In [1]:

```
# Python
import itertools
import numpy as np
import pandas as pd
import pandas as pd
import numpy as np
from autots import AutoTS
import matplotlib.pyplot as plt
import funciones
from sklearn.metrics import mean_squared_error, mean_absolute_percentage_error,
```

In [2]:

```
df_main = pd.read_excel("https://raw.githubusercontent.com/carrenogf/MCD-Series-
df_main = df_main.sort_values("FECHA",ascending=True)
df_main.set_index("FECHA", inplace=True)
df_copa = df_main["CHU_COPA_AJUST"].dropna()
df_recprop = df_main["CHU_REC_PROPIOS_AJUST"].dropna()
df_regal = df_main["CHU_REGALIAS_AJUST"].dropna()
dataframes = [df_copa, df_recprop, df_regal]
for i in range(len(dataframes)):
  dataframes[i] = dataframes[i].reindex(pd.date_range(start=dataframes[i].index.
  dataframes[i] = dataframes[i].fillna(0)

titulos = ["CHU_COPA_AJUST", "CHU_REC_PROPIOS_AJUST", "CHU_REGALIAS_AJUST"]
```

In [3]:

```
# TRAIN TEST
n_train = 0.9
train_copa = dataframes[0].iloc[:round(len(dataframes[0])*n_train)]
test_copa = dataframes[0].iloc[round(len(dataframes[0])*n_train):]
print(f"Coparticipacion: train({train_copa.shape}), test({test_copa.shape})")

train_recursos = dataframes[1].iloc[:round(len(dataframes[1])*n_train)]
test_recursos = dataframes[1].iloc[round(len(dataframes[1])*n_train):]
print(f"Recursos: train({train_recursos.shape}), test({test_recursos.shape})")

train_regalias = dataframes[2].iloc[:round(len(dataframes[2])*n_train)]
test_regalias = dataframes[2].iloc[round(len(dataframes[2])*n_train):]
print(f"Regalias: train({train_regalias.shape}), test({test_regalias.shape})")

dataframes_train = [ train_copa, train_recursos, train_regalias ]
dataframes_test = [ test_copa, test_recursos, test_regalias ]
```

```
Coparticipacion: train((1584,)), test((176,))
Recursos: train((1995,)), test((222,))
Regalias: train((1985,)), test((221,))
```

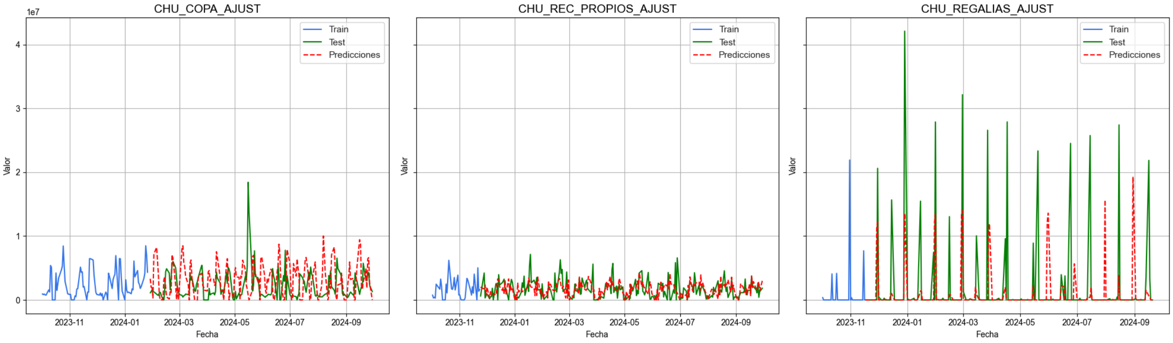
In [ ]:

```
results_train_test = []
predictions_test = []
for i, df in enumerate(dataframes_train):
    df_train = df
    df_test = dataframes_test[i]

    model = AutoTS(
        forecast_length=len(dataframes_test[i]),
        frequency="B",
        prediction_interval=0.95,
        ensemble=None,
        models_mode='deep',
        model_list = 'superfast',
        max_generations=10,   # intenta optimizar el modelo a traves de 10 itera
        num_validations=3,
        no_negatives=True,
        n_jobs='auto')
    modelAutoTS = model.fit(df_train)
    # Find the best parameters

    fechas = pd.date_range(start=df_test.index.min(), end=df_test.index.max(), f
    pred_test = model.predict(forecast_length=len(fechas)).forecast
    predictions_test.append(pred_test)
    # Cálculo del MSE en el conjunto de prueba
    mape_test = mean_absolute_percentage_error(df_test, pred_test)
    mape_mean = mean_absolute_percentage_error(df_test, [df_test.mean()] * len(d
    mse_test = mean_squared_error(df_test, pred_test)
    mae_test = mean_absolute_error(df_test, pred_test)
    rmse = np.sqrt(mean_squared_error(df_test, pred_test))
    results_train_test.append({
        "model": modelAutoTS,
        "name": df_train.name,
        "len_train": len(df_train),
        "len_test": len(df_test),
        "mape_test": mape_test,
        "mse_test":mse_test,
        "mape_mean": mape_mean,
        "mae_test": mae_test,
        "rmse": rmse
    })
```

In [5]:

```
pd.options.display.float_format = '{:,.2f}'.format
display(pd.DataFrame(results_train_test))

display(funciones.plot_train_test_predictions(
    dataframes_train=dataframes_train,
    dataframes_test=dataframes_test,
    predictions_test=predictions_test,
    series_names=titulos,
    start_date='2023-10-01'
))
```

	model	name	len_train	len_test	mape_test	
0	Initiated AutoTS object with best model: \nSea...	CHU_COPA_AJUST	1584	176	1,069,270,913,042,505,662,464.00	1
1	Initiated AutoTS object with best model: \nGLS...	CHU_REC_PROPIOS_AJUST	1995	222	476,620,172,305,521,311,744.00	
2	Initiated AutoTS object with best model: \nSea...	CHU_REGALIAS_AJUST	1985	221	2,174,434,595,027,651,395,584.00	3



None

In [6]:

```python
results = pd.DataFrame(results_train_test)

for i, row in results.iterrows():
    display(row["name"])
    print(row.model)
```

```
'CHU_COPA_AJUST'
Initiated AutoTS object with best model:
SeasonalNaive
{'fillna': 'pchip', 'transformations': {'0': 'SeasonalDifference', '1': 'MaxAbsScaler'}, 'transformation_params': {'0': {'lag_1': 7, 'method': 'LastValue'}, '1': {}}}
{'method': 'lastvalue', 'lag_1': 96, 'lag_2': 28}
Validation: 0, 1, 2, 3
SMAPE: nan, nan, nan, nan
MAE: 2822593.394881551, 2705886.889956714, 2266922.725699413, 2126160.779481562
SPL: 0.34733674670580267, 0.33363305331363236, 0.3567839576534018, 0.39804259609704773
'CHU_REC_PROPIOS_AJUST'
```

```
Initiated AutoTS object with best model:
GLS
{'fillna': 'ffill', 'transformations': {'0': 'DatepartRegression', '1': 'Historic
Values', '2': 'SeasonalDifference'}, 'transformation_params': {'0': {'regression_
model': {'model': 'ElasticNet', 'model_params': {'l1_ratio': 0.1, 'fit_intercep
t': True, 'selection': 'cyclic'}}, 'datepart_method': 'simple_2', 'polynomial_deg
ree': 2, 'transform_dict': {'fillna': None, 'transformations': {'0': 'ClipOutlier
s'}, 'transformation_params': {'0': {'method': 'clip', 'std_threshold': 4}}}, 'ho
liday_countries_used': False, 'lags': None, 'forward_lags': None}, '1': {'windo
w': 730}, '2': {'lag_1': 24, 'method': 2}}}
{}
Validation: 0, 1, 2, 3
SMAPE: nan, nan, nan, nan
MAE: 1226828.4737256807, 958627.634529741, 872269.9874219908, 777486.4746628217
SPL: 0.2207936109057398, 0.20243127261189903, 0.1972549963009233, 0.1784455234438
5997
'CHU_REGALIAS_AJUST'
Initiated AutoTS object with best model:
SeasonalityMotif
{'fillna': 'pchip', 'transformations': {'0': 'PositiveShift', '1': 'HistoricValue
s'}, 'transformation_params': {'0': {}, '1': {'window': None}}}
{'window': 10, 'point_method': 'midhinge', 'distance_metric': 'minkowski', 'k': 1
0, 'datepart_method': 'recurring', 'independent': True}
Validation: 0, 1, 2, 3
SMAPE: nan, nan, nan, nan
MAE: 1399081.8144796381, 1430369.8235294118, 1441480.6425339365, 1386704.18099547
5
SPL: 0.13252659123779703, 0.11893795878406024, 0.09366669094475673, 0.20322019724
881865
```

```
In [ ]:
```