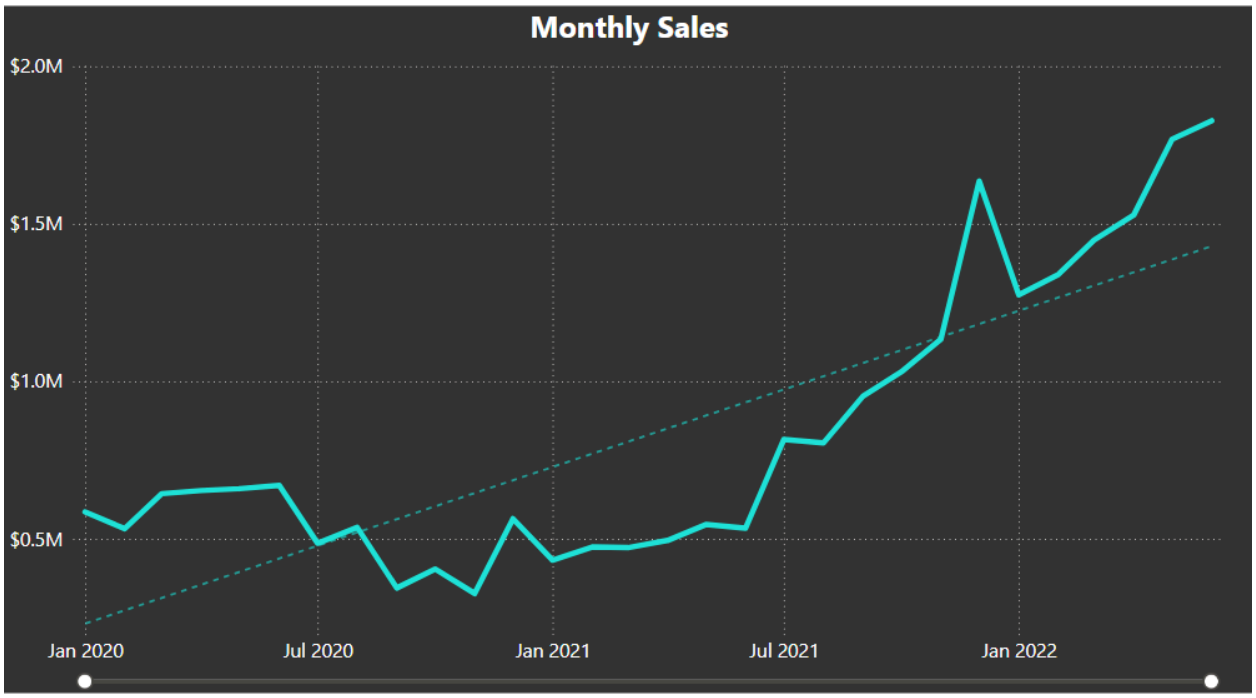
Region	Total Revenue	Total Customers	Average Revenue Per Customer	Avg Order Quantity
Australia	$7,416,456	3,480	$2,131.17	1.45
Southwest	$4,822,795	4,134	$1,166.62	1.50
Northwest	$3,095,074	3,075	$1,006.53	1.51
United Kingdom	$2,902,562	1,822	$1,593.06	1.51
Germany	$2,524,680	1,675	$1,507.27	1.50
France	$2,362,643	1,705	$1,385.71	1.50
Canada	$1,769,246	1,499	$1,180.28	1.58
Southeast	$11,586	10	$1,158.56	1.44
Northeast	$6,402	8	$800.20	1.48
Central	$3,143	8	$392.88	1.50
Total	**$24,914,587**	**17,416**	**$1,430.56**	**1.50**

An average order quantity lingering around 1.5 suggests that clients' purchases likely include either just an accessory or bike, or a bike accompanied by an attachment or other accessory. **Australia** being at the top of sales results from having the second most customers and the **highest sales per customer at $2,131.17**. Sales_per_customer could potentially be explained by factors such as the average income of customers in those countries and regions as well as their spending habits (segmentation is done in a later question). There are external

factors outside of this data that could also explain it such as potentially better marketing campaigns, or varying market demand for bikes in different regions.

4. Monthly Sales Trends with Year-Over-Year Growth:

	year integer	month_name character varying (15)	month_sales text	prior_year integer	prior_year_month_sales text	yoy_pct_change text
1	2022	June	1,826,987.14	2021	533,824.98	242.24%
2	2022	May	1,768,432.51	2021	545,534.74	224.16%
3	2022	April	1,527,813.72	2021	494,957.42	208.68%
4	2022	March	1,448,596.12	2021	471,961.88	206.93%
5	2022	February	1,339,241.29	2021	474,162.79	182.44%
6	2022	January	1,274,378.67	2021	432,425.74	194.70%
7	2021	December	1,635,308.80	2020	563,761.53	190.07%
8	2021	November	1,133,913.05	2020	326,611.15	247.18%
9	2021	October	1,029,821.05	2020	404,276.60	154.73%
10	2021	September	952,743.49	2020	344,062.87	176.91%
11	2021	August	804,193.39	2020	536,452.82	49.91%
12	2021	July	815,356.47	2020	486,115.01	67.73%
13	2021	June	533,824.98	2020	669,988.67	-20.32%
14	2021	May	545,534.74	2020	659,325.90	-17.26%
15	2021	April	494,957.42	2020	653,364.04	-24.24%
16	2021	March	471,961.88	2020	643,436.10	-26.65%
17	2021	February	474,162.79	2020	532,226.25	-10.91%
18	2021	January	432,425.74	2020	585,312.65	-26.12%



I don't have enough data or information to be able to explain the drastic fall in sales from 2020 to 2021 and subsequent rise going into 2022, but a fair assumption is that COVID-19 is the culprit.

5. Customer Lifetime Value Segmentation (Top 10% as top-tier, Next 40% as mid-tier, bottom 50% as lower-tier)

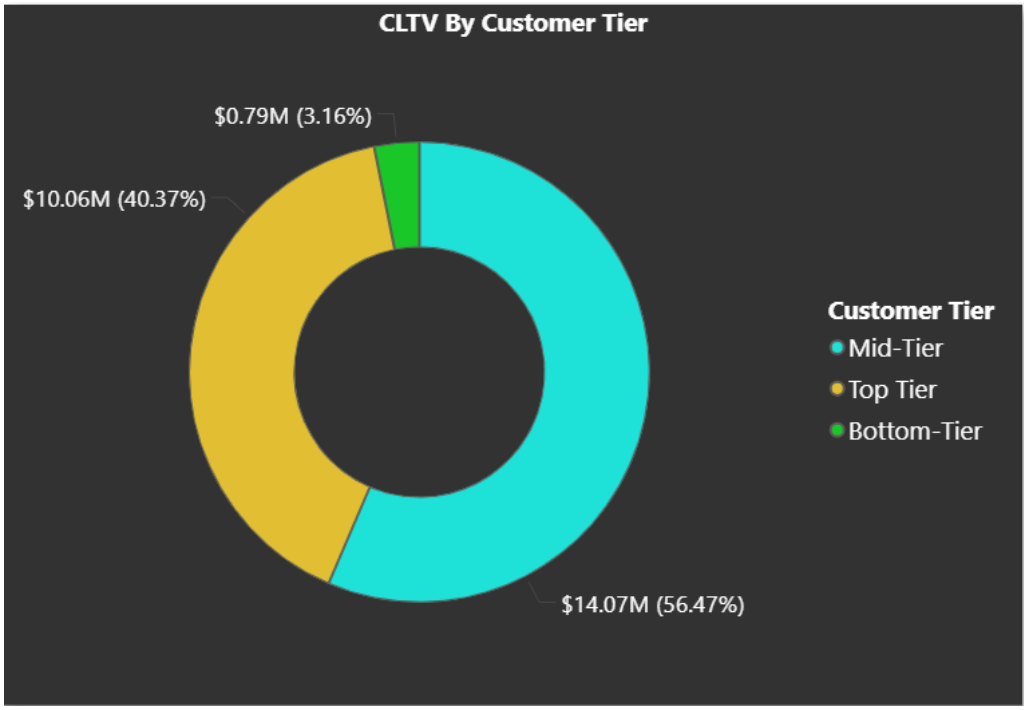
	customer_name character varying	customer_lifetime_value text	ltv_ranking bigint	customer_tier text	total_ltv_pct_contribution text
1	Jordan Turner	15,570.81	1	Top Tier	0.06%
2	Maurice Shan	12,407.95	2	Top Tier	0.05%
3	Janet Munoz	12,015.40	3	Top Tier	0.05%
4	Lisa Cai	11,330.45	4	Top Tier	0.05%
5	Lacey Zheng	11,085.75	5	Top Tier	0.04%
6	Franklin Xu	10,863.44	6	Top Tier	0.04%
7	Larry Munoz	10,852.03	7	Top Tier	0.04%
8	Kate Anand	10,436.51	8	Top Tier	0.04%
9	Larry Vazquez	10,394.98	9	Top Tier	0.04%
10	Ariana Gray	10,391.43	10	Top Tier	0.04%
11	Clarence Gao	10,331.73	11	Top Tier	0.04%
12	Aaron Wright	10,329.23	12	Top Tier	0.04%
13	Ethan Bryant	10,308.52	13	Top Tier	0.04%

From AdventureWorks' perspective, top-tier customers should be well-taken care of and if they don't make any purchases for a certain amount of time, maybe sending them a little promo code or coupon would be a good idea, or conducting consumer interviews to get feedback from them on what they like and dislike about products, and what new products could be offered that could improve their biking experience while further increasing revenue.

Output to follow-up query (per-tier contribution to revenue, number of customers in each tier)

	customer_tier text	total_ltv text	pct_of_revenue text	customers_in_tier text	ltv_per_customer text
1	Mid-Tier	14,068,959.55	56.47%	6,938.00	2,027.81
2	Top Tier	10,057,524.24	40.37%	1,735.00	5,796.84
3	Bottom-Tier	788,101.27	3.16%	8,670.00	90.90

Visual on next page:



Mid-Tier Customers are the highest contributors to company revenue. This statistic is subject to change based on how the tiers are determined, as if the top-tier were to consist of the customers in the highest 20% in terms of lifetime value, it would become the top revenue-contributing group. The top 10% of customers with regards to lifetime value do have a significantly higher LTV per customer compared to the mid and bottom tiers (again, subject to change based on segmentation approach), and the retention of these customers is paramount to the company's success. Given the LTV per bottom-tier, it is very likely that they stick to purchasing accessories and such rather than the pricier product line of bikes.

6. Top 5 Products with Longest Average Lead Time

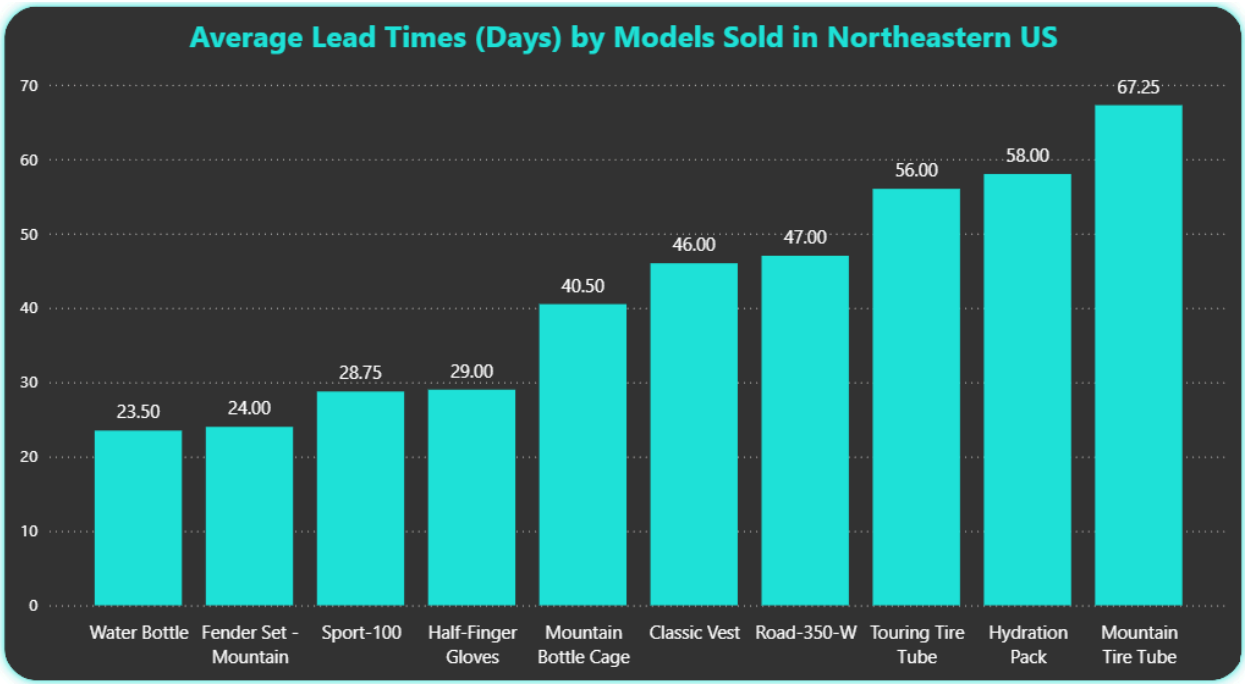
	model_name character varying (50)	avg_lead_time_days numeric	diff_from_avg_in_days numeric	lead_time_rank bigint
1	All-Purpose Bike Stand	70.95	3.60	1
2	Touring-3000	69.99	2.64	2
3	Bike Wash	68.69	1.34	3
4	ML Mountain Tire	68.69	1.34	3
5	Mountain Tire Tube	68.68	1.33	4
6	Touring-2000	68.34	0.99	5

It is worth noting that the fastest (average) lead time is about 65 days, so not a huge difference compared to the slowest lead times. There will be more variation in lead times if we look at individual products and not an aggregation (done next for the Northeast US).

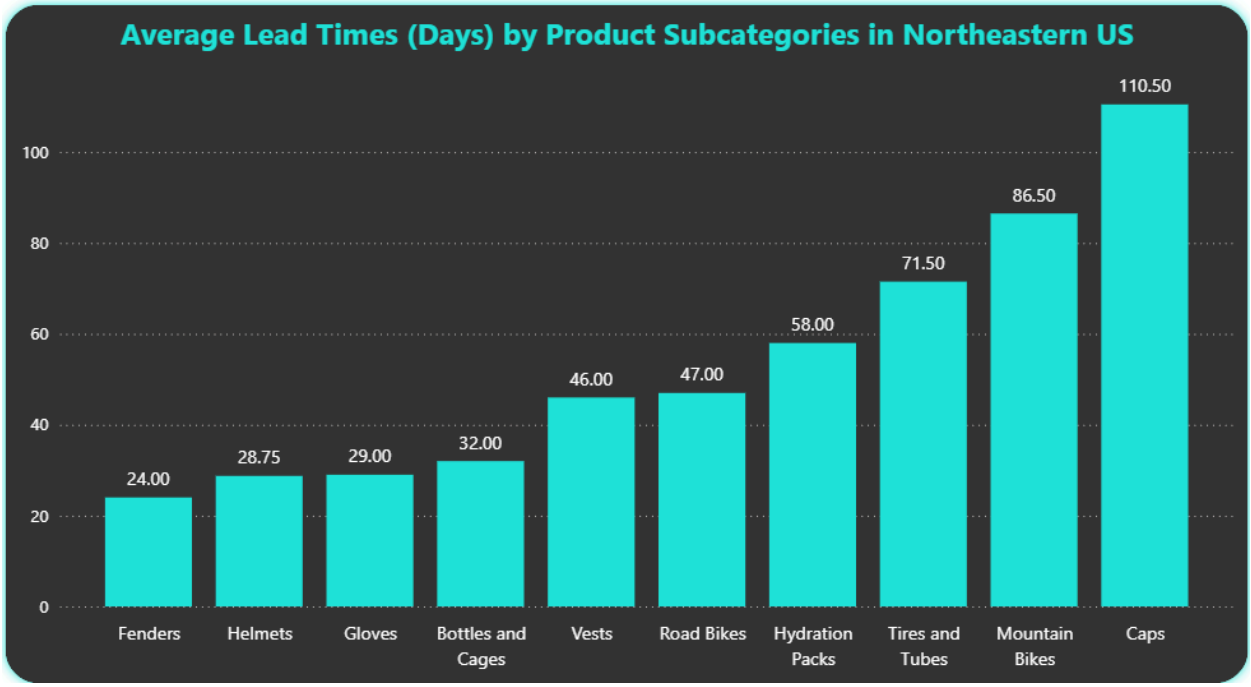
Overall Average Lead Time per Location:

	sales_territory_key [PK] integer	country character varying (50)	region character varying (50)	avg_overall_lead_time numeric
1	2	United States	Northeast	57.63
2	5	United States	Southeast	63.50
3	6	Canada	Canada	66.83
4	7	France	France	66.84
5	8	Germany	Germany	67.14
6	9	Australia	Australia	67.19
7	10	United Kingdom	United Kingdom	67.43
8	1	United States	Northwest	67.71
9	4	United States	Southwest	67.87
10	3	United States	Central	68.45

Since the Notheast US has a fastest overall average lead time, let's look at its products with the fastest turnover on average (Top 10, next page):



By Subcategory:



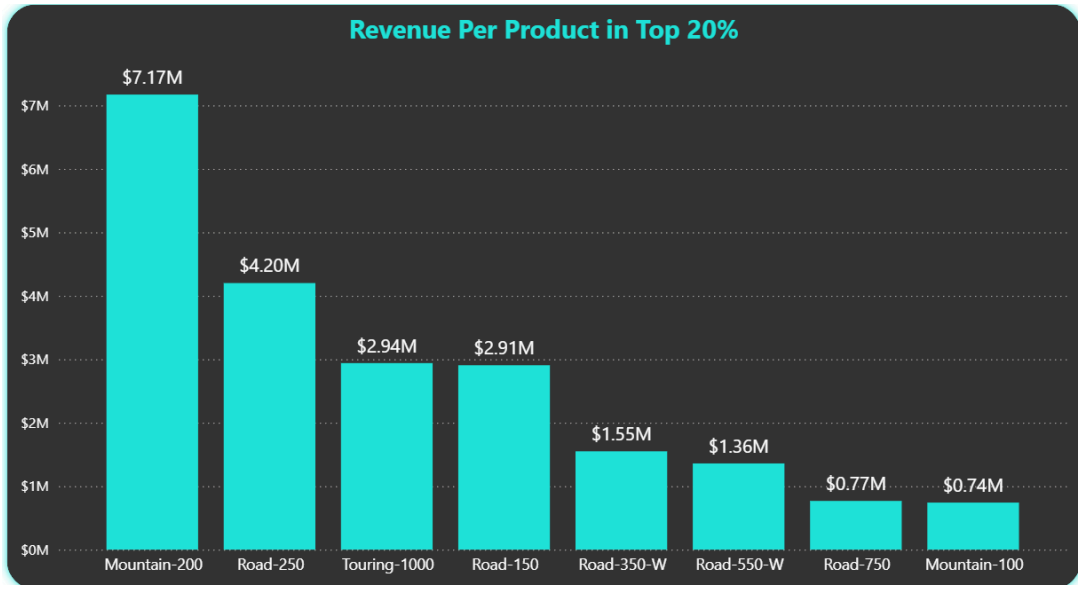
As we can see above (looking more generally at subcategories), bike accessories unsurprisingly have a faster turnover rate than the bikes themselves. This must be taken into account when managing supply chains and flow of inventory to each location. For example, in the Northeastern US, accessories such as helmets will be needed more often than things such as caps. The same could be done for territories that bring in more revenue such as Australia.

7. Contribution of Top Products to Total Revenue (Pareto Analysis) In other words, seeing if top 20% of products contribute to ~80% of revenue:

	top_20_pct_revenue text	total_revenue text	top_20_pct_contribution text
1	21,634,561.40	24,914,586.82	86.83%

The top 20% of products contributing to 86.83% of revenue confirms the pareto principle. For reference, here are the top 20% themselves along with their subcategories:

	model_name character varying (50)	subcategory_name character varying (50)	revenue text	pctile_group integer
1	Mountain-200	Mountain Bikes	7,170,946.50	1
2	Road-250	Road Bikes	4,200,816.75	1
3	Touring-1000	Touring Bikes	2,939,558.31	1
4	Road-150	Road Bikes	2,905,555.24	1
5	Road-350-W	Road Bikes	1,549,601.89	1
6	Road-550-W	Road Bikes	1,358,594.13	1
7	Road-750	Road Bikes	767,865.78	1
8	Mountain-100	Mountain Bikes	741,622.81	1



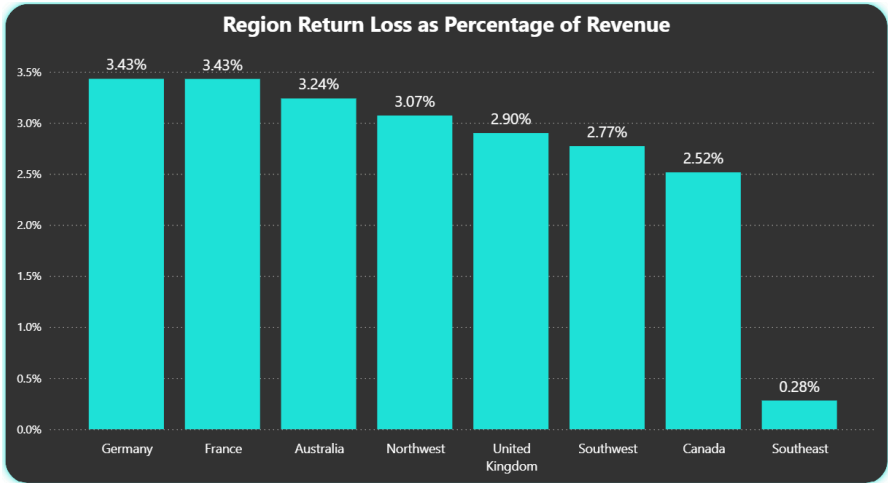
No surprise that the top 20% of products are all bikes. Effectively managing the supply chain of these and getting them to all the locations where they need to be in time (could see what locations sell the most) is crucial. Also, either developing

new models or combining features of a few different bikes into one is something to consider as it could generate another significant source of revenue for the company. Customer reviews, feedback, competitor company bikes are all good sources of inspiration to develop this product line.

8. Sales Loss from Returns by Territory

	country character varying (50)	region character varying (50)	return_losses numeric
1	Australia	Australia	240180.46
2	United States	Southwest	133684.93
3	United States	Northwest	95059.68
4	Germany	Germany	86615.51
5	United Kingdom	United Kingdom	84167.38
6	France	France	81035.01
7	Canada	Canada	44502.27
8	United States	Southeast	32.60

Again, this is under the assumption that returns are a sunk cost, which isn't the case most of the time (in electronics they refurbish products, and surely a similar concept for bikes).



There may be a much higher return amount in Australia and the Southwest, but this comes naturally with the sales and revenue they bring in. The accompanying visual shows us that though Australia and the Southwest have the greatest return

losses, it is not something to be alarmed by as they have a very similar return loss as percentage of revenue as the rest of the branches.

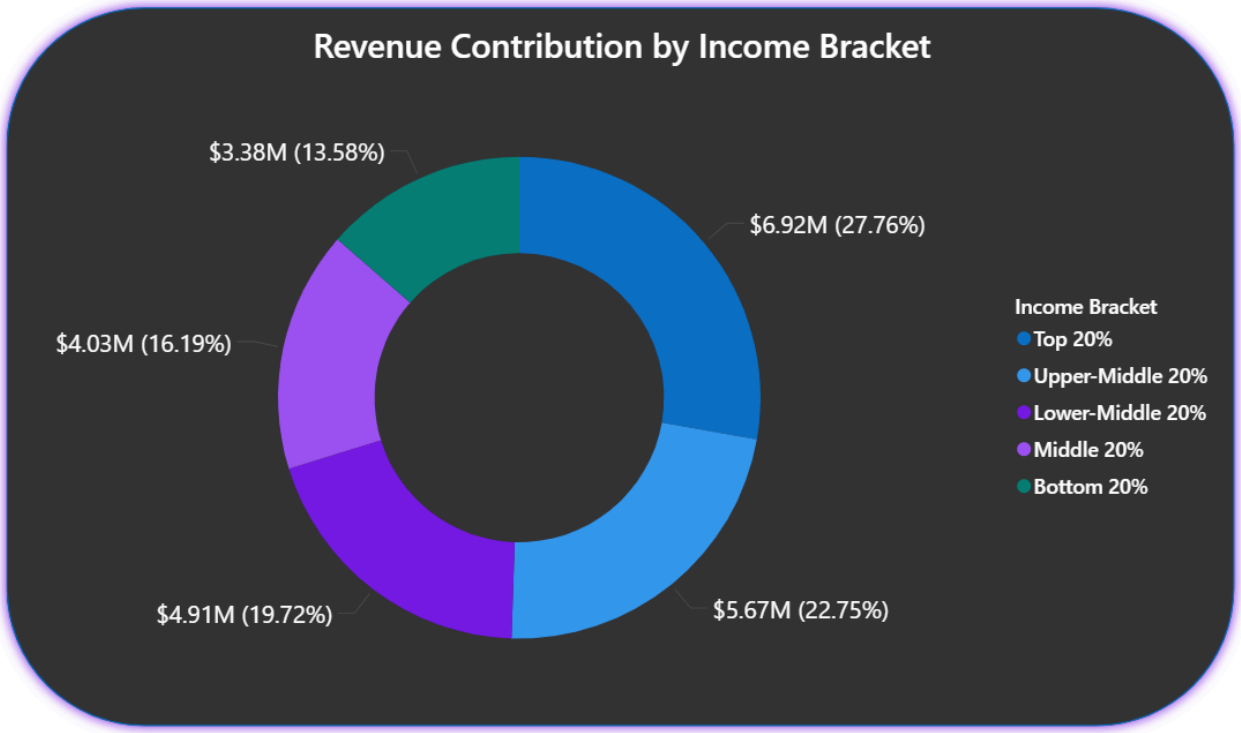
9. Impact of Customer Demographics on Spending (By education and occupation)

	education_level character varying (100)	occupation character varying (100)	amount_spent text	pct_contribution_to_revenue text
1	Bachelors	Professional	3,422,464.75	13.74%
2	Bachelors	Management	2,193,612.22	8.80%
3	Partial College	Professional	2,155,846.78	8.65%
4	Graduate Degree	Management	1,690,557.48	6.79%
5	Partial College	Skilled Manual	1,682,416.57	6.75%
6	Partial College	Clerical	1,596,745.81	6.41%
7	Bachelors	Skilled Manual	1,551,588.64	6.23%
8	Graduate Degree	Professional	1,265,574.05	5.08%
9	High School	Professional	1,243,682.27	4.99%
10	Bachelors	Clerical	1,204,877.49	4.84%
11	High School	Skilled Manual	1,066,934.65	4.28%
12	Partial College	Manual	961,529.42	3.86%

Output to additional query exploring the different income brackets, how much they've spent and % revenue contribution:

	income_group text	group_spend text	pct_revenue_contribution text
1	Top 20%	6,917,437.92	27.76%
2	Upper-Middle 20%	5,667,567.57	22.75%
3	Lower-Middle 20%	4,912,785.91	19.72%
4	Middle 20%	4,033,888.52	16.19%
5	Bottom 20%	3,382,906.90	13.58%

Visual on next page



Output to query showing countries and region with the most high-income customers (Top 2 Income Groups):

	country character varying (50)	region character varying (50)	high_income_customers bigint
1	United States	Southwest	2053
2	Australia	Australia	2050
3	United States	Northwest	1300
4	Canada	Canada	547
5	United Kingdom	United Kingdom	414
6	Germany	Germany	346
7	France	France	313
8	United States	Southeast	5
9	United States	Central	2
10	United States	Northeast	1

This provides insight as to where marketing efforts could be focused given the percentage contribution of high income customers to revenue, keeping in mind the still significant contribution of other income brackets. The idea of opening new locations could also be considered in high revenue stores such as Australia and Southwest US depending on store activity.

10. Top Territories by Return-Adjusted Profit

Note: The return sunk cost assumption is still at play here

	country character varying (50)	region character varying (50)	returns_adj_profit text
1	France	France	941,899.45
2	Canada	Canada	732,050.14
3	United States	Southeast	5,121.10
4	Australia	Australia	2,936,587.87
5	United States	Northeast	2,874.58
6	United States	Southwest	1,962,493.15
7	United States	Central	1,437.44
8	United States	Northwest	1,260,396.83
9	United Kingdom	United Kingdom	1,165,795.65
10	Germany	Germany	1,002,636.43

11. Identifying Frequently Returned Products with Low Profit Margins (Candidates for Discontinuation)

	model_name character varying (50)	profit_margin numeric	return_rate text
1	HL Mountain Tire	21.91	3.75%

Before discontinuing, more investigation would need to be done with respect to volume sold and how much revenue the product brings in, as though it may have appeared here, 3.75% is still quite a low return rate

12. Per-Product Subcategory 3-Month Moving Average

	year integer	month integer	subcategory_name character varying (50)	revenue_for_month text	moving_avg_3month text
1	2021	7	Bike Racks	960.00	960.00
2	2021	8	Bike Racks	3,000.00	1,980.00
3	2021	9	Bike Racks	3,960.00	2,640.00
4	2021	10	Bike Racks	2,400.00	3,120.00
5	2021	11	Bike Racks	2,760.00	3,040.00
6	2021	12	Bike Racks	3,120.00	2,760.00
7	2022	1	Bike Racks	2,160.00	2,680.00
8	2022	2	Bike Racks	2,760.00	2,680.00
9	2022	3	Bike Racks	3,600.00	2,840.00
10	2022	4	Bike Racks	2,520.00	2,960.00
11	2022	5	Bike Racks	5,280.00	3,800.00
12	2022	6	Bike Racks	3,720.00	3,840.00

Output screenshot just shows results for one of the subcategories

13. Cross-Category Purchase Analysis (Top 5 Most frequently purchased combination of subcategories)

	subcategory_1 character varying (50)	subcategory_2 character varying (50)	pair_purchase_count bigint	pct_of_multi_subcat_customers text
1	Helmets	Tires and Tubes	2682	20.20%
2	Helmets	Road Bikes	1870	14.08%
3	Mountain Bikes	Road Bikes	1725	12.99%
4	Bottles and Cages	Road Bikes	1455	10.96%
5	Bottles and Cages	Helmets	1354	10.20%

Information such as this can help the company or employees in-store in making recommendations to clients based on the initial product they purchase, though full recommendation systems can be developed with python.