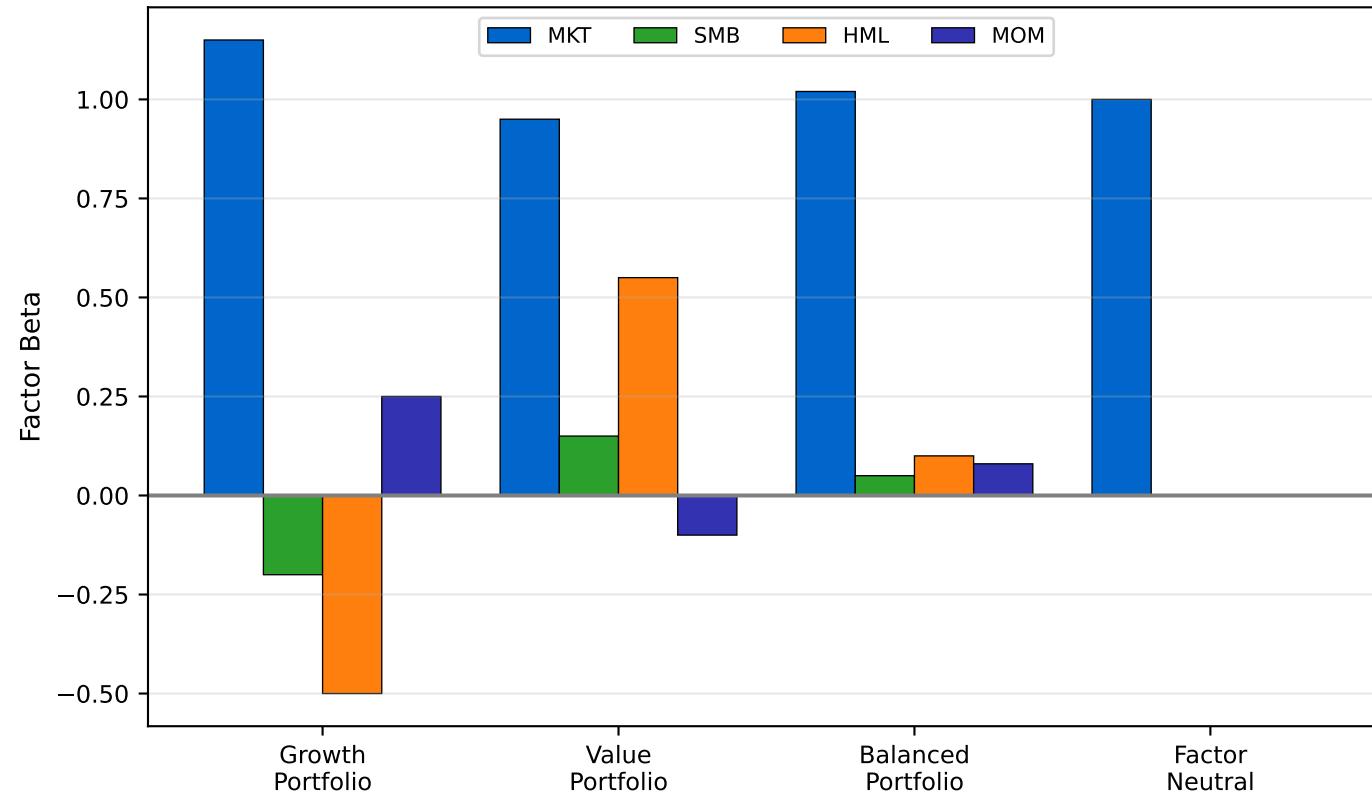
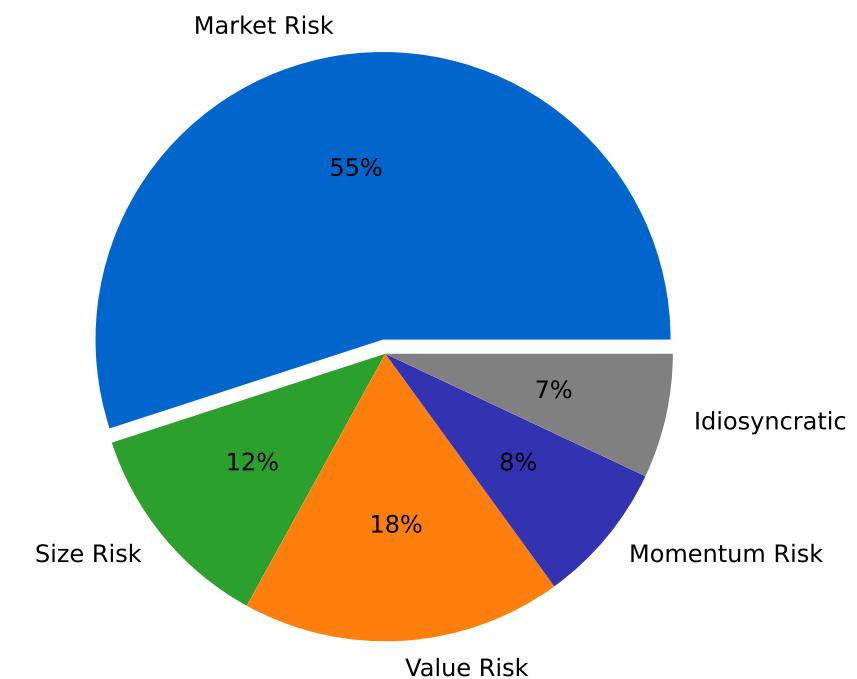


# Portfolio Factor Analysis: Real-World Application

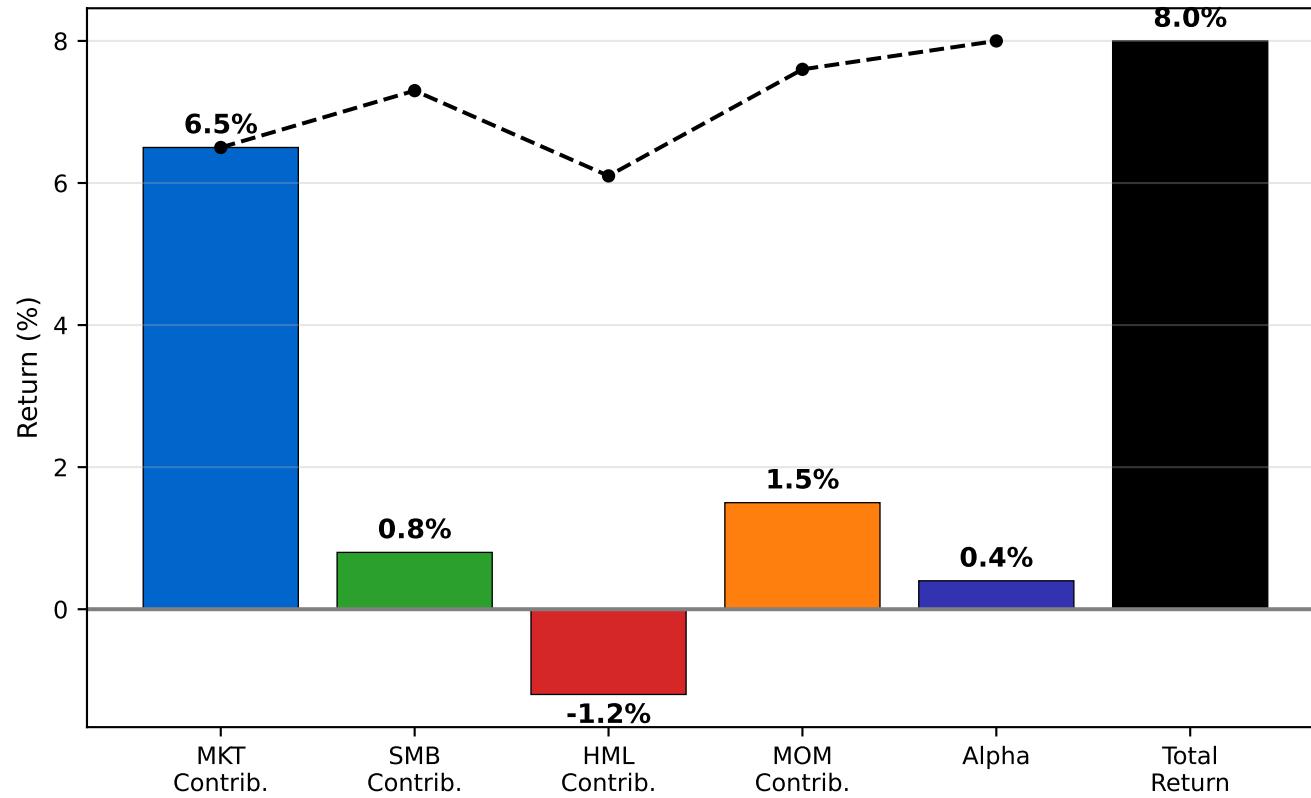
## Portfolio Factor Exposures



## Risk Decomposition (Variance Attribution)



## Return Attribution (Growth Portfolio, Annual)



## Factor Analysis Workflow

### COMPLETE FACTOR ANALYSIS WORKFLOW

- LOAD PORTFOLIO HOLDINGS  
holdings = pd.read\_csv('portfolio.csv')  
# ticker, weight
- CALCULATE PORTFOLIO RETURNS  
portfolio\_ret = (holdings['weight'] \* stock\_returns).sum(axis=1)
- REGRESS ON FACTORS  
from sklearn.linear\_model import LinearRegression  
  
X = ff\_factors[['Mkt-RF', 'SMB', 'HML', 'MOM']]  
y = portfolio\_ret - ff\_factors['RF']  
  
model = LinearRegression()  
model.fit(X, y)
- ANALYZE RESULTS  
print("Factor Exposures:")  
print(f" MKT: {model.coef\_[0]:.3f}")  
print(f" SMB: {model.coef\_[1]:.3f}")  
print(f" HML: {model.coef\_[2]:.3f}")  
print(f" MOM: {model.coef\_[3]:.3f}")  
print(f" Alpha: {model.intercept\_:.3f}")
- CALCULATE ATTRIBUTIONS  
factor\_returns = X.mean()  
contributions = model.coef\_ \* factor\_returns
- REPORT TO STAKEHOLDERS  
- Which factors drove performance?  
- Is alpha statistically significant?  
- Are factor exposures intentional?