In [ ]:
```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import plotly.express as px
import seaborn as sns
```

In [ ]:
```python
df_ti=pd.read_excel('Consulta_20230622-185234029.xlsx')
df_pib=pd.read_excel('Indicadores20230623152744.xls')
df_mxn_x=pd.read_csv('MXN=X (2).csv')
df_indicadores=pd.read_excel('Indicadores20230622190157.xls')
df_fed=pd.read_csv('FEDFUNDS (1).csv')
df_reservas=pd.read_excel('Consulta_20230623-125314125.xlsx')
df_gdp=pd.read_csv('GDP.csv')
df_desmpleo_usa=pd.read_csv('UNRATE.csv')
df_cpi=pd.read_csv('CPIAUCSL.csv')
```

```
c:\Users\Pablo\anaconda3\lib\site-packages\openpyxl\styles\stylesheet.py:226: UserWarning: Workbook contains n
o default style, apply openpyxl's default
  warn("Workbook contains no default style, apply openpyxl's default")
```

In [ ]:
```python
df_reservas=df_reservas[['Banco de México','Unnamed: 1']]
df_reservas.rename(columns={'Banco de México':'Periodos',
                            'Unnamed: 1':'Reserva Extranjera'},inplace=True)
df_reservas.drop(df_reservas.index[0:11],inplace=True)
df_reservas['Periodos']=pd.to_datetime(df_reservas['Periodos'])
trimestres=df_reservas['Periodos'].dt.month.isin([3, 6, 9, 12])
df_reservas=df_reservas[trimestres]
df_reservas['Periodos'] = df_reservas['Periodos'] + pd.offsets.QuarterEnd()
```

In [ ]:
```python
periodos=df_reservas['Periodos']
periodos=pd.DataFrame({'Periodos':periodos}).reset_index(drop=True)
```

In [ ]:
```python
df_pib.rename(columns={'Instituto Nacional de Estadística y Geografía (INEGI)':'Periodos',
                            'Unnamed: 1':'PIB_pct'},inplace=True)
df_pib.drop(df_pib.index[0:4],inplace=True)
df_pib.dropna(inplace=True)
df_pib.drop(['Periodos'],axis=1,inplace=True)
df_pib.reset_index(drop=True,inplace=True)
df_pib=pd.concat([periodos,df_pib],axis=1)
df_pib['Periodos'] = df_pib['Periodos'] + pd.offsets.QuarterEnd()
```

In [ ]:
```python
df_gdp.rename(columns={'DATE':'Periodos',
               'GDP_PCH':'GPD_pct'},inplace=True)
df_gdp.drop(['Periodos'],axis=1,inplace=True)
df_gdp=pd.concat([periodos,df_gdp],axis=1)
df_gdp['Periodos'] = df_gdp['Periodos'] + pd.offsets.QuarterEnd()
```

In [ ]:
```python
df_cpi.rename(columns={'DATE':'Periodos','CPIAUCSL':'CPI'}, inplace=True)
df_cpi['Periodos']=pd.to_datetime(df_cpi['Periodos'])
trimestres=df_cpi['Periodos'].dt.month.isin([3,6,9,12])
df_cpi=df_cpi[trimestres]
df_cpi['Periodos'] = df_cpi['Periodos'] + pd.offsets.QuarterEnd()
```

In [ ]:
```python
df_desmpleo_usa.rename(columns={'DATE':'Periodos','FEDFUNDS':'Tasa Desmpleo USA'}, inplace=True)
df_desmpleo_usa['Periodos']=pd.to_datetime(df_desmpleo_usa['Periodos'])
trimestres=df_desmpleo_usa['Periodos'].dt.month.isin([3,6,9,12])
df_desmpleo_usa=df_desmpleo_usa[trimestres]
df_desmpleo_usa['Periodos'] = df_desmpleo_usa['Periodos'] + pd.offsets.QuarterEnd()
```

In [ ]:
```python
df_ti=df_ti.drop(df_ti.iloc[:,1:-1],axis=1)
df_ti.rename(columns={'Banco de México':'Periodos','Unnamed: 7':'Tasa de interes'},inplace= True)
df_ti.drop(df_ti.index[0:17], inplace=True)
df_ti=df_ti.loc[~df_ti['Tasa de interes'].isin(['N/E'])]
```

In [ ]:
```python
df_mxn_x=df_mxn_x.drop(df_mxn_x[['Open','High','Low','Adj Close','Volume']],axis=1)
df_mxn_x.rename(columns={'Date':'Periodos',
                         'Close':'MX=X'},inplace=True)
```

In [ ]:
```python
df_mxn_x.rename(columns={'Date':'Periodos',
                         'Close':'MX=X'},inplace=True)
df_indicadores.loc[3].values
df_indicadores.rename(columns={'Instituto Nacional de Estadística y Geografía (INEGI)':'Periodos',
                               'Unnamed: 1':'Tasa de ocupacion',
                               'Unnamed: 2':'INPC',
                               'Unnamed: 3':'Exportaciones (FOB)',
                               'Unnamed: 4':'Importaciones (FOB)',
                               'Unnamed: 5':'Balanza Comercial',
                               'Unnamed: 6':'Ingresos y egresos brutos'},inplace=True)
df_indicadores=df_indicadores.drop(['Exportaciones (FOB)','Importaciones (FOB)'],axis=1)
df_indicadores.drop(df_indicadores.index[0:4], inplace=True)
df_indicadores.drop(['Ingresos y egresos brutos'],axis=1, inplace=True)
df_indicadores=df_indicadores.dropna()
df_indicadores['Periodos']=pd.to_datetime(df_indicadores['Periodos'])
trimestres=df_indicadores['Periodos'].dt.month.isin([3, 6, 9, 12])
df_indicadores=df_indicadores[trimestres]
df_indicadores['Periodos'] = df_indicadores['Periodos'] + pd.offsets.QuarterEnd()
```

In [ ]:
```python
df_mxn_x['Periodos']=pd.to_datetime(df_mxn_x['Periodos'])
trimestres=df_mxn_x['Periodos'].dt.month.isin([3,6,9,12])
df_mxn_x=df_mxn_x[trimestres]
df_mxn_x['Periodos'] = df_mxn_x['Periodos'] + pd.offsets.QuarterEnd()
```

In [ ]:
```python
df_ti['Periodos']=pd.to_datetime(df_ti['Periodos'])
df_ti=df_ti.resample('Q', on='Periodos').last().reset_index()
```

In [ ]:
```python
df_fed.rename(columns={'DATE':'Periodos','FEDFUNDS':'Tasa Fed'}, inplace=True)
df_fed['Periodos']=pd.to_datetime(df_fed['Periodos'])
trimestres=df_fed['Periodos'].dt.month.isin([3,6,9,12])
df_fed=df_fed[trimestres]
df_fed['Periodos'] = df_fed['Periodos'] + pd.offsets.QuarterEnd()
fecha=pd.to_datetime('2023-03-31')
dato=4.33
datos={'Periodos':fecha,'Tasa Fed':dato}
df_fed=df_fed.append(datos,ignore_index=True)
```

```
C:\Users\Pablo\AppData\Local\Temp\ipykernel_52716\1699872842.py:9: FutureWarning: The frame.append method is d
eprecated and will be removed from pandas in a future version. Use pandas.concat instead.
  df_fed=df_fed.append(datos,ignore_index=True)
```

In [ ]:
```python
def unir(df1,df2,columna,variable,join='inner'):
    globals()[variable]=pd.merge(df1,df2,how=join,on=columna)
```

In [ ]:
```python
unir(df_ti, df_mxn_x, 'Periodos', 'df_total', 'right')
unir(df_total,df_indicadores,'Periodos','df_total','right')
unir(df_total,df_fed,'Periodos','df_total','right')
unir(df_total,df_cpi,'Periodos','df_total','right')
unir(df_total,df_reservas,'Periodos','df_total','right')
unir(df_total,df_pib,'Periodos','df_total','right')
unir(df_total,df_gdp,'Periodos','df_total','right')
unir(df_total,df_desmpleo_usa,'Periodos','df_total','right')
```

In [ ]:
```python
df_total.dropna(inplace=True)
df_total=df_total.set_index('Periodos')
```

In [ ]:
```python
def grafico_lineal(data):
    for column in data:
        fig=px.line(x=data.index,y=data[column],
                    title=f'{column}',height=800,width=1200)
        fig.show()
```

In [ ]:
```python
grafico_lineal(df_total)
```

In [ ]:
```python
df_total.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 61 entries, 2008-03-31 to 2023-03-31
Data columns (total 11 columns):
 #   Column              Non-Null Count  Dtype
---  ------              --------------  -----
 0   Tasa de interes     61 non-null     float64
 1   MX=X                61 non-null     float64
 2   Tasa de ocupacion   61 non-null     object
 3   INPC                61 non-null     object
 4   Balanza Comercial   61 non-null     object
 5   Tasa Fed            61 non-null     float64
 6   CPI                 61 non-null     float64
 7   Reserva Extranjera  61 non-null     object
 8   PIB_pct             61 non-null     object
 9   GPD_pct             61 non-null     float64
 10  UNRATE              61 non-null     float64
dtypes: float64(6), object(5)
memory usage: 5.7+ KB
```

In [ ]:
```python
def convertir_valores(data):
    if any(data.dtypes != 'float64'):
        data = data.apply(pd.to_numeric, errors='coerce')
    return data
```

In [ ]:
```python
df_total=convertir_valores(df_total)
```

In [ ]:
```python
df_total.describe().to_excel('descripcion_estadistica.xlsx', index=True)
df_total.describe()
```

Out[ ]:

	Tasa de interes	MX=X	Tasa de ocupacion	INPC	Balanza Comercial	Tasa Fed	CPI	Reserva Extranjera	PIB_pct	GPD_pct	UN
count	61.000000	61.000000	61.000000	61.000000	61.000000	61.000000	61.000000	61.000000	61.00000	61.000000	61.0
mean	5.553279	16.321623	59.468337	91.248804	338.231984	0.751475	243.059475	165329.596148	1.55059	0.980166	6.1
std	2.018206	3.584158	1.265715	16.878043	1809.905573	1.019266	22.794233	37827.128831	4.61974	1.841201	2.1
min	3.000000	10.299000	53.111205	66.019891	-3971.164000	0.070000	211.398000	81476.217000	-18.61400	-8.827640	3.5
25%	4.250000	13.027310	59.243066	77.792385	-518.037000	0.100000	227.223000	149208.695000	1.17900	0.617950	4.3
50%	4.500000	16.913639	59.711229	87.752419	147.159000	0.180000	237.657000	178008.699000	2.62100	1.060470	5.6
75%	7.250000	19.639999	60.053019	103.476000	1001.516000	1.210000	255.159000	193331.800000	3.39100	1.430080	7.9
max	11.250000	23.833000	61.471040	128.389000	6274.687000	4.330000	301.808000	212002.533000	19.61200	8.788110	11.0

In [ ]:
```python
y=df_total['MX=X']
```

In [ ]:
```python
x=df_total.drop(['MX=X'],axis=1)
```

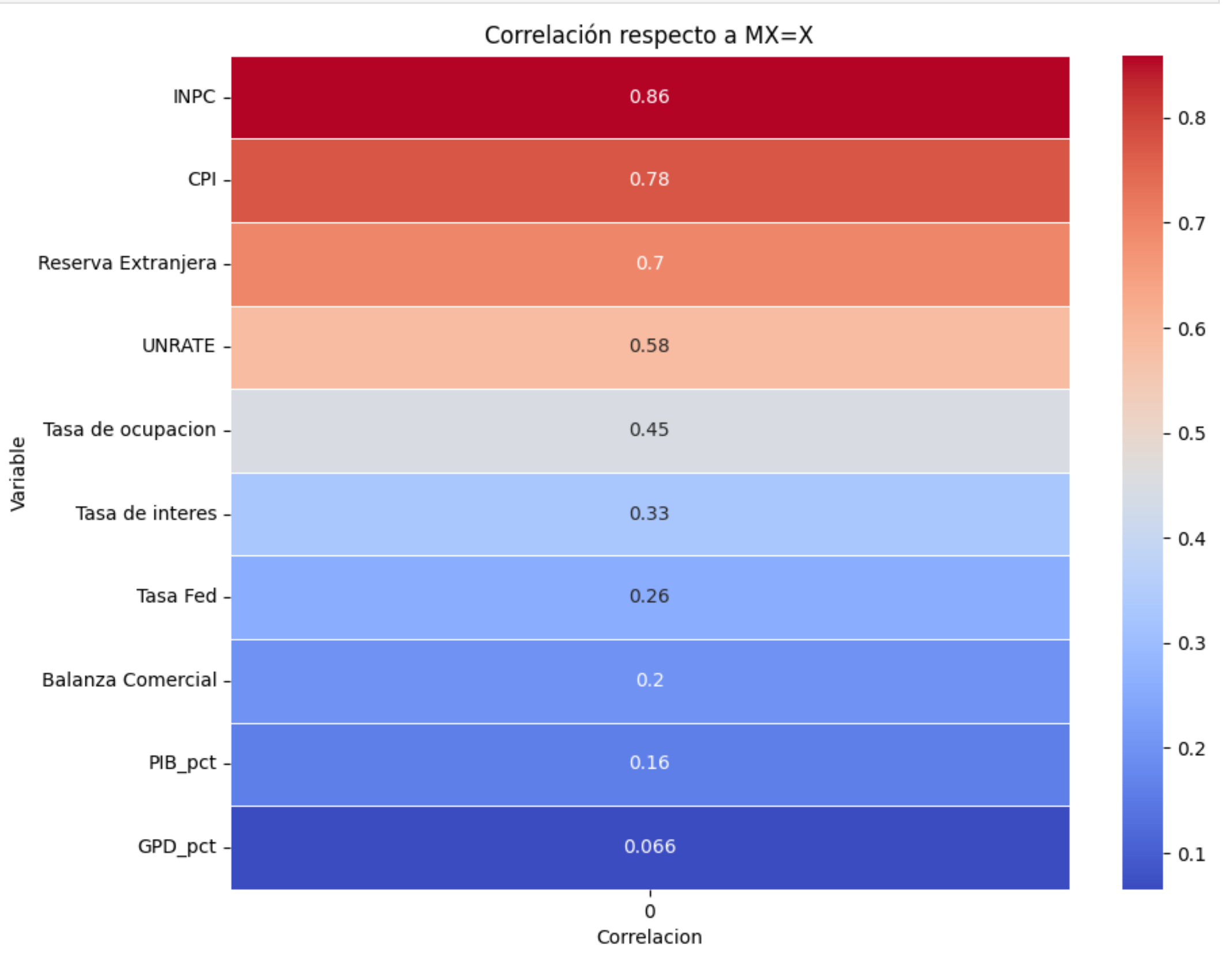
In [ ]:
```python
def correlacion(x, y):
    correlacion = x.corrwith(y).abs().sort_values(ascending=False)
    return correlacion
```

In [ ]:
```python
correlacion(x,y).to_excel('correlacion.xlsx', index=True)
correlacion(x,y)
```

Out[ ]:
```
INPC                  0.859404
CPI                   0.775686
Reserva Extranjera    0.696736
UNRATE                0.584170
Tasa de ocupacion     0.449930
Tasa de interes       0.329998
Tasa Fed              0.259633
Balanza Comercial     0.198155
PIB_pct               0.159689
GPD_pct               0.065667
dtype: float64
```

In [ ]:
```python
def tabla_correlacion(x, y):
    corr_matrix = correlacion(x, y)
    plt.figure(figsize=(10, 8))
    sns.heatmap(corr_matrix.to_frame(), annot=True, cmap='coolwarm', linewidths=0.5)
    plt.title(f'Correlación respecto a {y.name}')
    plt.xlabel('Correlacion')
    plt.ylabel('Variable')
    plt.show()
```

In [ ]:
```python
tabla_correlacion(x,y)
```



In [ ]:
```python
def dispersion(x,y):
    corr_matrix=correlacion(x,y)
    for column, correlation in corr_matrix.iteritems():
        fig = px.scatter(x=x[column], y=y, trendline='ols', title=f'Dispersión entre {column} y {y.name}',heig
        fig.show()
```

In [ ]:
```python
dispersion(x,y)
```

```
C:\Users\Pablo\AppData\Local\Temp\ipykernel_52716\3129074370.py:3: FutureWarning:

iteritems is deprecated and will be removed in a future version. Use .items instead.
```

In [ ]:
```python
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import  StandardScaler
from sklearn.compose import ColumnTransformer
from sklearn.ensemble import RandomForestRegressor
from sklearn.linear_model import LinearRegression
from sklearn.pipeline import Pipeline,make_pipeline
from sklearn.experimental import enable_iterative_imputer
from sklearn.impute import IterativeImputer, SimpleImputer
from sklearn.metrics import mean_squared_error, r2_score, mean_absolute_error
```

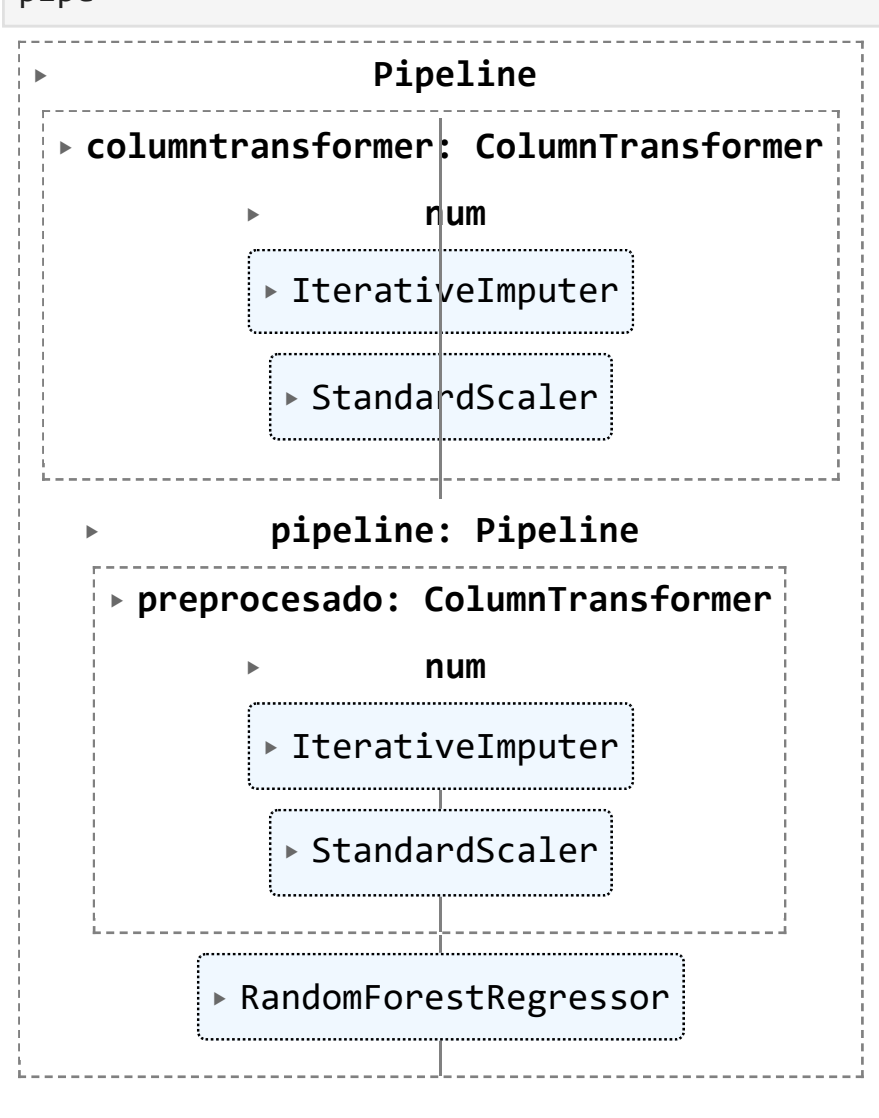
In [ ]:
```python
X_train,X_test,y_train,y_test=train_test_split(x[['INPC','CPI']],y,test_size=0.2,random_state=42)
```

In [ ]:
```python
num_col=[k for k, v in (x[['INPC','CPI']].dtypes!='object').to_dict().items() if v]
```

In [ ]:
```python
variables=Pipeline(
    steps=[
        ('imputer',IterativeImputer()),
        ('scaler',StandardScaler())
    ]
)
preprocesado=ColumnTransformer(
    transformers=[
        ('num',variables,num_col)
    ]
)
regresion=Pipeline(
    steps=[
        ('preprocesado',preprocesado),
        ('regresion',RandomForestRegressor())
    ]
)
```

In [ ]:
```python
regresion.fit(X_train,y_train)
pipe=make_pipeline(preprocesado,regresion)
pipe
```

Out[ ]:



In [ ]:
```python
y_pred=regresion.predict(X_test)
r2_score(y_test,y_pred)
```

Out[ ]:
```
0.9501157692698131
```

In [ ]:
```python
importancia= regresion.named_steps['regresion'].feature_importances_
importancia=pd.DataFrame({'Variables':X_train.columns,
                          'Importancia':importancia}).sort_values(by='Importancia',ascending=False)
importancia.to_excel('importancia.xlsx',index=True)
importancia
```

Out[ ]:

	Variables	Importancia
0	INPC	0.688316
1	CPI	0.311684

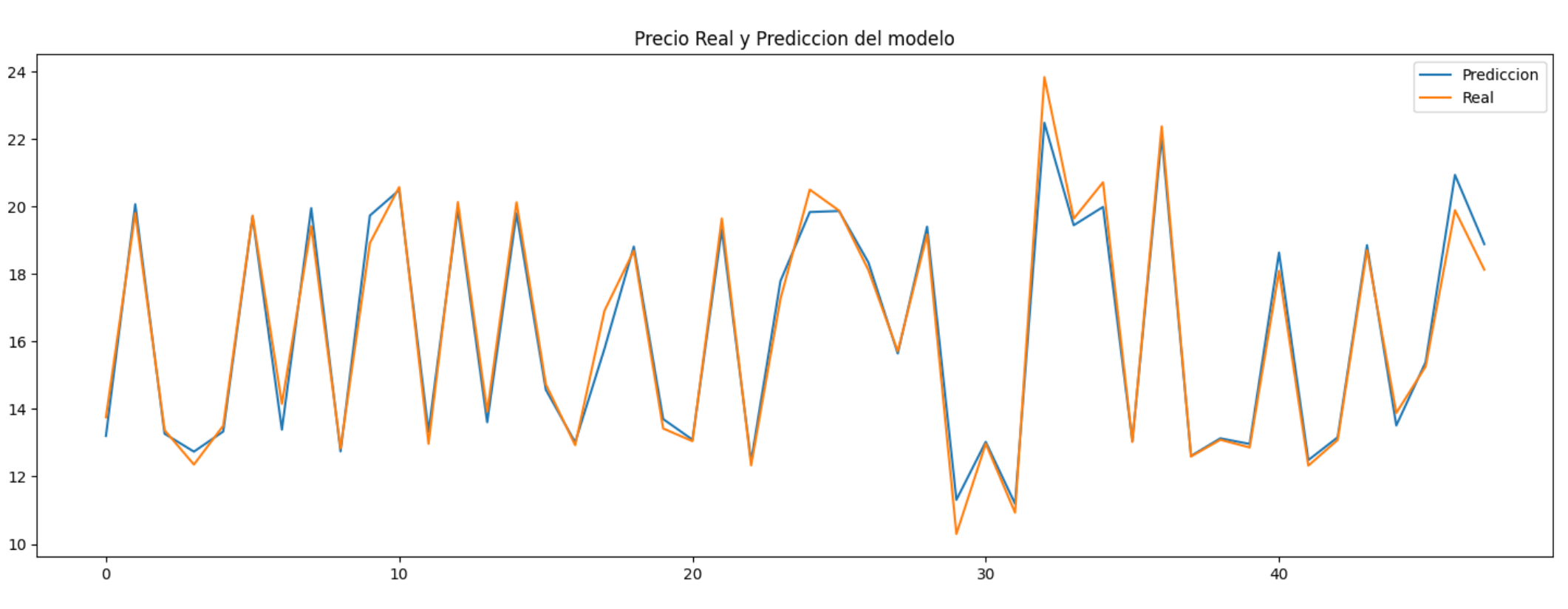
In [ ]:
```python
def EvaluationMetric(Xt,yt,yp,disp="on"):
    MSE=round(mean_squared_error(y_true=yt,y_pred=yp),4)
    RMSE=(np.sqrt(MSE))
    R2=(r2_score(y_true=yt,y_pred=yp))
    Adjusted_R2=(1-(1-r2_score(yt,yp))*((Xt.shape[0]-1)/(Xt.shape[0]-Xt.shape[1]-1)))
    if disp=="on":
        print("MSE: ",MSE,"RMSE :",RMSE)
        print("R2 :",R2,"ADJUSTED R2 :",Adjusted_R2)

    plt.figure(figsize=(18,6))
    plt.plot((yp)[:100])
    plt.plot((np.array(yt)[:100]))
    plt.legend(["Prediccion","Real"])
    plt.title('Precio Real y Prediccion del modelo')

    return (MSE,RMSE,R2,Adjusted_R2)
```

In [ ]:
```python
y_predt=regresion.predict(X_train)
```

In [ ]:
```python
EvaluationMetric(X_train,y_train,y_predt)
```

```
MSE:  0.2208 RMSE : 0.4698936049788292
R2 : 0.9815251860996601 ADJUSTED R2 : 0.980704083259645
```

Out[ ]:
```
(0.2208, 0.4698936049788292, 0.9815251860996601, 0.980704083259645)
```



In [ ]:
```python
predict=regresion.predict(X_test)
predict_df=pd.DataFrame(np.ravel(predict), columns=['Predicciones'])
predict_df.index = y_test.index  # Asignar los mismos índices que y_test al DataFrame predict_df
comparasion_df=pd.concat([y_test, predict_df], axis=1)
comparasion_df.columns = ['MX=X', 'Predicciones']
comparasion_df.round(2)
comparasion_df.to_excel('Comparasion.xlsx',index=True)
comparasion_df
```

Out[ ]:

	MX=X	Predicciones
Periodos		
2008-03-31	10.635500	11.207503
2009-06-30	13.179000	13.764792
2019-09-30	19.678699	19.552014
2015-12-31	17.269760	16.696498
2011-06-30	11.711200	13.296581
2021-12-31	20.459101	20.238773
2016-09-30	19.368931	19.072759
2020-06-30	23.056570	22.474935
2011-03-31	11.891000	13.243269
2018-03-31	18.146400	19.586182
2016-06-30	18.322950	17.665513
2022-12-31	19.467100	19.546153
2012-03-31	12.797500	13.495377

Prueba unicamente para ver si podia predecir con ARIMA las variables y asi generar una prediccion con esas mismas.