In [2]:
```
import yfinance as yf
import pandas as pd
import warnings
import matplotlib.pyplot as plt
warnings.filterwarnings('ignore')
```

In [4]:
```
ibm_walmart = yf.download(tickers = 'wmt ibm', period = '5y', interval = '1d', rounding = True)
ibm_walmart
```

```
[**********100%**********]  2 of 2 completed
```

Out[4]:

Price	Close		High		Low		Open		Volume	
Ticker	IBM	WMT	IBM	WMT	IBM	WMT	IBM	WMT	IBM	WMT
Date										
2020-09-14	94.06	42.70	95.05	43.87	93.80	42.25	94.27	42.33	3809009	45733800
2020-09-15	94.33	42.71	95.07	43.24	94.17	42.50	94.62	42.98	3049299	30427800
2020-09-16	95.70	42.37	96.93	43.12	94.53	42.30	94.53	43.04	3962666	27860400
2020-09-17	96.24	42.50	96.72	42.78	93.96	41.98	94.47	42.11	3317180	37245000
2020-09-18	94.57	42.07	96.24	42.76	94.49	41.90	95.73	42.42	5639614	54709200
...	...	...	...	...	...	...	...	...	...	...
2025-09-08	256.09	102.28	257.15	102.36	247.02	100.42	248.63	100.85	6940300	13685700
2025-09-09	259.11	102.29	260.66	102.49	254.88	101.55	256.12	102.00	4931100	11819700
2025-09-10	256.88	100.41	260.08	102.45	254.56	100.39	259.65	101.95	5185400	17934900
2025-09-11	257.01	102.65	258.55	102.78	255.66	100.28	257.56	100.99	3576000	15900800
2025-09-12	253.44	103.49	257.25	103.98	252.43	102.36	256.95	102.54	3431100	11640100

1256 rows × 10 columns

In [6]:
```
ibm_walmart = ibm_walmart['Close']
ibm_walmart
```

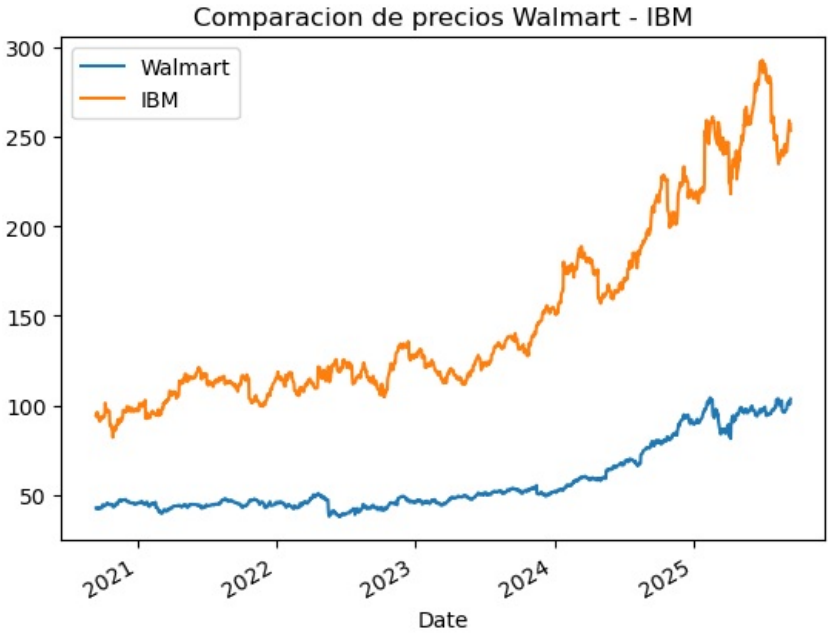
Out[6]:

Ticker	IBM	WMT
Date		
2020-09-14	94.06	42.70
2020-09-15	94.33	42.71
2020-09-16	95.70	42.37
2020-09-17	96.24	42.50
2020-09-18	94.57	42.07
...	...	...
2025-09-08	256.09	102.28
2025-09-09	259.11	102.29
2025-09-10	256.88	100.41
2025-09-11	257.01	102.65
2025-09-12	253.44	103.49

1256 rows × 2 columns

In [8]:
```
ibm_walmart['WMT'].plot()
ibm_walmart['IBM'].plot()
plt.legend(['Walmart', 'IBM'])
plt.title('Comparacion de precios Walmart - IBM')
plt.show
```

Out[8]:
```
<function matplotlib.pyplot.show(close=None, block=None)>
```



In [12]:
```
rend_ibm_walmart = ibm_walmart.pct_change()
rend_ibm_walmart = rend_ibm_walmart.dropna()
rend_ibm_walmart
```

Out[12]:

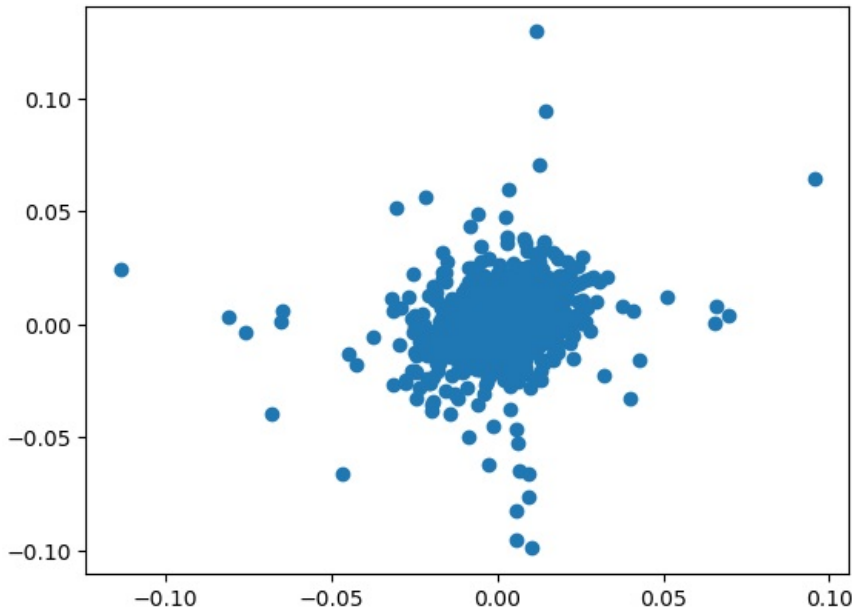
Ticker	IBM	WMT
Date		
2020-09-15	0.002871	0.000234
2020-09-16	0.014523	-0.007961
2020-09-17	0.005643	0.003068
2020-09-18	-0.017352	-0.010118
2020-09-21	-0.020408	0.013073
...	...	...
2025-09-08	0.030419	0.017610
2025-09-09	0.011793	0.000098
2025-09-10	-0.008606	-0.018379
2025-09-11	0.000506	0.022309
2025-09-12	-0.013891	0.008183

1255 rows × 2 columns

In [14]:
```
correlacion = rend_ibm_walmart['WMT'].corr(rend_ibm_walmart['IBM'])
print("Correlacion entre Walmart y IBM", correlacion)
```

```
Correlacion entre Walmart y IBM 0.2175162483626146
```

In [16]:
```
# Crear grafico de dispersion
plt.scatter(rend_ibm_walmart['WMT'], rend_ibm_walmart['IBM'])
plt.show()
```



In [18]:
```
# Modelo de regresion simple
import statsmodels.api as sm
rend_ibm_walmart = sm.add_constant(rend_ibm_walmart)
rend_ibm_walmart
```

Out[18]:

Date	const	IBM	WMT
2020-09-15	1.0	0.002871	0.000234
2020-09-16	1.0	0.014523	-0.007961
2020-09-17	1.0	0.005643	0.003068
2020-09-18	1.0	-0.017352	-0.010118
2020-09-21	1.0	-0.020408	0.013073
...	...	...	...
2025-09-08	1.0	0.030419	0.017610
2025-09-09	1.0	0.011793	0.000098
2025-09-10	1.0	-0.008606	-0.018379
2025-09-11	1.0	0.000506	0.022309
2025-09-12	1.0	-0.013891	0.008183

1255 rows × 3 columns

In [20]:
```
regresion = sm.OLS(rend_ibm_walmart['WMT'], rend_ibm_walmart[['const', 'IBM']]).fit()
print(regresion.summary())
```

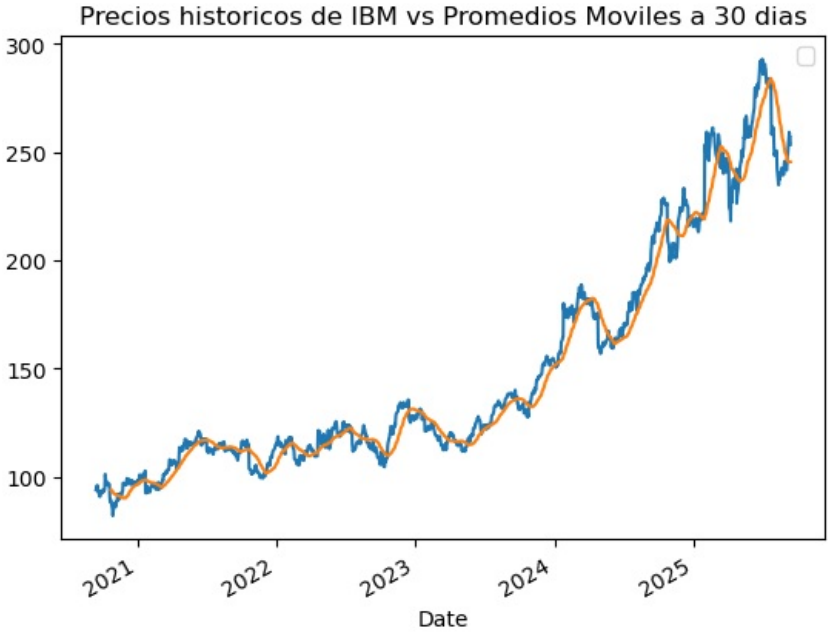
```
                            OLS Regression Results
==============================================================================
Dep. Variable:                    WMT   R-squared:                       0.047
Model:                            OLS   Adj. R-squared:                  0.047
Method:                 Least Squares   F-statistic:                     62.23
Date:                Fri, 12 Sep 2025   Prob (F-statistic):           6.62e-15
Time:                        19:42:10   Log-Likelihood:                 3703.8
No. Observations:                1255   AIC:                            -7404.
Df Residuals:                    1253   BIC:                            -7393.
Df Model:                           1
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const          0.0006      0.000      1.732      0.084   -8.24e-05       0.001
IBM            0.1887      0.024      7.888      0.000       0.142       0.236
==============================================================================
Omnibus:                      372.867   Durbin-Watson:                   1.948
Prob(Omnibus):                  0.000   Jarque-Bera (JB):             8721.251
Skew:                          -0.815   Prob(JB):                         0.00
Kurtosis:                      15.811   Cond. No.                         67.0
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

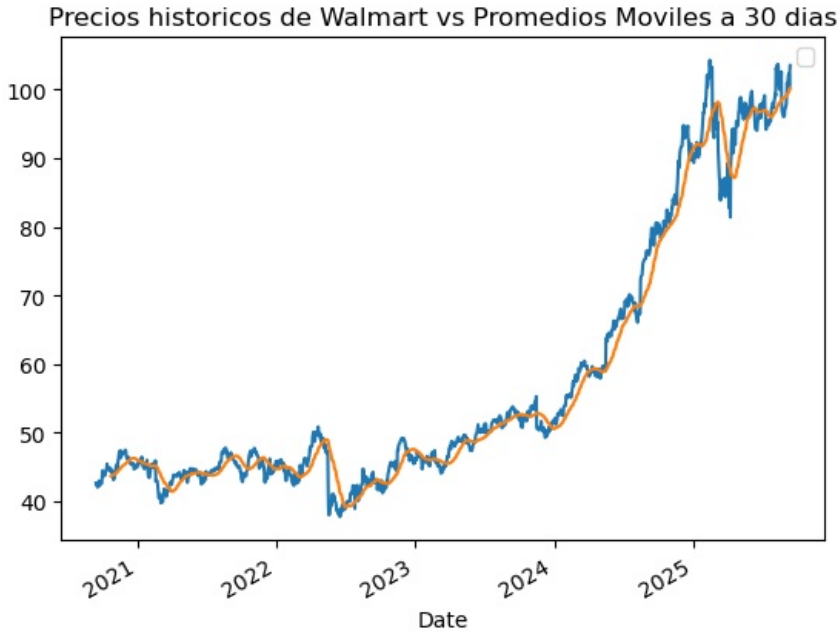
In [26]:
```
walmart = ibm_walmart['WMT']
ibm = ibm_walmart['IBM']
```

In [28]:
```
# Prueba Dickey-Fuller
from statsmodels.tsa.stattools import adfuller
import numpy as np

resultado_wmt = adfuller(walmart)
print("El valor p de la prueba para Walmart es: " + str(resultado_wmt[1]))

resultado_ibm = adfuller(ibm)
print("El valor p de la prueba para IBM es: " + str(resultado_ibm[1]))
```

```
El valor p de la prueba para Walmart es: 0.9971585516551154
El valor p de la prueba para IBM es: 0.9580224456565243
```

In [32]:
```
# Graficacion de la media movil para IBM
rolling_ibm = ibm.rolling(30).mean()
ibm.plot()
rolling_ibm.plot()
plt.title("Precios historicos de IBM vs Promedios Moviles a 30 dias")
plt.legend(['IBM'], ['Media Movil'])
plt.show()

# Graficacion de la media movil para Walmart
rolling_walmart = walmart.rolling(30).mean()
walmart.plot()
rolling_walmart.plot()
plt.title("Precios historicos de Walmart vs Promedios Moviles a 30 dias")
plt.legend(['Walmart'], ['Media Movil'])
plt.show()
```





In [46]:
```
print(walmart.shape)
print(ibm.shape)
```

```
(1256,)
(1256,)
```

In [50]:
```
len_train = int(1256 * 0.8)
len_train
```

Out[50]:
```
1004
```

In [110…
```
# Definicion de grupos de entrenamiento Walmart
train_wmt = walmart[0 : len_train]
test_wmt = walmart[len_train :]

# Definimos las variables
y_pred_wmt = walmart.copy()
y_pred_wmt = pd.DataFrame(y_pred_wmt)

y_pred_wmt['Pronostico'] = walmart.rolling(30).mean()
y_pred_wmt[0:35]

# Pronostico para el siguiente dia
y_pred_wmt.tail(1)['Pronostico']
```

Out[110…
```
Date
2025-09-12    100.170333
Name: Pronostico, dtype: float64
```

In [84]:
```
# Definicion de grupos de entrenamiento Walmart
train_ibm = ibm[0 : len_train]
test_ibm = ibm[len_train :]

# Definimos las variables
y_pred_ibm = ibm.copy()
y_pred_ibm = pd.DataFrame(y_pred_ibm)

y_pred_ibm['Pronostico'] = ibm.rolling(30).mean()
y_pred_ibm[0:35]

# Pronostico para el siguiente dia
y_pred_ibm.tail(1)['Pronostico']
```

Out[84]:
```
Date
2025-09-12    245.389667
Name: Pronostico, dtype: float64
```

In [124…
```
y_pred_wmt2 = pd.DataFrame(y_pred_wmt['Pronostico'][1004:])
test_wmt = pd.DataFrame(test_wmt)

y_pred_ibm2 = pd.DataFrame(y_pred_ibm['Pronostico'][1004:])
test_ibm = pd.DataFrame(test_ibm)

rmse_wmt = np.sqrt(mean_squared_error(test_wmt, y_pred_wmt2)).round(2)
mape_wmt = np.round(np.mean(np.abs((test_wmt['WMT'] - y_pred_wmt2['Pronostico'])/test_wmt['WMT'])) * 100, 2)

rmse_ibm = np.sqrt(mean_squared_error(test_ibm, y_pred_ibm2)).round(2)
mape_ibm = np.round(np.mean(np.abs((test_ibm['IBM'] - y_pred_ibm2['Pronostico'])/test_ibm['IBM'])) * 100, 2)
```

In [126…
```
print("RMSE Walmart =", rmse_wmt, "MAPE Walmart =", mape_wmt)
print("RMSE IBM =", rmse_ibm, "MAPE IBM =", mape_ibm)
```

```
RMSE Walmart = 4.52 MAPE Walmart = 3.87
RMSE IBM = 14.84 MAPE IBM = 5.12
```

Conclusion:

1. No existe correlacion entre las dos compañias, ya que vemos el grafico con una concentracion en el centro (0, 0).
2. Podemos tener cierto grado de confianza en los pronosticos que obtuvimos para el dia siguiente, ya que vemos un RMSE y un MAPE muy bajos en relacion al precio pronosticado en cada uno de las compañias.