

# Bike Sharing Analysis Report

## Introduction to the Data

This report analyzes a bike-sharing dataset containing daily and hourly records of bike rentals from 2011 to 2012. The dataset includes two key response variables:

- **Casual users** (non-registered)
- **Registered users**

Key predictor variables include:

- **Temporal factors:** Season, month, weekday, hour
- **Weather conditions:** Clear, Misty/Cloudy, Rain/Snow
- **Temperature & humidity:** Normalized values

Our analysis focuses on:

1. **User behavior trends**
2. **Year-over-year growth**
3. **Validation of marketing assumptions**
4. **Impact of weather on ridership**
5. **Peak vs. off-peak usage patterns**

Finally, we provide **business recommendations** based on statistical findings.

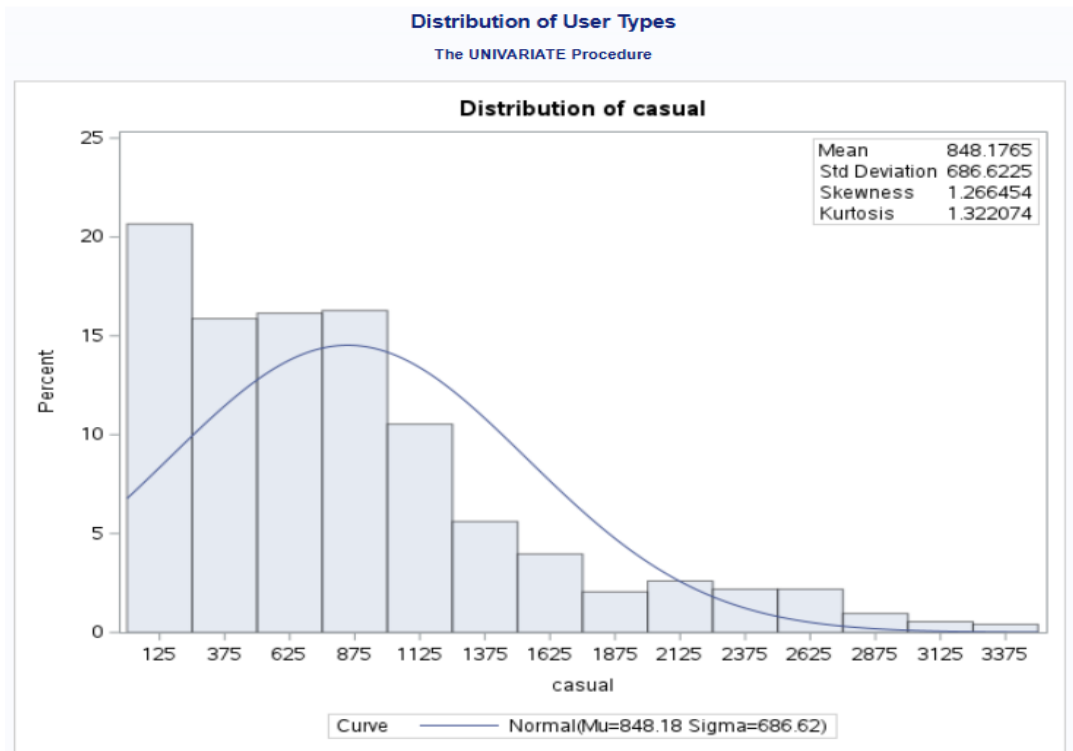
## Goals

1. **Analyze user distribution:** Compare casual vs. registered users.
2. **Evaluate growth:** Compare registered users between 2011 and 2012.
3. **Test marketing claims:** Validate assumptions about seasonal usage.
4. **Assess weather impact:** Determine how weather affects ridership.
5. **Provide actionable insights:** Recommend business strategies based on findings.

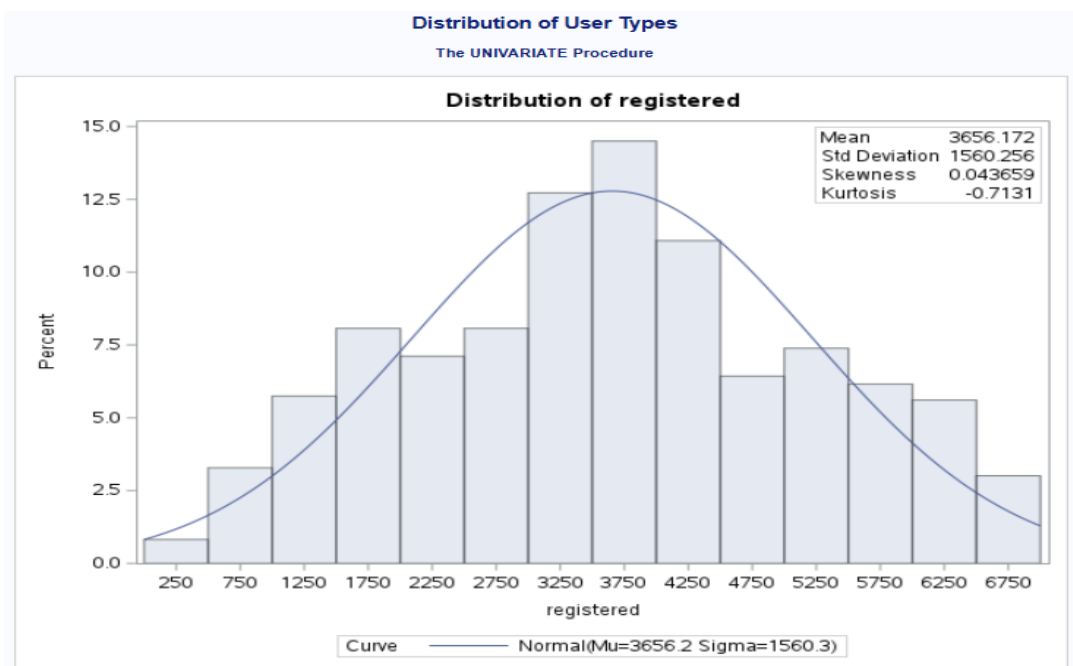
## Analysis & Key Findings

### 1. User Behavior Analysis

- **Casual users** (Mean = 848, SD = 687)
  - Highly variable, with extreme peaks on weekends (especially in Fall).
  - Right-skewed distribution, indicating occasional high-demand days.



- **Registered users** (Mean = 3,656, SD = 1,560)
  - More consistent usage, with highest demand on weekdays in Fall.



- Extreme observations for casual users often occur on weekends in Fall (e.g., 3,410 users on one Saturday in Fall), while registered users show highest usage on weekdays in Fall (peak of 6,946 users).

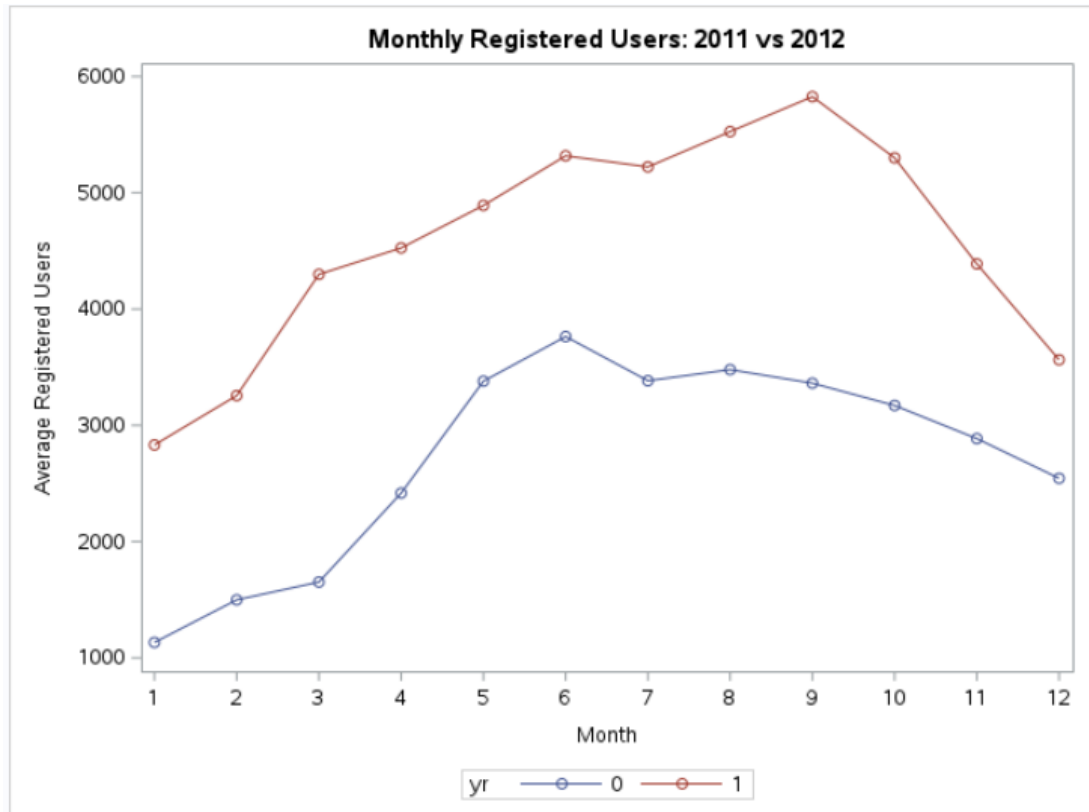
**Business Insight:**

- **Casual users** are more weather- and weekend-dependent.

- **Registered users** are more predictable, suggesting subscription-based promotions could stabilize revenue.

## 2. Year-over-Year Growth (2011 vs. 2012)

- **2011 Avg. registered users:** 2,728/day
- **2012 Avg. registered users:** 4,582/day
- **Growth:** 1,853 more users/day ( $p < 0.0001$ , 95% CI: 1,671–2,036)



### Test for Difference in Registered Users Between Years

The TTEST Procedure

Variable: registered

yr	Method	N	Mean	Std Dev	Std Err	Minimum	Maximum
0		365	2728.4	1060.1	55.4887	416.0	4614.0
1		366	4581.5	1424.3	74.4510	20.0000	6946.0
Diff (1-2)	Pooled		-1853.1	1255.7	92.8910		
Diff (1-2)	Satterthwaite		-1853.1		92.8545		

yr	Method	Mean	95% CL Mean	Std Dev	95% CL Std Dev
0		2728.4	2619.2 2837.5	1060.1	988.4 1143.2
1		4581.5	4435.0 4727.9	1424.3	1328.1 1535.7
Diff (1-2)	Pooled	-1853.1	-2035.5 -1670.7	1255.7	1194.5 1323.7
Diff (1-2)	Satterthwaite	-1853.1	-2035.4 -1670.8		

Method	Variances	DF	t Value	Pr >  t
Pooled	Equal	729	-19.95	<.0001
Satterthwaite	Unequal	674.45	-19.96	<.0001

Equality of Variances				
Method	Num DF	Den DF	F Value	Pr > F
Folded F	365	364	1.81	<.0001

#### Business Recommendation:

- **Continue user acquisition strategies** that drove growth in 2012 (e.g., membership discounts, corporate partnerships).
- **Invest in retention programs** to maintain this growth trend.

### 3. Marketing Claims Validation (2012 Data)

The marketing team assumed:

1. **Spring  $\geq 4,000$  users/day** → Actual: 3,531 (Rejected,  $p = 0.9994$ )
2. **Summer  $\geq 6,500$  users/day** → Actual: 6,209 (Rejected,  $p = 0.9876$ )
3. **Fall  $\leq 6,500$  users/day** → Actual: 6,824 (Rejected,  $p = 0.9996$ )
4. **Winter  $\leq 5,000$  users/day** → Actual: 5,792 (Rejected,  $p = 1.0000$ )

#### ANOVA Results (Seasonal Differences):

- **Fall** had the highest usage (6,824 users/day).
- **Summer** was second (6,209 users/day).
- **Winter** exceeded expectations (5,792 users/day).
- **Spring** was the weakest season (3,531 users/day).

Marketing Claims Validation Results									
Season	Days Observed	Actual Mean	Standard Deviation	t Statistic	Degrees of Freedom	p-value	Conclusion	season_number	Marketing Claim
Spring	91	3,531.30	1,341.20	-3.33368	90	0.9994	Rejects claim	1	ge 4000
Summer	92	6,209.49	1,221.35	-2.28149	91	0.9876	Rejects claim	2	ge 6500
Fall	94	6,824.24	912.76	3.44415	93	0.9996	Rejects claim	3	le 6500
Winter	89	5,791.87	1,598.52	4.67335	88	1.0000	Rejects claim	4	le 5000

#### Business Recommendations:

- **Reallocate marketing budget:**
  - **Increase spending in Fall & Summer** (highest demand).
  - **Reduce spending in Spring** (underperforming).
- **Introduce seasonal promotions:**
  - **Spring:** Discounts to boost ridership.
  - **Fall & Summer:** Premium pricing (higher demand).

### 4. Weather Impact on Ridership

- **Clear weather:**
  - **Casual users:** 849 (baseline)
  - **Registered users:** 3,837 (baseline)

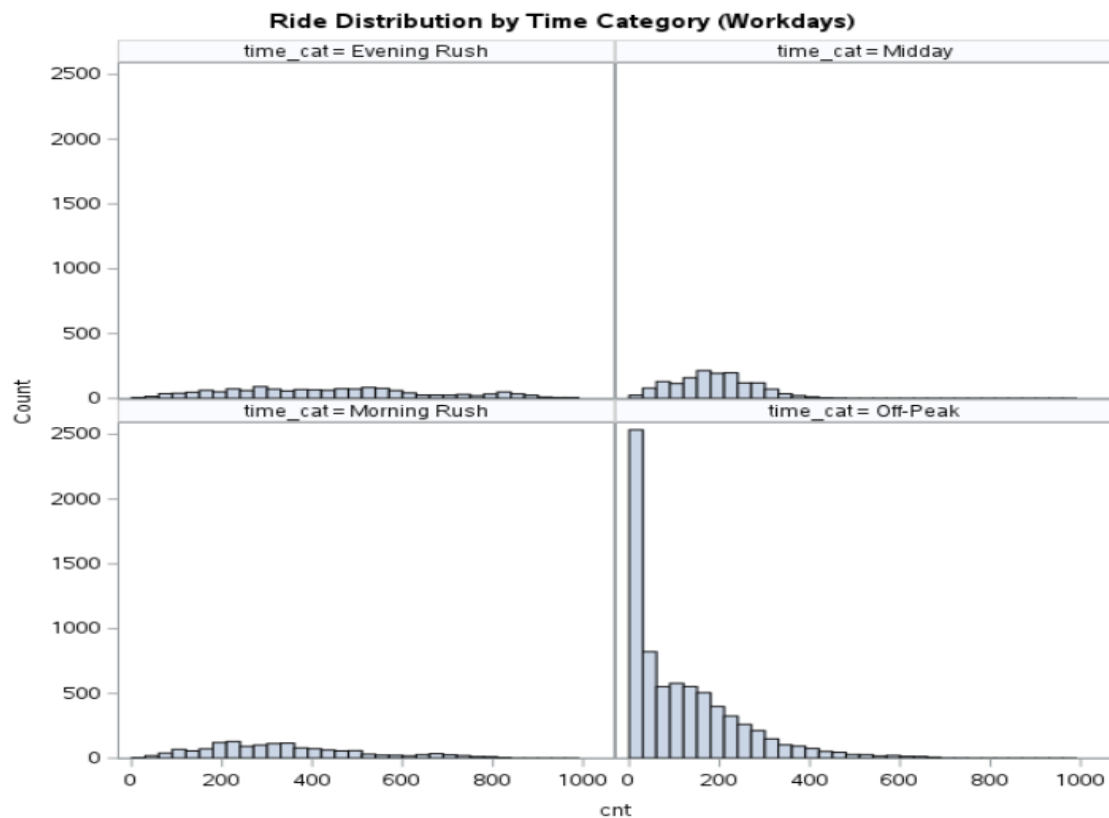
- **Misty/Cloudy:**
  - Casual users dropped by **276** ( $p < 0.0001$ ).
  - Registered users dropped by **564** ( $p < 0.0001$ ).
- **Rain/Snow:**
  - Casual users dropped by **779** ( $p < 0.0001$ ).
  - Registered users dropped by **2,295** ( $p < 0.0001$ ).

#### Business Recommendations:

- **Weather-based dynamic pricing:**
  - Offer **discounts on rainy/snowy days** to encourage ridership.
  - **Premium pricing on clear days** (higher demand).
- **Promote rain gear partnerships** (e.g., discounts on waterproof accessories).

## 5. Temporal Patterns (Weekdays vs. Weekends, Peak Hours)

- **Weekdays:** 4,551 users/day
- **Weekends:** 4,390 users/day
- **No significant difference** ( $p = 0.31$ )



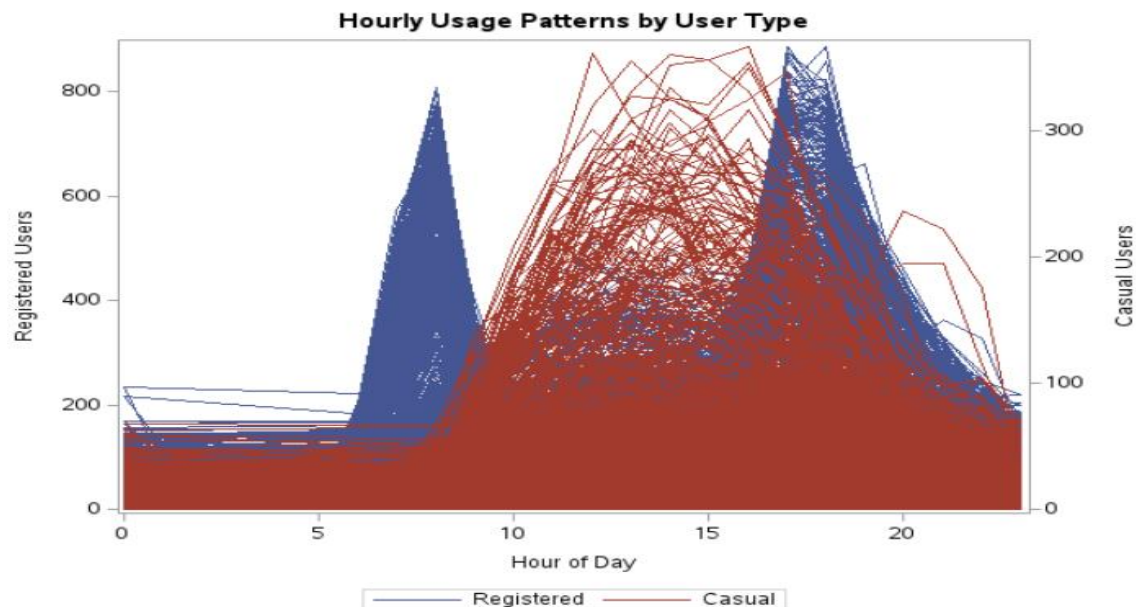
## Average Hourly Usage by Time and Weather

The MEANS Procedure

time_cat	weathersit	N Obs	Variable	Mean
Evening Rush	Clear	1517	casual	76.9624258
			registered	354.2623599
	Misty/Cloudy	455	casual	63.3692308
			registered	307.6175824
	Rain/Snow	214	casual	32.5140187
			registered	206.7990654
	4	2	casual	3.5000000
			registered	96.5000000
Midday	Clear	1353	casual	78.8070953
			registered	187.8957871
	Misty/Cloudy	671	casual	52.1192250
			registered	158.7481371
	Rain/Snow	160	casual	25.7437500
			registered	88.7062500
Morning Rush	Clear	1312	casual	23.0838415
			registered	245.9885671
	Misty/Cloudy	687	casual	20.9941776
			registered	260.0072780
	Rain/Snow	182	casual	8.5000000
			registered	148.3076923
Off-Peak	Clear	7231	casual	28.9145346
			registered	105.2485133
	Misty/Cloudy	2731	casual	20.5979495
			registered	86.5470524
	Rain/Snow	863	casual	11.7717265
			registered	58.0625724
	4	1	casual	1.0000000
			registered	22.0000000

### Peak Hour Analysis:

- **Morning rush (7–9 AM):** High registered user demand (245 avg.).
- **Evening rush (4–6 PM):** High casual user demand (77 avg.).
- **Off-peak hours:** Lowest usage.



### Business Recommendations:

- **Targeted promotions:**
  - **Morning commuters:** Subscription plans for registered users.
  - **Evening casual riders:** Happy-hour discounts.
- **Incentivize off-peak usage:**
  - Lower prices during non-peak hours to balance demand.

## Final Business Recommendations Summary

### 1. Adjust Marketing Budget Based on Seasonal Demand

- **Increase Fall & Summer spending** (highest ridership).
- **Reduce Spring budget** (lowest demand).

### 2. Introduce Dynamic Pricing Strategies

- **Higher prices on clear days** (high demand).
- **Discounts on rainy/snowy days** (low demand).

### 3. Improve User Retention & Acquisition

- **Membership perks** for registered users (loyalty programs).
- **Casual user incentives** (weekend promotions, first-ride discounts).

### 4. Optimize Bike Availability

- **Increase supply during peak hours** (morning & evening).
- **Balance inventory in low-demand periods** (off-peak, bad weather).

### 5. Weather-Adaptive Strategies

- **Partner with weather apps** for real-time promotions.
- **Offer rain gear bundles** (e.g., free poncho rentals).

## Conclusion

The statistical analysis reveals key trends in bike-sharing usage, including **seasonal peaks, weather sensitivity, and user type differences**. By implementing **data-driven pricing, marketing, and inventory strategies**, the business can **maximize revenue, improve user engagement, and optimize operations**.

### Next Steps:

- Test dynamic pricing in pilot locations.
- Launch seasonal membership campaigns.
- Monitor weather-based ridership adjustments for effectiveness.

This approach ensures the business remains competitive while meeting customer demand efficiently.