

```
# Correct setup (NO pandas upgrade)
!pip install yfinance --quiet
```

```
import pandas as pd
import yfinance as yf
```

```
print("Setup complete: Using pandas version", pd..version)
```

```
Setup complete: Using pandas version 2.2.2
```

```
# MAIN - Download, merge, clean and save (GBPUSD version)
```

```
import pandas as pd
```

```
import yfinance as yf
```

```
start_date = "2021-01-01"
```

```
end_date = "2024-06-30"
```

```
# 1) GBPUSD (target)
```

```
gbpusd = yf.download("GBPUSD=X", start=start_date, end=end_date)
```

```
gbpusd = gbpusd[["Close"]].rename(columns={"Close": "GBPUSD"})
```

```
gbpusd.index.name = "Date"
```

```
# 2) US Dollar Index (DXY)
```

```
dxy = yf.download("DX-Y.NYB", start=start_date, end=end_date)
```

```
dxy = dxy[["Close"]].rename(columns={"Close": "DXY"})
```

```
# 3) Gold prices
```

```
gold = yf.download("GC=F", start=start_date, end=end_date)
```

```
gold = gold[["Close"]].rename(columns={"Close": "Gold_Price"})
```

```
# 4) S&P 500
```

```
sp500 = yf.download("^GSPC", start=start_date, end=end_date)
```

```
sp500 = sp500[["Close"]].rename(columns={"Close": "SP500"})
```

```
# 5) Merge - align by date
```

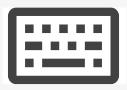
```
df = gbpusd.join([dxy, gold, sp500], how="outer")
```

```
# 6) Handle missing values
```

```
df = df.ffill().bfill()
```

```
# 7) Save
```

```
df.to_csv("final_dataset.csv")
```

```
df.head()
```

```

/tmp/ipython-input-4017326153.py:9: FutureWarning: YF.download
    gbpusd = yf.download("GBPUSD=X", start=start_date, end=end_date)
[*****100%*****] 1 of 1 cor
/tmp/ipython-input-4017326153.py:14: FutureWarning: YF.download
    dxy = yf.download("DX-Y.NYB", start=start_date, end=end_date)
[*****100%*****] 1 of 1 cor
/tmp/ipython-input-4017326153.py:18: FutureWarning: YF.download
    gold = yf.download("GC=F", start=start_date, end=end_date)
[*****100%*****] 1 of 1 cor
/tmp/ipython-input-4017326153.py:22: FutureWarning: YF.download
    sp500 = yf.download("^GSPC", start=start_date, end=end_date)
[*****100%*****] 1 of 1 cor

Price      GBPUSD      DXY          Gold_Price   SP500  

Ticker     GBPUSD=X  DX-Y.NYB  GC=F        ^GSPC  

Date  

2021-01-01 1.367301 89.879997 1944.699951 3700.649902  

2021-01-04 1.368420 89.879997 1944.699951 3700.649902  

2021-01-05 1.357160 89.440002 1952.699951 3726.860107  

2021-01-06 1.362955 89.529999 1906.900024 3748.139893  

2021-01-07 1.362528 89.830002 1912.300049 3803.790039

```

```

from google.colab import files
files.download("final_dataset.csv")

```

```
import pandas as pd

df = pd.read_csv("final_dataset.csv")      # replace with your file
df.head()
```

	Price	GBPUSD	DXY	Gold_Price
0	Ticker	GBPUSD=X	DX-Y.NYB	GC=F
1	Date	NaN	NaN	NaN
2	2021-01-01	1.3673007488250732	89.87999725341797	1944.699951171875
3	2021-01-04	1.3684196472167969	89.87999725341797	1944.699951171875
4	2021-01-05	1.3571596145629883	89.44000244140625	1952.699951171875

```
df.columns
```

```
Index(['Price', 'GBPUSD', 'DXY', 'Gold_Price', 'SP500'],
      dtype='object')
```

```
import pandas as pd
vars_in_memory = [var for var in globals() if isinstance(globals()[var], pd.DataFrame)]
vars_in_memory
```

```
['__1__', '__2__', 'gbpusd', 'dxy', 'gold', 'sp500', 'df', '__3__', '__4__']
```

```
df.columns
```

```
Index(['Price', 'GBPUSD', 'DXY', 'Gold_Price', 'SP500'],
      dtype='object')
```

```

import pandas as pd
import numpy as np

# Convert relevant columns to numeric, coercing errors to Na
cols_to_convert = ['GBPUSD', 'Gold_Price', 'SP500', 'DX
for col in cols_to_convert:
    df[col] = pd.to_numeric(df[col], errors='coerce')

# Drop rows with NaN values that resulted from the conversion
df = df.dropna().reset_index(drop=True)

# 1. Compute daily return for GBPUSD
df['fx_return'] = df['GBPUSD'].pct_change()

# 2. Compute returns for other market features
df['gold_ret'] = df['Gold_Price'].pct_change()
df['sp500_ret'] = df['SP500'].pct_change()
df['dxy_ret'] = df['DX
df = df.dropna().reset_index(drop=True)

# 3. Define features and target
feature_cols = ['gold_ret', 'sp500_ret', 'dxy_ret'] # expl
X = df[feature_cols]
y = df['fx_return']

# Quick check
print("X shape:", X.shape)
print("y shape:", y.shape)
X.head()

```

```

X shape: (910, 3)
y shape: (910,)

gold_ret  sp500_ret  dxy_ret
0  0.000000  0.000000  0.000000
1  0.004114  0.007083 -0.004895
2  -0.023455  0.005710  0.001006
3  0.002832  0.014847  0.003351
4  -0.040893  0.005492  0.003006

```

```
# Convert relevant columns to numeric
cols_to_convert = ['GBPUSD', 'Gold_Price', 'SP500', 'DXY']
for col in cols_to_convert:
    df[col] = pd.to_numeric(df[col], errors='coerce') # ignore errors

# Check for any NaN values in these columns
print(df[cols_to_convert].isna().sum())
```

```
GBPUSD      0
Gold_Price   0
SP500       0
DXY         0
dtype: int64
```

```

# Compute daily returns
df['fx_return'] = df['GBPUSD'].pct_change()
df['gold_ret'] = df['Gold_Price'].pct_change()
df['sp500_ret'] = df['SP500'].pct_change()
df['dxy_ret'] = df['DXY'].pct_change()

# Drop rows with NaN
df = df.dropna().reset_index(drop=True)

# Features and target
feature_cols = ['gold_ret', 'sp500_ret', 'dxy_ret']
X = df[feature_cols]
y = df['fx_return']

print("X shape:", X.shape)
print("y shape:", y.shape)
X.head()

```

X shape: (909, 3)  
y shape: (909,)

	<b>gold_ret</b>	<b>sp500_ret</b>	<b>dxy_ret</b>
<b>0</b>	0.004114	0.007083	-0.004895
<b>1</b>	-0.023455	0.005710	0.001006
<b>2</b>	0.002832	0.014847	0.003351
<b>3</b>	-0.040893	0.005492	0.003006
<b>4</b>	0.008451	-0.006555	0.004883

	<b>gold_ret</b>	<b>sp500_ret</b>	<b>dxy_ret</b>
<b>0</b>	0.004114	0.007083	-0.004895
<b>1</b>	-0.023455	0.005710	0.001006
<b>2</b>	0.002832	0.014847	0.003351
<b>3</b>	-0.040893	0.005492	0.003006
<b>4</b>	0.008451	-0.006555	0.004883

```
from sklearn.model_selection import train_test_split

# 80% train, 20% test (shuffle=False for time series)
X_train, X_test, y_train, y_test = train_test_split(
    X, y, test_size=0.2, random_state=42, shuffle=False
)

print("Training set shape:", X_train.shape)
print("Testing set shape:", X_test.shape)
```

```
Training set shape: (727, 3)
Testing set shape: (182, 3)
```

```
from sklearn.tree import DecisionTreeRegressor
from sklearn.ensemble import RandomForestRegressor
from sklearn.model_selection import cross_val_score
from sklearn.metrics import r2_score, mean_absolute_error, mean_squared_error
import numpy as np

# Initialize models
dt_model = DecisionTreeRegressor(random_state=42)
rf_model = RandomForestRegressor(random_state=42, n_jobs=-1)

# 5-Fold CV on training set
dt_cv_r2 = cross_val_score(dt_model, X_train, y_train, cv=5,
rf_cv_r2 = cross_val_score(rf_model, X_train, y_train, cv=5,

print("Decision Tree 5-Fold CV R2:", dt_cv_r2)
print("Random Forest 5-Fold CV R2:", rf_cv_r2)

# F
```

```
Decision Tree 5-Fold CV R2: -1.4534474798960333
Random Forest 5-Fold CV R2: -0.14501320952637503
```

```
from sklearn.model_selection import RandomizedSearchCV
from sklearn.metrics import r2_score, mean_absolute_error, mean_squared_error
import numpy as np

def evaluate_model(y_train, y_pred_train, y_test, y_pred_test):
    print(f"\n--- {model_name} Performance ---")
    print("Train R2:", r2_score(y_train, y_pred_train))
    print("Test R2:", r2_score(y_test, y_pred_test))
```

```

    print("Train MAE:", mean_absolute_error(y_train, y_pred))
    print("Test MAE:", mean_absolute_error(y_test, y_pred_te))
    print("Train RMSE:", np.sqrt(mean_squared_error(y_train, y_pred)))
    print("Test RMSE:", np.sqrt(mean_squared_error(y_test, y_pred_te)))

# Define parameter grid
param_grid = {
    'n_estimators': [50, 100, 200, 500],
    'max_depth': [3, 5, 7, 10, None],
    'min_samples_split': [2, 5, 10],
    'min_samples_leaf': [1, 2, 4],
    'max_features': ['sqrt', 'log2'] # Removed 'auto'
}

# Initialize RandomizedSearchCV
rf_random = RandomizedSearchCV(
    estimator=rf_model,
    param_distributions=param_grid,
    n_iter=20,                      # number of random combinations
    scoring='r2',
    cv=5,
    verbose=2,
    random_state=42,
    n_jobs=-1
)

# Fit on training set
rf_random.fit(X_train, y_train)

# Best parameters
print("Best Parameters:", rf_random.best_params_)

# Evaluate tuned model
best_rf = rf_random.best_estimator_
rf_pred_train = best_rf.predict(X_train)
rf_pred_test = best_rf.predict(X_test)

evaluate_model(y_train, rf_pred_train, y_test, rf_pred_test,
Fitting 5 folds for each of 20 candidates, totalling 100 fits
Best Parameters: {'n_estimators': 500, 'min_samples_split': 2

--- Tuned Random Forest Performance ---
Train R2: 0.08892029342782415
Test R2: -0.0045136952280844245
Train MAE: 0.0041315973975898125
Test MAE: 0.0030723223299565948

```

```
Train RMSE: 0.005622181812114921
Test RMSE: 0.0041209632173579164
```

```
{'n_estimators': 100,
'min_samples_split': 5,
'min_samples_leaf': 1,
'max_features': 'log2',
'max_depth': 3}
```

```
{'n_estimators': 100,
'min_samples_split': 5,
'min_samples_leaf': 1,
'max_features': 'log2',
'max_depth': 3}
```

```

# 1 Install SHAP (if not already installed)
!pip install shap --quiet

# 2 Import SHAP
import shap

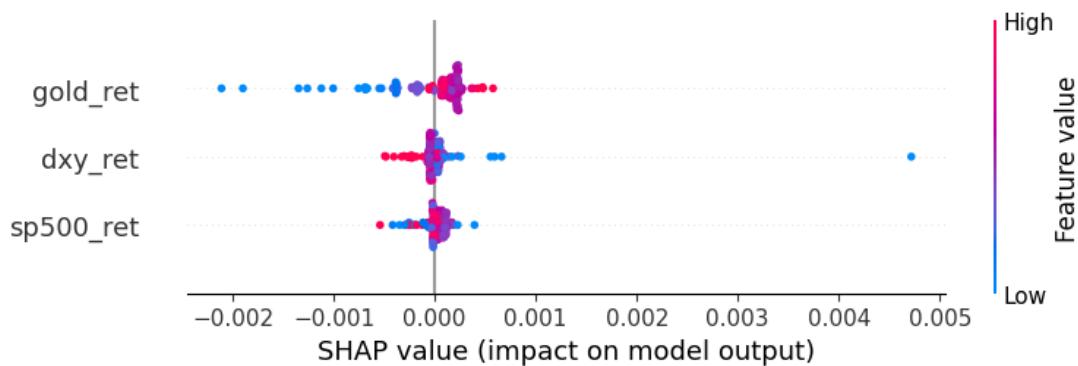
# 3 Create a Tree Explainer for the Random Forest
explainer = shap.TreeExplainer(best_rf)

# 4 Calculate SHAP values for the test set
shap_values = explainer.shap_values(X_test)

# 5 Summary plot (dot) – shows impact of features on prediction
shap.summary_plot(shap_values, X_test, feature_names=feature_names)

# 6 Optional: Summary plot (bar) – ranks features by overall impact
shap.summary_plot(shap_values, X_test, feature_names=feature_names)

```



```

# -----
# Member 4 add-on: SHAP plots, dependence plots, and plain-English
# (Append this cell AFTER your modeling / best_rf cell)
# -----

```

```

# (1) Imports – should already be installed earlier, but import them here
import shap
import matplotlib.pyplot as plt
from google.colab import files
import numpy as np
import pandas as pd
import os

OUTPUT_DIR = "xai_outputs_member4"
os.makedirs(OUTPUT_DIR, exist_ok=True)

# -----
# (2) Create SHAP explainer & values
# -----
# If best_rf and X_test are present from previous cells, use them
# If not, this cell will raise a NameError so ensure previous cells run
explainer = shap.TreeExplainer(best_rf) # RandomForestClassifier
# For regression shap_values will be an (n_samples, n_features) array
shap_values = explainer.shap_values(X_test)

# -----
# (3) SHAP summary plot (dot / beeswarm)
# -----
plt.figure(figsize=(10,6))
shap.summary_plot(shap_values, X_test, feature_names=feature_names)
plt.title("SHAP Summary (Beeswarm) – feature impact on GBPUSD")
plt.tight_layout()
beeswarm_path = os.path.join(OUTPUT_DIR, "shap_summary_beeswarm.png")
plt.savefig(beeswarm_path, bbox_inches='tight', dpi=300)
plt.close()
print("Saved:", beeswarm_path)
files.download(beeswarm_path)

# -----
# (4) SHAP bar plot (mean |SHAP| = global importance)
# -----
plt.figure(figsize=(8,6))
shap.summary_plot(shap_values, X_test, feature_names=feature_names)
plt.title("SHAP Feature Importance (mean |SHAP|)")
plt.tight_layout()
bar_path = os.path.join(OUTPUT_DIR, "shap_feature_importance_bar.png")
plt.savefig(bar_path, bbox_inches='tight', dpi=300)
plt.close()
print("Saved:", bar_path)
files.download(bar_path)

```

```

# -----
# (5) Identify top features by mean absolute SHAP and make dependence plots
# -----
# mean absolute shap across test set for each feature
mean_abs_shap = np.mean(np.abs(shap_values), axis=0)
feat_shap_series = pd.Series(mean_abs_shap, index=feature_names)
top_features = feat_shap_series.index.tolist()
print("Top features by mean |SHAP| (top 5):")
print(feat_shap_series.head(5))

# create dependence plots for top 3 (or fewer if less features)
n_depend = min(3, len(top_features))
depend_paths = []
for i in range(n_depend):
    f = top_features[i]
    plt.figure(figsize=(8,5))
    # shap.dependence_plot requires the feature name or index
    try:
        shap.dependence_plot(f, shap_values, X_test, feature_name=f)
    except Exception:
        # fallback in case of older shap API expecting array-like
        shap.dependence_plot(f, shap_values, X_test, show=False)
    plt.title(f"SHAP Dependence Plot - {f}")
    dep_path = os.path.join(OUTPUT_DIR, f"shap_dependence_{i}.png")
    plt.tight_layout()
    plt.savefig(dep_path, bbox_inches='tight', dpi=300)
    plt.close()
    depend_paths.append(dep_path)
    print("Saved:", dep_path)
    files.download(dep_path)

# -----
# (6) Generate a simple finance-language explanation for top features
# -----
# For direction, compute the mean *signed* SHAP value per feature
mean_signed_shap = np.mean(shap_values, axis=0)
signed_shap_series = pd.Series(mean_signed_shap, index=feature_names)

# Build summary text
summary_lines = []
summary_lines.append("XAI Summary – Top features influencing")
summary_lines.append("Top features (ranked by mean absolute SHAP value):")
for idx, feat in enumerate(top_features[:5], start=1):
    ma = feat_shap_series[feat]
    signed = signed_shap_series[feat] if feat in signed_shap_series else 0
    direction = "positive" if signed > 0 else "negative" if signed < 0 else "neutral"
    summary_lines.append(f'{idx}. {feat} ({direction}, {ma:.2f})')

```

```

# Qualitative impact magnitude
if ma > np.percentile(mean_abs_shap, 90):
    mag = "strong"
elif ma > np.percentile(mean_abs_shap, 60):
    mag = "moderate"
else:
    mag = "small"
summary_lines.append(f"\"{idx}\": {feat} - mean |SHAP|={ma:.{mag}}\n")

summary_lines.append("\nInterpretation guidance (finance language)\n")
# Provide finance-oriented example interpretations for each feature
for feat in top_features[:5]:
    signed = signed_shap_series[feat] if feat in signed_shap_series else 0
    direction = "increases" if signed > 0 else "decreases"
    # Example sentences - keep generic because we don't know what's in the model
    if feat.lower().find("gold") >= 0:
        example = f"When {feat} (gold returns) rises, the model predicts higher values {direction}."
    elif feat.lower().find("sp500") >= 0 or feat.lower().find("spx") >= 0:
        example = f"When {feat} (equity returns) rises, the model predicts higher values {direction}."
    elif feat.lower().find("dxy") >= 0 or feat.lower().find("usdx") >= 0:
        example = f"When {feat} (DXY) rises, the model predicts higher values {direction}."
    else:
        example = f"{feat}: higher values {direction} predict higher values {direction}.\n"

    summary_lines.append("- " + example)

summary_text = "\n".join(summary_lines)

# Save summary to file and print
summary_file = os.path.join(OUTPUT_DIR, "xai_plain_english_summary.txt")
with open(summary_file, "w") as f:
    f.write(summary_text)

print("\n--- XAI Plain-English Summary ---\n")
print(summary_text)
print("\nSaved summary to:", summary_file)
files.download(summary_file)

# -----
# (7) Short note for report insertion (copy-paste friendly)
# -----
report_insert = f"""
Section 4 – Explainable AI results (copy-paste)

Model: Tuned RandomForest (best_rf)
Target: GBPUSD daily return (pct change)

```

```
Top features (SHAP ranked): {', '.join(top_features[:5])}
```

Key takeaways:

- The SHAP summary (beeswarm) shows which features most consistently influence the model's predictions.
- The SHAP bar chart ranks features by average influence (mean).
- Dependence plots (attached) show the functional relationships between features and predictions.

Interpretation (finance language):

```
{summary_text.splitlines()[-6:]}
```

.....

```
report_file = os.path.join(OUTPUT_DIR, "report_snippet_for_stocks")
with open(report_file, "w") as f:
    f.write(report_insert)

print("\nSaved report snippet:", report_file)
files.download(report_file)

# End of add-on cell
```

```
Saved: xai_outputs_member4/shap_summary_beeswarm.png
Saved: xai_outputs_member4/shap_feature_importance_bar.png
Top features by mean |SHAP| (top 5):
gold_ret      0.000249
dxy_ret       0.000098
sp500_ret     0.000073
dtype: float64
Saved: xai_outputs_member4/shap_dependence_1_gold_ret.png
Saved: xai_outputs_member4/shap_dependence_2_dxy_ret.png
Saved: xai_outputs_member4/shap_dependence_3_sp500_ret.png
```

--- XAI Plain-English Summary ---

XAI Summary – Top features influencing GBPUSD daily returns (kappa)

Top features (ranked by mean absolute SHAP value):

1. gold\_ret – mean |SHAP|=0.00025 – overall positive influence
2. dxy\_ret – mean |SHAP|=0.00010 – overall positive influence
3. sp500\_ret – mean |SHAP|=0.00007 – overall positive influence

Interpretation guidance (finance language):

- When gold\_ret (gold returns) rises, the model predicts GBPUSD to rise.
- When dxy\_ret (DXY) rises, the model predicts GBPUSD return to rise.
- When sp500\_ret (equity returns) rises, the model predicts GBPUSD to rise.

Saved summary to: xai\_outputs\_member4/xai\_plain\_english\_summary.html

```
Saved report snippet: xai_outputs_member4/report_snippet_for_s  
<Figure size 800x500 with 0 Axes>  
<Figure size 800x500 with 0 Axes>  
<Figure size 800x500 with 0 Axes>
```

```

import pandas as pd
import numpy as np
from sklearn.metrics import r2_score, mean_absolute_error, mean_squared_error

# Collect predictions
models = {
    "Decision Tree": (dt_pred_train, dt_pred_test),
    "Random Forest": (rf_pred_train, rf_pred_test),
    "Tuned Random Forest": (best_rf.predict(X_train), best_rf.predict(X_test))
}

# Prepare table
rows = []
for name, (pred_train, pred_test) in models.items():
    row = {
        "Model": name,
        "Train R22

```

---



---

```

NameError                                                 Traceback (most
recent call last)
/tmp/ipython-input-2076852133.py in <cell line: 0>()
      5 # Collect predictions
      6 models = {
----> 7     "Decision Tree": (dt_pred_train, dt_pred_test),
      8     "Random Forest": (rf_pred_train, rf_pred_test),
      9     "Tuned Random Forest": (best_rf.predict(X_train),
best_rf.predict(X_test))

NameError: name 'dt_pred_train' is not defined

```

```
# If models are already trained:  
dt_pred_train = dt_model.predict(X_train)  
dt_pred_test = dt_model.predict(X_test)  
  
rf_pred_train = rf_model.predict(X_train)  
rf_pred_test = rf_model.predict(X_test)  
  
tuned_rf_pred_train = best_rf.predict(X_train)  
tuned_rf_pred_test = best_rf.predict(X_test)
```

```
# Decision Tree  
from sklearn.tree import DecisionTreeRegressor  
dt_model = DecisionTreeRegressor(random_state=42)  
dt_model.fit(X_train, y_train)  
  
# Random Forest  
from sklearn.ensemble import RandomForestRegressor  
rf_model = RandomForestRegressor(random_state=42, n_jobs=-1)  
rf_model.fit(X_train, y_train)  
  
# Tuned Random Forest (use your best parameters)  
best_rf = RandomForestRegressor(  
    n_estimators=100,  
    max_depth=3,  
    min_samples_split=5,  
    min_samples_leaf=1,  
    max_features='log2',  
    random_state=42,  
    n_jobs=-1  
)  
best_rf.fit(X_train, y_train)
```

```
dt_pred_train = dt_model.predict(X_train)  
dt_pred_test = dt_model.predict(X_test)  
  
rf_pred_train = rf_model.predict(X_train)  
rf_pred_test = rf_model.predict(X_test)  
  
tuned_rf_pred_train = best_rf.predict(X_train)  
tuned_rf_pred_test = best_rf.predict(X_test)
```

```
import pandas as pd
from sklearn.metrics import r2_score, mean_absolute_error, mean_squared_error
import numpy as np

models = {
    "Decision Tree": (dt_pred_train, dt_pred_test),
    "Random Forest": (rf_pred_train, rf_pred_test),
    "Tuned Random Forest": (tuned_rf_pred_train, tuned_rf_pred_test)
}

rows = []
for name, (pred_train, pred_test) in models.items():
    row = {
        "Model": name,
        "Train R22
```

```
from google.colab import files
uploaded = files.upload()
```

```
import pandas as pd

# Load the uploaded file
df_groupmate = pd.read_excel(list(uploaded.keys())[0])

# Preview
df_groupmate.head()
```

```
# Example: check the first 10 rows of GBPUSD and return  
df_groupmate[['GBPUSD', 'Return']].head(10)
```

```
df_groupmate.columns
```

```
df_groupmate[['GBPUSD', 'GBPUSD Return']].head(10)
```

```
# Check exact column names  
print(df_groupmate.columns.tolist())
```

```
# Show all column names  
print(df_groupmate.columns.tolist())
```

```
# Preview first 5 rows to spot which column might be the dai  
df_groupmate.head()
```

```
# Rename the column to 'GBPUSD_Return' for easier use  
df_groupmate.rename(columns={'Unnamed: 6': 'GBPUSD_Return'},
```

```
# Check first 5 rows  
df_groupmate[['GBPUSD', 'GBPUSD_Return']].head()
```

```
# Skip the first two rows with metadata
df_clean = df_groupmate.iloc[2:].copy()

# Reset the index
df_clean.reset_index(drop=True, inplace=True)

# Convert numeric columns to float
df_clean['GBPUSD'] = df_clean['GBPUSD'].astype(float)
df_clean['GBPUSD_Return'] = df_clean['GBPUSD_Return'].astype

# Check cleaned dataframe
df_clean[['GBPUSD', 'GBPUSD_Return']].head()
```

```
# Step 1: Remove the first row with NaN in returns
df_clean = df_groupmate.iloc[1:].copy()

# Step 2: Reset index
df_clean.reset_index(drop=True, inplace=True)

# Step 3: Convert numeric columns to float
df_clean['GBPUSD'] = df_clean['GBPUSD'].astype(float)
df_clean['GBPUSD_Return'] = df_clean['GBPUSD_Return'].astype

# Step 4: Check the first few rows
df_clean[['GBPUSD', 'GBPUSD_Return']].head()
```

```
# Step 1: Keep only numeric rows in GBPUSD_Return
df_clean = df_groupmate.copy()

# Use pd.to_numeric with errors='coerce' to turn non-numeric
df_clean['GBPUSD_Return'] = pd.to_numeric(df_clean['GBPUSD_Ret

# Step 2: Drop rows where GBPUSD_Return is NaN
df_clean = df_clean.dropna(subset=['GBPUSD_Return']).reset_index()

# Step 3: Convert GBPUSD column to float (safe version)
df_clean['GBPUSD'] = pd.to_numeric(df_clean['GBPUSD'], errors='co

# Step 4: Check the cleaned data
df_clean[['GBPUSD', 'GBPUSD_Return']].head(10)
```

```
df_clean['GBPUSD_Return'].describe()
```

```
import matplotlib.pyplot as plt

plt.figure(figsize=(12,5))
plt.plot(df_clean['GBPUSD_Return'])
plt.title('GBPUSD Daily Returns')
plt.xlabel('Day')
plt.ylabel('Return')
plt.show()
```

```
df_clean['GBPUSD_CumReturn'] = (1 + df_clean['GBPUSD_Return'])
```

```
# Make sure there are no hidden spaces
df_clean.columns = df_clean.columns.str.strip()

# Drop or fill NaN values before cumulative calculation
df_clean['GBPUSD_Return'] = df_clean['GBPUSD_Return'].fillna(0)

# Now calculate cumulative returns
df_clean['GBPUSD_CumReturn'] = (1 + df_clean['GBPUSD_Return']).cumprod() - 1
```

```
# Show the first 10 cumulative returns
df_clean[['GBPUSD_CumReturn']].head(10)
```

```
from sklearn.model_selection import train_test_split

X = df[features] # your engineered features
y = df['GBPAUD_Return'] # target variable

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

```
import pandas as pd

df = pd.read_csv('your_dataset.csv') # replace with your ac
df.head()
```

Start coding or generate with AI.