Indian Institute of Management Jammu

Operations Management

Capacity Planning of United Postal Services

By: Satyansh

Roll Number: HAHM24076

Mentor: Dr. P. Praveen Vijaya Raj

UPS: Demand Forecasting and Capacity Planning

Company Overview

United Parcel Service (UPS), founded in 1907, is a global leader in package delivery and supply chain solutions, providing services to individuals, businesses, and industries around the world. Headquartered at Atlanta, Georgia, UPS operates in over 220 countries and territories, facilitating the movement of goods through its extensive transportation network, which includes ground, air, and freight services.

Competitive Landscape:

UPS faces competition from other major logistics companies like FedEx, DHL, and regional carriers. However, UPS differentiates itself with its vast global network, strong brand recognition, and innovative logistics solutions.

Current Operations

UPS (United Parcel Service) continues to operate as a global leader in package delivery, logistics, and supply chain solutions. Its current operations are extensive and span various segments.

UPS's operations are divided into several segments:

Package Delivery Services

- Domestic Operations (U.S.): UPS remains one of the largest package delivery services in the U.S., handling millions of packages daily. Its U.S. operations focus on ground and air shipping services, serving residential, commercial, and retail customers.
- International Operations: UPS operates in over 220 countries and territories, with significant presence in Europe, Asia-Pacific, Latin America, and the Middle East. It offers cross-border shipping, customs brokerage, and time-definite delivery solutions to customers globally.

Freight and Supply Chain Solutions

- UPS Supply Chain Solutions: This division manages end-to-end supply chains for businesses across different industries. UPS provides warehousing, inventory management, freight forwarding (air, sea, and land), and specialized transportation.

- UPS Freight (now TForce Freight): In 2021, UPS sold its less-than-truckload (LTL) freight business to TFI International, which operates under the brand TForce Freight. However, UPS still offers global freight services through its logistics network.
- Healthcare Logistics: UPS has been heavily involved in healthcare logistics, focusing on shipping temperature-sensitive materials such as pharmaceuticals, vaccines, and medical devices. UPS Healthcare offers specialized packaging, cold chain logistics, and distribution for healthcare companies.

eCommerce and Retail Operations

- UPS Digital Solutions: UPS has continued to enhance its eCommerce services, including "UPS My Choice®" for tracking and managing deliveries, and "UPS Access Point®" locations that allow customers to pick up packages from convenient local stores.
- Last-Mile Delivery: UPS has invested in improving last-mile delivery solutions for retailers and eCommerce platforms, offering same-day and next-day delivery services to meet the growing demand for fast delivery.
- UPS Returns: With the rise of online shopping, UPS has developed comprehensive returns management services to support retailers. This includes integrated solutions for returns logistics, labelling, and returns processing.

UPS's current capacity

UPS's current capacity and performance reflect its significant scale in the logistics industry. The company reported revenue of $91 billion in 2023, with expectations for 2024 set at $108 to $114 billion. UPS continues to focus on expanding its logistics services, including air and ocean freight. In 2024, air freight demand is expected to grow by 4.7%, while ocean freight faces overcapacity, which may lead to lower rates. The company is also diversifying its logistics strategies, including nearshoring in Mexico

Operations strategy

UPS (United Parcel Service) operates with a robust operations strategy that is designed to enhance efficiency, minimize costs, and maintain high service quality. Here are the key components of their operations strategy:

1. Integrated Global Network

- **Scope**: UPS has developed a vast global network that integrates air, ground, rail, and ocean transportation. This allows the company to offer a wide range of logistics services, including parcel delivery, freight forwarding, and supply chain management.
- **Efficiency**: By consolidating different types of deliveries (residential, commercial, domestic, international) into a single network, UPS reduces redundancies and optimizes resource utilization.

2. Hub-and-Spoke System

- **Structure**: UPS utilizes a hub-and-spoke model for its logistics operations. Packages are sent to centralized hubs, sorted, and then distributed to their final destinations via spokes. This structure ensures that transportation routes are optimized, reducing delivery times and operational costs.
- **Air Hubs**: Major air hubs like the World port in Louisville, Kentucky, allow UPS to quickly process international shipments and distribute them across the globe.

3. Technological Innovation

- **Data-Driven Decisions**: UPS uses advanced data analytics to optimize delivery routes, manage fleet maintenance, and forecast demand. Their proprietary software, such as ORION (On-Road Integrated Optimization and Navigation), dynamically optimizes delivery routes based on factors like traffic, weather, and customer preferences.

- **Tracking and Transparency**: UPS has invested in technologies that allow customers to track their shipments in real time, enhancing customer experience and reducing uncertainty.

4. Sustainability Initiatives

- **Fleet Management**: UPS has been expanding its fleet of electric vehicles and adopting alternative fuels to reduce carbon emissions. The company is also optimizing routes to cut down on fuel consumption.
- **Packaging Solutions**: UPS focuses on eco-friendly packaging and reducing waste by reusing materials where possible.

Demand Forecasting

Purpose and Role of Demand Forecasting

Demand forecasting is the process of predicting the future customer demand for a specific product or service. Precise forecasting is essential for making well-informed decisions in key areas such as strategy planning, operational modifications, and financial budgeting. Consequently, it guarantees that enterprises are adequately equipped to fulfil client demands and efficiently allocate resources.

Procedures for Gathering Data for Demand Forecasting

Data Collection Methods for Demand Forecasting

Historical Sales Data (Bloomberg Terminal)

Historical sales data is a highly valuable resource for demand forecasting since it serves as a historical record, revealing long-term trends and patterns in customer demand. The analysis of historical sales data allows firms to acquire significant knowledge about recurring trends, such as seasonal peaks or cyclical fluctuations. This analysis also facilitates the prediction of future trends, enabling businesses to effectively prepare for potential growth or downturns, which are further influenced by risk factors.

Forecasting Techniques and methods used for calculation forecasted sales

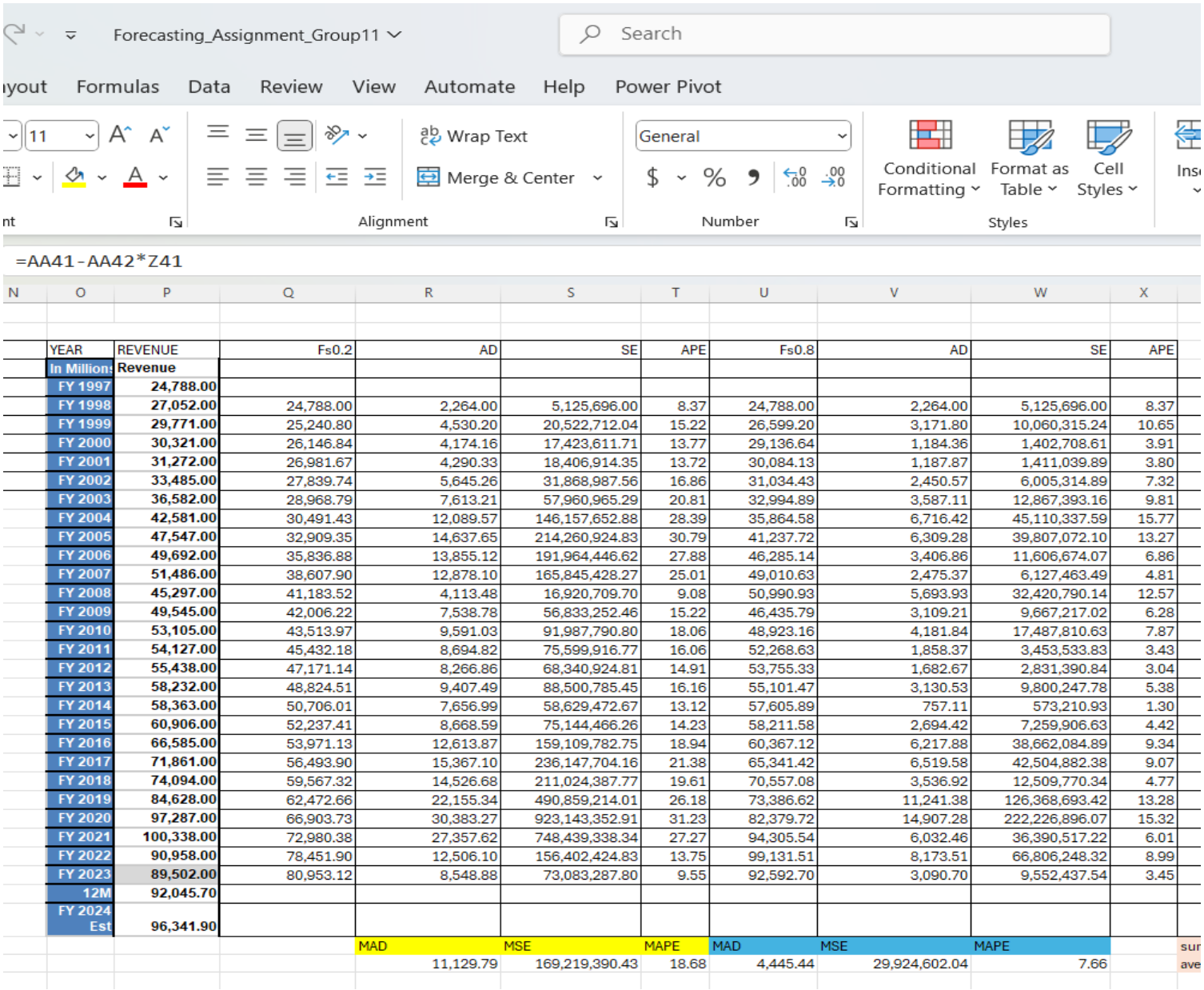
In this analysis, I employed four distinct forecasting models to estimate future demand and trends: **Simple Weighted Average Moving**, **Weighted Average**, **Exponential Smoothing**, and **Regression Model**. Each of these methods has unique advantages suited to different data patterns and requirements.

	A	B	C	D	E	F	G	H	I	J	K	L	M
6								Two periods before			0.85		
7								Three periods before			0.87		
8		ups											
9	YEAR	REVENUE	FA	AD	SE	APE		YEAR	REVENUE	FA	AD	SE	APE
10	In Millions	Revenue						In Millions	Revenue				
11	FY 1997	24,788.00						FY 1997	24,788.00				
12	FY 1998	27,052.00						FY 1998	27,052.00				
13	FY 1999	29,771.00						FY 1999	29,771.00				
14	FY 2000	30,321.00	27,203.67	3117.333333	9717767.111	11.4592396		FY 2000	30,321.00	27,318.47	3002.531365	9015194.6	10.9908
15	FY 2001	31,272.00	29,048.00	2224	4946176	7.65629303		FY 2001	31,272.00	29,099.03	2172.96679	4721784.669	7.46749
16	FY 2002	33,485.00	30,454.67	3030.333333	9182920.111	9.95030866		FY 2002	33,485.00	30,491.85	2993.154982	8958976.744	9.81625
17	FY 2003	36,582.00	31,692.67	4889.333333	23905580.44	15.4273333		FY 2003	36,582.00	31,775.14	4806.863469	23105936.41	15.1278
18	FY 2004	42,581.00	33,779.67	8801.333333	77463468.44	26.0551219		FY 2004	42,581.00	33,905.93	8675.070111	75256841.43	25.5857
19	FY 2005	47,547.00	37,549.33	9997.666667	99953338.78	26.6254172		FY 2005	47,547.00	37,779.28	9767.723247	95408417.43	25.8547
20	FY 2006	49,692.00	42,236.67	7455.333333	55581995.11	17.6513298		FY 2006	49,692.00	42,469.27	7222.730627	52167837.71	17.007
21	FY 2007	51,486.00	46,606.67	4879.333333	23807893.78	10.4691747		FY 2007	51,486.00	46,736.35	4749.653137	22559204.92	10.1627
22	FY 2008	45,297.00	49,575.00	4278	18301284	8.62934947		FY 2008	45,297.00	49,658.76	4361.756458	19024919.4	8.78346
23	FY 2009	49,545.00	48,825.00	720	518400	1.47465438		FY 2009	49,545.00	48,649.14	895.8597786	802564.7429	1.84147
24	FY 2010	53,105.00	48,776.00	4329	18740241	8.87526652		FY 2010	53,105.00	48,835.73	4269.273063	18226692.48	8.74211
25	FY 2011	54,127.00	49,315.67	4811.333333	23148928.44	9.75619648		FY 2011	54,127.00	49,481.77	4645.232472	21578184.72	9.38777
26	FY 2012	55,438.00	52,259.00	3179	10106041	6.08316271		FY 2012	55,438.00	52,335.47	3102.527675	9625677.976	5.92815
27	FY 2013	58,232.00	54,223.33	4008.666667	16069408.44	7.39288129		FY 2013	58,232.00	54,277.83	3954.169742	15635458.35	7.28505
28	FY 2014	58,363.00	55,932.33	2430.666667	5908140.444	4.34572728		FY 2014	58,363.00	56,037.81	2325.188192	5406500.128	4.14932
29	FY 2015	60,906.00	57,344.33	3561.666667	12685469.44	6.21101765		FY 2015	60,906.00	57,382.89	3523.110701	12412309.01	6.13965
30	FY 2016	66,585.00	59,167.00	7418	55026724	12.5373942		FY 2016	66,585.00	59,249.94	7335.062731	53803145.26	12.3799
31	FY 2017	71,861.00	61,951.33	9909.666667	98201493.44	15.9958892		FY 2017	71,861.00	62,164.23	9696.771218	94027372.05	15.5986
32	FY 2018	74,094.00	66,450.67	7643.333333	58420544.44	11.5022673		FY 2018	74,094.00	66,689.25	7404.752768	54830363.55	11.1034
33	FY 2019	84,628.00	70,846.67	13781.33333	189925148.4	19.4523384		FY 2019	84,628.00	70,982.97	13645.02583	186186729.9	19.223
34	FY 2020	97,287.00	76,861.00	20426	417221476	26.5752462		FY 2020	97,287.00	77,225.35	20061.65314	402469926.6	25.9781
35	FY 2021	100,338.00	85,336.33	15001.66667	225050002.8	17.5794601		FY 2021	100,338.00	85,870.74	14467.2583	209301562.8	16.8477
36	FY 2022	90,958.00	94,084.33	3126.333333	9773960.111	3.32290534		FY 2022	90,958.00	94,337.61	3379.612546	11421780.96	3.58247
37	FY 2023	89,502.00	96,194.33	6692.333333	44787325.44	6.95709726		FY 2023	89,502.00	95,931.89	6429.885609	41343428.94	6.70255
38	12M	92,045.70						12M	92,045.70				
39	FY 2024 Est	96,341.90						FY 2024 Est	96,341.90				
40													
41			MAD	MSE	MAPE						MAD	MSE	MAPE

ups FEDEX dhl1 +

Simple Weighted Average Moving, Weighted Average

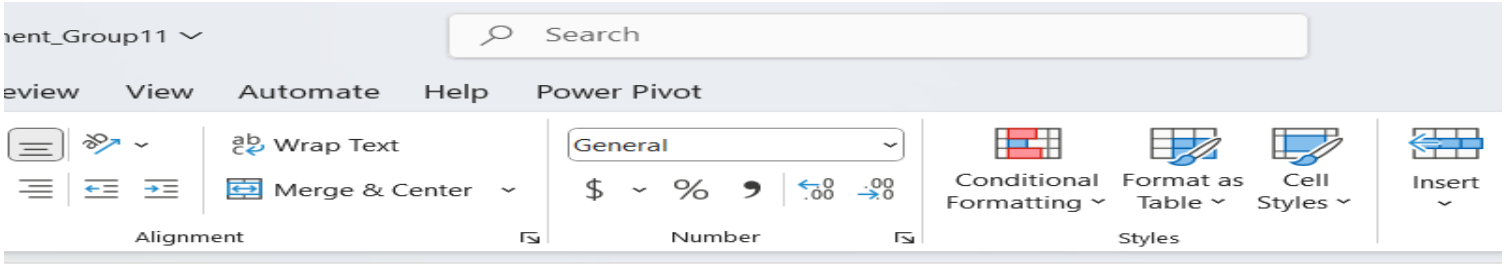
(In Millions of USD)



	YEAR	REVENUE	Fs0.2	AD	SE	APE	Fs0.8	AD	SE	APE
	In Million:	Revenue								
	FY 1997	24,788.00								
	FY 1998	27,052.00	24,788.00	2,264.00	5,125,696.00	8.37	24,788.00	2,264.00	5,125,696.00	8.37
	FY 1999	29,771.00	25,240.80	4,530.20	20,522,712.04	15.22	26,599.20	3,171.80	10,060,315.24	10.65
	FY 2000	30,321.00	26,146.84	4,174.16	17,423,611.71	13.77	29,136.64	1,184.36	1,402,708.61	3.91
	FY 2001	31,272.00	26,981.67	4,290.33	18,406,914.35	13.72	30,084.13	1,187.87	1,411,039.89	3.80
	FY 2002	33,485.00	27,839.74	5,645.26	31,868,987.56	16.86	31,034.43	2,450.57	6,005,314.89	7.32
	FY 2003	36,582.00	28,968.79	7,613.21	57,960,965.29	20.81	32,994.89	3,587.11	12,867,393.16	9.81
	FY 2004	42,581.00	30,491.43	12,089.57	146,157,652.88	28.39	35,864.58	6,716.42	45,110,337.59	15.77
	FY 2005	47,547.00	32,909.35	14,637.65	214,260,924.83	30.79	41,237.72	6,309.28	39,807,072.10	13.27
	FY 2006	49,692.00	35,836.88	13,855.12	191,964,446.62	27.88	46,285.14	3,406.86	11,606,674.07	6.86
	FY 2007	51,486.00	38,607.90	12,878.10	165,845,428.27	25.01	49,010.63	2,475.37	6,127,463.49	4.81
	FY 2008	45,297.00	41,183.52	4,113.48	16,920,709.70	9.08	50,990.93	5,693.93	32,420,790.14	12.57
	FY 2009	49,545.00	42,006.22	7,538.78	56,833,252.46	15.22	46,435.79	3,109.21	9,667,217.02	6.28
	FY 2010	53,105.00	43,513.97	9,591.03	91,987,790.80	18.06	48,923.16	4,181.84	17,487,810.63	7.87
	FY 2011	54,127.00	45,432.18	8,694.82	75,599,916.77	16.06	52,268.63	1,858.37	3,453,533.83	3.43
	FY 2012	55,438.00	47,171.14	8,266.86	68,340,924.81	14.91	53,755.33	1,682.67	2,831,390.84	3.04
	FY 2013	58,232.00	48,824.51	9,407.49	88,500,785.45	16.16	55,101.47	3,130.53	9,800,247.78	5.38
	FY 2014	58,363.00	50,706.01	7,656.99	58,629,472.67	13.12	57,605.89	757.11	573,210.93	1.30
	FY 2015	60,906.00	52,237.41	8,668.59	75,144,466.26	14.23	58,211.58	2,694.42	7,259,906.63	4.42
	FY 2016	66,585.00	53,971.13	12,613.87	159,109,782.75	18.94	60,367.12	6,217.88	38,662,084.89	9.34
	FY 2017	71,861.00	56,493.90	15,367.10	236,147,704.16	21.38	65,341.42	6,519.58	42,504,882.38	9.07
	FY 2018	74,094.00	59,567.32	14,526.68	211,024,387.77	19.61	70,557.08	3,536.92	12,509,770.34	4.77
	FY 2019	84,628.00	62,472.66	22,155.34	490,859,214.01	26.18	73,386.62	11,241.38	126,368,693.42	13.28
	FY 2020	97,287.00	66,903.73	30,383.27	923,143,352.91	31.23	82,379.72	14,907.28	222,226,896.07	15.32
	FY 2021	100,338.00	72,980.38	27,357.62	748,439,338.34	27.27	94,305.54	6,032.46	36,390,517.22	6.01
	FY 2022	90,958.00	78,451.90	12,506.10	156,402,424.83	13.75	99,131.51	8,173.51	66,806,248.32	8.99
	FY 2023	89,502.00	80,953.12	8,548.88	73,083,287.80	9.55	92,592.70	3,090.70	9,552,437.54	3.45
	12M	92,045.70								
	FY 2024 Est	96,341.90								
				MAD	MSE	MAPE	MAD	MSE	MAPE	
				11,129.79	169,219,390.43	18.68	4,445.44	29,924,602.04	7.66	

(In Millions of USD)

Exponential Smoothing with factors 0.2 and 0.8



	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH
		X	Y Samsung	X*Y	X*X	Fs	abs(A-F) AD	SE	(MAD/Actual D)*100 APE	
		1997	24788	49501636	3988009	21210.9709	3,577.03	12,795,137.19	14.43	
		1998	27052	54049896	3992004	23895.14978	3,156.85	9,965,703.34	11.67	
		1999	29771	59512229	3996001	26579.32865	3,191.67	10,186,765.99	10.72	
		2000	30321	60642000	4000000	29263.50753	1,057.49	1,118,290.33	3.49	
		2001	31272	62575272	4004001	31947.68641	675.69	456,552.12	2.16	
		2002	33485	67036970	4008004	34631.86528	1,146.87	1,315,299.98	3.43	
		2003	36582	73273746	4012009	37316.04416	734.04	538,820.83	2.01	
		2004	42581	85332324	4016016	40000.22304	2,580.78	6,660,409.74	6.06	
		2005	47547	95331735	4020025	42684.40191	4,862.60	23,644,860.16	10.23	
		2006	49692	99682152	4024036	45368.58079	4,323.42	18,691,953.67	8.70	
		2007	51486	103332402	4028049	48052.75967	3,433.24	11,787,139.19	6.67	
		2008	45297	90956376	4032064	50736.93854	5,439.94	29,592,931.35	12.01	
		2009	49545	99535905	4036081	53421.11742	3,876.12	15,024,286.25	7.82	
		2010	53105	106741050	4040100	56105.2963	3,000.30	9,001,777.87	5.65	
		2011	54127	108849397	4044121	58789.47517	4,662.48	21,738,674.74	8.61	
		2012	55438	111541256	4048144	61473.65405	6,035.65	36,429,119.81	10.89	
		2013	58232	117221016	4052169	64157.83293	5,925.83	35,115,495.87	10.18	
		2014	58363	117543082	4056196	66842.0118	8,479.01	71,893,641.16	14.53	
		2015	60906	122725590	4060225	69526.19068	8,620.19	74,307,687.35	14.15	
		2016	66585	134235360	4064256	72210.36956	5,625.37	31,644,782.65	8.45	
		2017	71861	144943637	4068289	74894.54843	3,033.55	9,202,416.10	4.22	
		2018	74094	149521692	4072324	77578.72731	3,484.73	12,143,324.42	4.70	
		2019	84628	170863932	4076361	80262.90619	4,365.09	19,054,044.00	5.16	
		2020	97287	196519740	4080400	82947.08506	14,339.91	205,633,160.40	14.74	
		2021	100338	202783098	4084441	85631.26394	14,706.74	216,288,085.55	14.66	
		2022	90958	183917076	4088484	88315.44282	2,642.56	6,983,108.47	2.91	
		2023	89502	181062546	4092529	90999.62169	1,497.62	2,242,870.74	1.67	
		2024								
		2025								
	sum	54270	1514843	3049231115	109084338					
	average	2010	56105.3	112934485.7	4040160.7					
		b	2684.18			MAD	MSE	MAPE		
		a	-5E+06			4,610.18	33,090,975.53	8.14		

(In Millions of USD)

Regression model

SIMPLE WEIGHTED AVERAGE	MAD	MSE	MAPE
	6487.99	62851821	12.17

MOVING WEIGHTED AVERAGE	MAD	MSE	MAPE
	6370.33	60303783	11.90
Exponential Smoothening 0.2	MAD	MSE	MAPE
	11129.79	169219390	18.68
Exponential Smoothening 0.8	MAD	MSE	MAPE
	4445.44	29924602.04	7.66
REGRESSION	MAD	MSE	MAPE
	4610.18	33090975.33	8.14

Lower values for Mean Absolute Deviation (MAD), Mean Squared Error (MSE), and
Mean Absolute Percentage Error (MAPE) indicates that Exponential Smoothening (0.8) is performing better than other methods. It suggests that the model is making fewer
and smaller errors. Comparing all the methods graphically also we get that Exponential Smoothening (0.8) is giving the closest results.

Identification of Capacity Gaps and Solutions:

1. Delivery Network Capacity

- Issue: As e-commerce continues to grow, UPS may struggle to handle the increased volume of packages, especially during peak seasons (e.g., holidays).
- Capacity Gap: Insufficient delivery personnel, outdated vehicle fleets, or lack of local delivery hubs.
- Solution: Increase investment in local sorting facilities, add more delivery personnel, and implement smart routing technologies to optimize routes.

2. Technological Infrastructure

- Issue: With the rise in demand for real-time tracking and efficient logistics management, older IT systems may not be able to cope with the volume and sophistication of modern operations.
- Capacity Gap: Limited scalability of legacy systems, lack of real-time data analytics capabilities.
- Solution: Invest in cloud-based solutions, AI-powered analytics for demand forecasting, and IoT-based tracking for better operational control.

3. Sustainability and Green Logistics

- Issue: Growing environmental regulations and customer preferences for eco-friendly solutions require UPS to adopt sustainable practices.
- Capacity Gap: Insufficient electric vehicle (EV) fleets, inadequate carbon-neutral shipping options, and lack of green supply chain practices.
- Solution: Invest in electric vehicles, renewable energy solutions for facilities, and offer more carbon-neutral delivery options.

4. Global Shipping Capacity

- Issue: The expansion of global markets demands a robust international shipping network, and any disruptions in supply chains (e.g., geopolitical issues or pandemics) can highlight weaknesses.
- Capacity Gap: Limited global reach in certain regions, insufficient partnerships or infrastructure in key international markets.
- Solution: Strengthen international logistics networks through new partnerships, expand regional hubs, and enhance customs and border processing technologies.

5. Workforce and Skill Development

- Issue: Rapid changes in technology and logistics demand a workforce that can adapt quickly to new tools and methodologies.
- Capacity Gap: Lack of skilled workers in areas like data analytics, AI, and robotics for automated warehouses.
- Solution: Implement continuous training programs, hire specialists in new logistics technologies, and focus on upskilling existing employees.

6. Customer Service and Experience

- Issue: In a competitive landscape, customer service expectations are higher than ever. Slow response times or inadequate customer service capabilities can lead to dissatisfaction.
- Capacity Gap: Insufficient customer support channels, limited integration of AI chatbots, or slow response times.
- Solution: Invest in AI-driven customer service tools, improve call center infrastructure, and expand customer interaction touchpoints (social media, live chat, etc.).

7. Warehouse and Fulfillment Centers

- Issue: Inadequate warehousing can lead to slow processing, bottlenecks in fulfillment, and increased shipping times.
- Capacity Gap: Lack of automated fulfillment centers, insufficient storage space, or poor geographic distribution of warehouses.
- Solution: Expand or build new fulfillment centers, integrate robotics and automation in warehousing, and improve geographic spread to meet demand faster.

Conclusion: Strategic Capacity Planning for FedEx's Future Growth

From my analysis, UPS's future growth hinges on its ability to balance demand fluctuations with capacity expansion through strategic planning. Key elements like optimizing technology, workforce management, and infrastructure will drive efficiency and cost-effectiveness. By investing in automation, AI, and data analytics, UPS can enhance forecasting accuracy and operational scalability. Collaboration with e-commerce platforms and diversifying services, such as healthcare logistics, further position UPS to meet rising demand.

Long-term success will depend on a flexible yet data-driven approach that adapts to shifting market conditions while maintaining customer-centric service, ensuring UPS remains a leader in the global logistics industry.