

Financial Operations Analytics

Revenue Forecasting, Churn & Profitability Analysis

A Comprehensive End to End Financial Analytics Project

Duration: 2-3 Hours | Recorded Lectures Available

 @ashoks773

 @ashoks773

 [@sharma-ak](https://www.linkedin.com/in/sharma-ak)

Instructor: Dr. Ashok Kumar Sharma

Bioinformatics Scientist (Senior Data Analyst)
Los Angeles, CA

Project links:

[https://www.skillsetmaster.com
/data-analytics](https://www.skillsetmaster.com/data-analytics)

Tools: Python | Pandas | Scikit-learn | Prophet | Statsmodels



Follow: @datawithashok



Project Overview

1. Revenue Forecasting

- Predict monthly/quarterly revenue
- Identify seasonal patterns and trends
- Support strategic financial planning

2. Customer Churn Analysis

- Identify at-risk customers before they churn
- Calculate customer lifetime value (CLV)
- Reduce churn through targeted interventions

3. Profitability Analysis

- Segment customers by profitability
- Optimize pricing and resource allocation
- Maximize ROI across customer cohorts

Financial customers

customer_id	signup_date	segment	industry	country	plan	mrr	contract_len	number_of_u	support_ticks	usage_score	nps_score	churn_date	i
CUST_00000	1/31/23	Startup	Healthcare	Other	Basic	49	24	3	2	53	7		
CUST_00000	12/30/23	Startup	Retail	USA	Basic	49	12	4	1	55	60		
CUST_00000	5/10/22	Small Business	Retail	Other	Professional	149	12	8	1	52	7	3/22/24	
CUST_00000	7/18/23	Startup	Retail	USA	Business	399	1	1	3	54	17		
CUST_00000	2/4/23	Startup	Technology	USA	Business	399	12	2	0	55	100		
CUST_00000	12/31/22	Small Business	Retail	UK	Basic	49	12	6	1	45	-11		
CUST_00000	9/20/24	Small Business	Other	Canada	Professional	149	1	5	2	50	9		
CUST_00000	11/10/22	Startup	Finance	USA	Business	399	24	4	3	68	3		
CUST_00000	6/26/24	Enterprise	Manufacturing	USA	Professional	149	1	407	2	44	94		
CUST_00001	5/1/21	Startup	Retail	Australia	Basic	49	12	1	3	71	-22		
CUST_00001	4/11/21	Mid-Market	Real Estate	Other	Business	399	12	34	3	33	64		
CUST_00001	5/23/23	Small Business	Real Estate	USA	Basic	49	36	5	0	71	-34		

Financial transactions

transaction_id	customer_id	transaction_amount	transaction_status	payment_method	year_month	cohort_month	transaction_i		
CUST_00000	CUST_00000	1/31/23	52.78	New	Completed	Credit Card	2023-01	2023-01	2023-01
CUST_00000	CUST_00000	2/28/23	52.87	Subscription	Completed	Credit Card	2023-02	2023-01	2023-02
CUST_00000	CUST_00000	3/28/23	52.84	Subscription	Completed	Credit Card	2023-03	2023-01	2023-03
CUST_00000	CUST_00000	4/28/23	53.22	Subscription	Completed	Credit Card	2023-04	2023-01	2023-04
CUST_00000	CUST_00000	5/28/23	51.86	Subscription	Completed	Wire Transfer	2023-05	2023-01	2023-05
CUST_00000	CUST_00000	6/28/23	47.05	Subscription	Completed	PayPal	2023-06	2023-01	2023-06
CUST_00000	CUST_00000	7/28/23	49.53	Subscription	Completed	Wire Transfer	2023-07	2023-01	2023-07
CUST_00000	CUST_00000	8/28/23	47.83	Subscription	Completed	Credit Card	2023-08	2023-01	2023-08
CUST_00000	CUST_00000	9/28/23	48.12	Subscription	Completed	Credit Card	2023-09	2023-01	2023-09
CUST_00000	CUST_00000	10/28/23	69.56	Subscription	Completed	Credit Card	2023-10	2023-01	2023-10
CUST_00000	CUST_00000	11/28/23	45.58	Subscription	Completed	ACH	2023-11	2023-01	2023-11
CUST_00000	CUST_00000	12/28/23	51.68	Subscription	Completed	ACH	2023-12	2023-01	2023-12

Monthly revenue

year_month	total_revenue	num_transactions	avg_transact	unique_customers	revenue_growth	month	quarter	is_q4
1/1/20	21878.65	97	225.553093	97		1	1	0
2/1/20	42934	173	248.17341	173	96.2369707	2	1	0
3/1/20	55509	239	232.25523	239	29.2891415	3	1	0
4/1/20	75856.8	314	241.582166	314	36.6567584	4	2	0
5/1/20	104698.22	409	255.985868	409	38.0208762	5	2	0
6/1/20	118719.53	479	247.848706	479	13.3921188	6	2	0
7/1/20	136785.25	560	244.259375	560	15.2171425	7	3	0
8/1/20	152817.37	639	239.150814	639	11.7206497	8	3	0
9/1/20	173125.54	714	242.472745	714	13.2891765	9	3	0
10/1/20	192940.47	784	246.097538	784	11.4454112	10	4	1
11/1/20	204928.68	845	242.519148	845	6.21342428	11	4	1
12/1/20	233216.37	928	251.310744	928	13.8036755	12	4	1

Example 1

1. Revenue Forecasting “Predicting the company’s income”

Look at last month’s sales?

That’s correct: Revenue forecasting means **predicting future earnings** using past data.
It helps businesses plan budgets, set goals, and make smarter investments.

Example:

- If Netflix sees that subscriptions usually increase by 10% during holidays, it can **forecast** higher revenue in December.
- If a SaaS company earns \$100,000 this month and has been growing 5% each month, it can **predict \$105,000** next month.

Common tools & methods:

ARIMA or Prophet models : help predict future trends from past data.

Exponential smoothing : gives more weight to recent data.

Seasonality checks : catch repeating patterns (like holiday spikes).

Example 2

2. Churn Analysis — “Why customers leave you”

That's Chrun: **Customer churn** means customers who **stop buying or unsubscribe**.

Churn analysis helps find out:

- Who is likely to leave?
- Why they might leave?
- What can we do to keep them?

Example:

- A telecom company notices customers with frequent network issues are leaving.
- A bank sees users with low account activity eventually close their accounts.

Common tools & methods:

- **Logistic Regression:** Predicts yes/no: will this customer churn?
- **Random Forest & Gradient Boosting:** Advanced models that find hidden churn signals.
- **RFM & Cohort Analysis:** Groups customers by behavior and tracks retention.

Example 3

3. Profitability Analysis — “Where are we really making (or losing) money?”

Exactly — revenue ≠ profit.

it measures which customers, products, or regions **actually bring profit**, and which are **costing money**.

- A company finds small customers generate lots of support tickets → low profit.
- Premium clients bring fewer issues but higher revenue → high profit.
So they decide to **focus on high-value clients**.

Tools & techniques:

- **Regression models** : Understand what drives profit.
- **Feature importance** : Identify which factors (cost, discount, marketing spend) impact profit.
- **Monte Carlo Simulation** : Test “what if” profit scenarios (e.g., if prices change).

Real-world mini-examples for class discussion

Scenario

Netflix wants to predict next month's subscribers

A bank is losing customers after fee increase

An e-commerce store sells hundreds of items but low margin

Technique

Revenue Forecasting

Churn Analysis

Profitability Analysis

Questions?

What data would you use?

How can they detect this early?

How can they find what's really profitable?

Analytics Techniques Covered

Time Series Analysis

- └─ ARIMA/SARIMA Models
- └─ Facebook Prophet
- └─ Exponential Smoothing
- └─ Seasonality

Cohort & Retention Analysis

- └─ Cohort-based Revenue Tracking
- └─ Retention Rate Calculations
- └─ Customer Lifetime Value (CLV)
- └─ RFM Segmentation

Decomposition Regression Analysis

- └─ Linear Regression (Revenue Drivers)
- └─ Logistic Regression (Churn Prediction)
- └─ Random Forest & Gradient Boosting
- └─ Feature Importance Analysis

Advanced Techniques

- └─ Customer Segmentation (K-Means)
- └─ Survival Analysis
- └─ Monte Carlo Simulation



Project Workflow

Phase 1: Data Acquisition & Understanding

- └─ Load financial transaction data
- └─ Data quality assessment
- └─ Exploratory data analysis
- └─ Define business questions

Phase 2: Data Preprocessing

- └─ Handle missing values & outliers
- └─ Feature engineering
- └─ Time series preparation
- └─ Create cohort structures

Phase 3: Revenue Forecasting

- └─ Time series decomposition
- └─ ARIMA/Prophet modeling
- └─ Model validation & selection
- └─ Generate forecasts with confidence intervals

Phase 4: Churn Analysis

- └─ Define churn metrics
- └─ Build predictive models
- └─ Calculate CLV
- └─ Risk stratification

Phase 5: Profitability & Cohort Analysis

- └─ Customer segmentation
- └─ Cohort retention analysis
- └─ RFM analysis
- └─ Profitability optimization

Phase 6: Reporting & Documentation

- └─ Executive dashboard
- └─ Business recommendations
- └─ GitHub documentation



Deliverables

Technical Deliverables

- Clean, documented Python code
- Professional visualizations
- 3 trained ML models (ARIMA, Prophet, Random Forest)
- Interactive dashboards
- Comprehensive Jupyter notebooks

Business Deliverables

- Revenue forecast: Next 12 months
- Churn prediction model: >75%+ accuracy
- Customer segments: 5-7 actionable groups
- Profitability analysis by cohort
- Executive summary report

Documentation

- GitHub repository with README
- Technical methodology document
 - Business insights presentation
 - Data dictionary
 - Model performance reports



Expected Outcomes & Skills

Technical Skills

- Time series forecasting (ARIMA, Prophet, SARIMA)
- Advanced regression techniques
- Customer analytics (CLV, RFM, cohorts)
- Data visualization mastery
- Model evaluation & selection

Business Skills

- Financial metrics interpretation
- Strategic recommendations
- Stakeholder communication
- ROI quantification
- Data-driven decision making

Career Impact

- Portfolio-ready project for interviews
- Real-world business problem solving
- End-to-end analytics experience
- GitHub presence for recruiters
- Presentation-ready materials



LEARNING

GitHub

```
## 📈 Project Overview

A comprehensive end-to-end financial analytics project covering revenue forecasting, churn prediction, profitability analysis, and cohort analysis.

### 🎯 Business Objectives

1. **Revenue Forecasting** - Predict future revenue with 90%+ accuracy using time series analysis.
2. **Churn Prediction** - Identify at-risk customers before they leave.
3. **Profitability Analysis** - Segment customers and optimize resource allocation.
4. **Cohort Analysis** - Track customer behavior and retention over time.

###💡 Key Results

- ✅ **Revenue Forecast**: ${forecast.sum():,.0f} predicted for next 12 months
- 🚫 **Churn Model Accuracy**: {churn_results[best_churn_model_name]['roc_auc']:,.1%}
- 💰 **Identified Value**: ${at_risk_mrr * 12:.0f} annual revenue at risk
- 👤 **Customer Segments**: {optimal_k} distinct groups with targeted strategies

---
```

```
## 📁 Project Structure
```
financial-operations-analytics/
 ├── financial_customers.csv # Customer master data
 ├── financial_transactions.csv # Transaction history
 └── monthly_revenue.csv # Aggregated monthly metrics

 ├── financial_analytics.py # Complete analysis script
 ├── EXECUTIVE_SUMMARY_FINANCIAL.txt # Executive report
 └── kpi_summary.txt # Key metrics summary

 ├── at_risk_customers.csv # High churn risk list
 └── rfm_segmentation.csv # RFM customer segments

 └── financial_viz/ # All visualizations (16 files)
 ├── 01_initial_exploration.png
 ├── 02_ts_decomposition.png
 ├── 03_acf_pacf_analysis.png
 ├── 04_arima_forecast.png
 ├── 05_prophet_forecast.png
 ├── 06_prophet_components.png
 ├── 07_churn_analysis.png
 ├── 08_churn_model_evaluation.png
 ├── 09_churn_feature_importance.png
 ├── 10_risk_stratification.png
 ├── 11_cohort_retention.png
 ├── 12_revenue_cohorts.png
 ├── 13_rfm_analysis.png
 ├── 14_clv_analysis.png
 ├── 15_profitability_dashboard.png
 └── 16_FINAL_EXECUTIVE_DASHBOARD.png

 └── README.md # This file
 └── requirements.txt # Python dependencies
```

```