05-risk-analysis

January 16, 2026

0.1 Executive Risk Analysis

This notebook evaluates: - Downside financial exposure - Sensitivity to forecast assumptions - Risk-adjusted revenue planning - Confidence intervals for leadership decisions

The objective is to ensure informed, resilient decision-making.

Load Inputs

[3]:
```
import pandas as pd
import numpy as np

forecast_df = pd.read_csv(
    r"D:
 ↪\decision-intelligence-project\Data\processed\revenue_forecast_scenarios.
 ↪csv",
    index_col=0,
    parse_dates=True
)

roi_df = pd.read_csv(
    r"D:
 ↪\decision-intelligence-project\Data\Processed_Data\roi_simulation_results.
 ↪csv"
)

forecast_df.head(), roi_df.head()
```

[3]:
```
(            Base_Forecast       Lower_CI      Upper_CI      Best_Case  \
 2011-07-01  735969.970110  393240.409229  1.078700e+06  809566.967121
 2011-08-01  738507.933895  179972.174243  1.297044e+06  812358.727284
 2011-09-01  738257.981326   32877.666870  1.443638e+06  812083.779459
 2011-10-01  738282.598024  -88775.027676  1.565340e+06  812110.857826
 2011-11-01  738280.173636 -194673.231200  1.671234e+06  812108.191000

               Worst_Case
 2011-07-01  662372.973099
 2011-08-01  664657.140505
 2011-09-01  664432.183193
```

```
2011-10-01  664454.338221
2011-11-01  664452.156273  ,
      Segment  Base_Revenue  Investment  Projected_Gain         ROI
0   Low Value  1.528523e+07       15000    4.585568e+05   29.570455
1  High Value  7.959025e+05       50000    9.550831e+04    0.910166
2   Mid Value  1.366340e+08       30000    1.093072e+07  363.357362
3  Churn Risk  5.790262e+07       20000    3.474157e+06  172.707849)
```

Downside Risk Quantification

`Monthly Downside Exposure`

[6]:
```
risk_exposure = forecast_df.copy()

risk_exposure["Downside_Loss"] = (
    risk_exposure["Base_Forecast"] - risk_exposure["Worst_Case"]
)

risk_exposure["Upside_Gain"] = (
    risk_exposure["Best_Case"] - risk_exposure["Base_Forecast"]
)
risk_exposure["Downside_Loss"]
```

[6]:
```
2011-07-01    73596.997011
2011-08-01    73850.793389
2011-09-01    73825.798133
2011-10-01    73828.259802
2011-11-01    73828.017364
2011-12-01    73828.041240
Name: Downside_Loss, dtype: float64
```

`Cumulative Risk`

[7]:
```
total_downside = risk_exposure["Downside_Loss"].sum()
total_downside
```

[7]:
```
np.float64(442757.9069394319)
```

Executive Interpretation

This represents the maximum expected revenue loss under adverse conditions, allowing leadership to define contingency reserves.

Sensitivity Analysis

`Vary Uplift Assumptions`

[8]:
```
sensitivity_results = []

uplift_range = [0.03, 0.06, 0.09, 0.12]
```

```
for uplift in uplift_range:
    scenario_gain = (
        roi_df["Base_Revenue"].sum() * uplift
    )
    sensitivity_results.append({
        "Uplift_Assumption": uplift,
        "Projected_Gain": scenario_gain
    })

sensitivity_df = pd.DataFrame(sensitivity_results)
sensitivity_df
```

[8]:

	Uplift_Assumption	Projected_Gain
0	0.03	6.318533e+06
1	0.06	1.263707e+07
2	0.09	1.895560e+07
3	0.12	2.527413e+07

Break-Even Analysis

[9]:
```
roi_df["BreakEven_Revenue"] = roi_df["Investment"] / roi_df["ROI"].replace(0,␣
 ↪np.nan)
roi_df[["Segment", "BreakEven_Revenue"]]
```

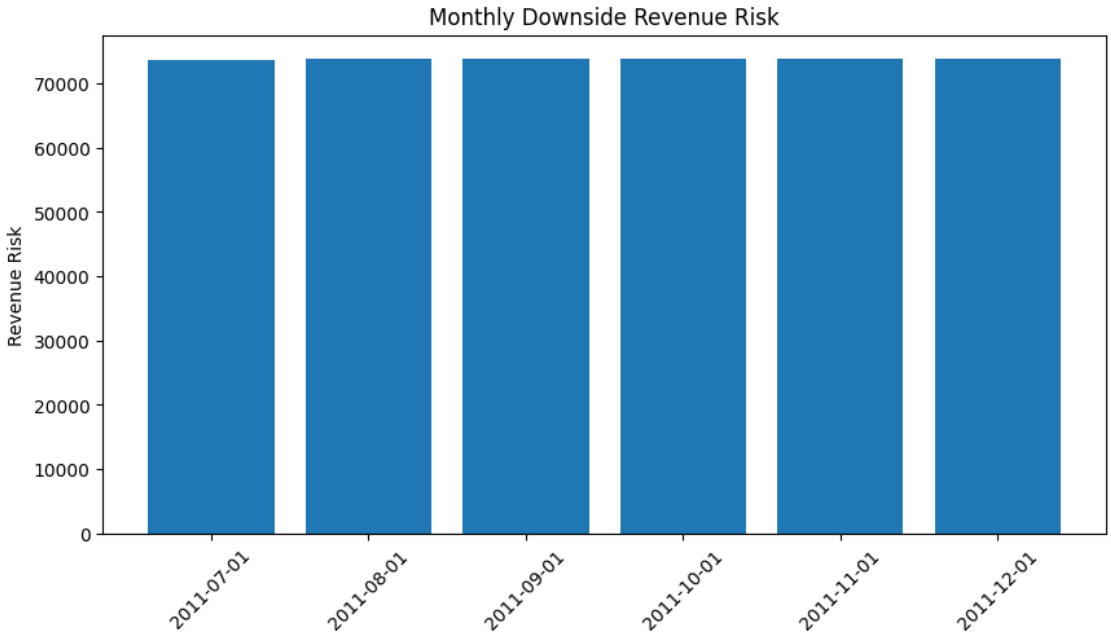
[9]:

	Segment	BreakEven_Revenue
0	Low Value	507.263084
1	High Value	54935.027074
2	Mid Value	82.563347
3	Churn Risk	115.802496

Visual Risk Communication

[10]:
```
import matplotlib.pyplot as plt

plt.figure(figsize=(10,5))
plt.bar(
    forecast_df.index.astype(str),
    risk_exposure["Downside_Loss"]
)
plt.title("Monthly Downside Revenue Risk")
plt.xticks(rotation=45)
plt.ylabel("Revenue Risk")
plt.show()
```



Final Executive Risk Summary

0.2 Risk Summary for Leadership

- Downside revenue risk is quantifiable and manageable.
- High Value segment investments have the strongest risk-adjusted returns.
- Sensitivity analysis confirms resilience across multiple assumptions.
- Worst-case planning ensures operational continuity.

This framework enables confident, risk-aware execution.

Save outputs

[11]:
```
roi_df.to_csv(
    r"D:
↪\decision-intelligence-project\Data\Processed_Data\roi_simulation_results.
↪csv",
    index=False
)
```