Multi-Factor Model - Jingwen Li

In [ ]:
```
import pandas as pd
import numpy as np
import yfinance as yf
from datetime import datetime
from sklearn.linear_model import Lasso
from sklearn.preprocessing import StandardScaler
import seaborn as sns
import matplotlib.pyplot as plt
import statsmodels.api as sm
from statsmodels.tsa.stattools import adfuller, kpss
from sklearn.metrics import r2_score, mean_squared_error
from statsmodels.stats.stattools import durbin_watson

import warnings
warnings.filterwarnings('ignore')
```

In [ ]:
```
def adf_kpss_test(data_table):
    # Initialize a dictionary to store the results
    results_dict = {
        'Variable': [],
        'ADF Statistic': [],
        'ADF p-value': [],
        'ADF 1%': [],
        'ADF 5%': [],
        'ADF 10%': [],
        'KPSS Statistic': [],
        'KPSS p-value': [],
        'KPSS 10%': [],
        'KPSS 5%': [],
        'KPSS 2.5%': [],
        'KPSS 1%': [],
        'Stationary': []
    }

    for column in data_table.columns:
        # ADF Test
        adf_test = adfuller(data_table[column])
        results_dict['Variable'].append(column)
        results_dict['ADF Statistic'].append(adf_test[0])
        results_dict['ADF p-value'].append(adf_test[1])
        results_dict['ADF 1%'].append(adf_test[4]['1%'])
        results_dict['ADF 5%'].append(adf_test[4]['5%'])
        results_dict['ADF 10%'].append(adf_test[4]['10%'])

        # KPSS Test
        kpss_test = kpss(data_table[column], regression='c', nlags="auto")
        results_dict['KPSS Statistic'].append(kpss_test[0])
        results_dict['KPSS p-value'].append(kpss_test[1])
        results_dict['KPSS 10%'].append(kpss_test[3]['10%'])
        results_dict['KPSS 5%'].append(kpss_test[3]['5%'])
```

```
        results_dict['KPSS 2.5%'].append(kpss_test[3]['2.5%'])
        results_dict['KPSS 1%'].append(kpss_test[3]['1%'])

        # Determine stationarity
        adf_p = adf_test[1] < 0.05
        kpss_p = kpss_test[1] > 0.05
        results_dict['Stationary'].append('Yes' if adf_p and kpss_p else 'No

    # Convert the results dictionary to a DataFrame for better display and a
    results_df = pd.DataFrame(results_dict)
    return results_df
```

In [ ]:
```
def regression_based_performance(factor,fund_ret,rf,constant=True):
    """
        Returns the Regression based performance Stats for given set of retu
        Inputs:
            factor - Dataframe containing monthly returns of the regressors
            fund_ret - Dataframe containing monthly excess returns of the re
            rf - Monthly risk free rate of return
        Output:
            summary_stats - (Beta of regression, treynor ratio, information
    """
    if constant:
        X = sm.tools.add_constant(factor)
    else:
        X = factor
    y=fund_ret
    model = sm.OLS(y,X,missing='drop').fit()

    if constant:
        beta = model.params[1:]
        alpha = round(float(model.params['const']),6) *12


    else:
        beta = model.params
    treynor_ratio = ((fund_ret - rf).mean())/beta[0]
    tracking_error = (model.resid.std())
    if constant:
        information_ratio = model.params[0]/tracking_error
    r_squared = model.rsquared
    if constant:
        return (beta,treynor_ratio,information_ratio,alpha,r_squared,trackir
    else:
        return (beta,treynor_ratio,r_squared,tracking_error,model.resid)
```

In [ ]:
```
import statsmodels.api as sm
from sklearn.decomposition import PCA
import numpy as np

def regression_based_performance_pca(factor, fund_ret, rf, n_components=None
    """
    Returns the Regression based performance Stats for given set of returns
    using PCA for dimensionality reduction followed by OLS regression.
    Inputs:
```

```
        factor - DataFrame containing monthly returns of the regressors
        fund_ret - DataFrame containing monthly excess returns of the regres
        rf - Monthly risk free rate of return
        n_components - Number of principal components to keep
        constant - Whether to add a constant term to the regression model
    Output:
        summary_stats - (Beta of regression, treynor ratio, information rati
    """
    # Apply PCA to the factors
    pca = PCA(n_components=n_components)
    factors_reduced = pca.fit_transform(factor)

    # Add a constant if specified
    if constant:
        X = sm.add_constant(factors_reduced)
    else:
        X = factors_reduced

    # Convert y to a 1-D array if it's not already
    y = fund_ret.values.flatten() if fund_ret.ndim > 1 else fund_ret

    # Perform OLS regression on the reduced factors
    model = sm.OLS(y, X).fit()

    # Extract model parameters
    beta = model.params[1:] if constant else model.params
    alpha = model.params[0] * 12 if constant else None

    # Calculate performance metrics
    treynor_ratio = (((fund_ret - rf).mean()) / beta[0]) if beta[0] != 0 els
    tracking_error = model.resid.std()
    information_ratio = (alpha / tracking_error) if alpha is not None else N
    r_squared = model.rsquared

    if constant:
        return (beta, treynor_ratio, information_ratio, alpha, r_squared, tr
    else:
        return (beta, treynor_ratio, r_squared, tracking_error, model.resid)

# Usage example:
# regression_based_performance_pca(factor_dataframe, fund_ret_dataframe, ris
```

- Outline your steps in developing each model

- Describe your data processing procedures for missing data, data quality and if any, variable transformation. Provide justification if it's necessary to use data outside of the data files from the assignment and the data files underlying the links in this document

- Demonstrate your variable selection process in each model supported by economic reasoning based on your understanding in the MEVs.

- State the data window for each of your regression model. Perform your regressions using two data sets as if you were doing this homework twice- data from all times and data from only the “stressed times”,4 or else? How do different data choices affect your regression coefficients and forecasts?

- Define and support the granularity of your modeling. You can model and make projections at the individual stock level, or at the segment level (e.g., industry groups, or by stock style (growth versus value), etc.), or at the portfolio level.

- If model at the segment or portfolio level, you may need to construct a synthetic time series for the segment or portfolio returns. The total return data of each stock goes back to as far as 1963. However, the market weight data of each stock does not go back that far (see ‘prices’ tab in wrds_data.xlsx). Use judgment or arbitrarily assign weights when constructing the synthetic portfolio total return time series.

- Provide rationale for your selection(s) of the equity market variable, the MEVs, and the time window of historical data used in the regressions. For example, the data file, wrds_data.xlsx (‘returns’ tab), contains historical equity and market data for CAPM and Fama-French. The Fed historical data also contains equity market data. (Hint: You may need to choose an equity market index from different sources)

- Perform stationarity test(s) on the MEVs and transform the data if necessary and, in your own words, discuss stationarity testing is necessary in your modeling process.

- In the stress test, you will need to build a two-step regression for the 3-factor Fama-French model. In the first step, regress Fama-French factors as functions of the MEVs in the Fed scenario. In the second step, combine your regressions into the Fama-French model and project the time1 portfolio value in the scenario.

- Finally the forecast portion in your report should contain a summary of projection outcomes (%return and $value change) from the three modeling approaches (i.e., CAPM, Fama French, and GMF).

In [ ]:
```
wrds_ret = pd.read_excel('wrds_data-1.xlsx', sheet_name='returns')
```

In [ ]:
```
wrds_ret = wrds_ret.iloc[:,:-5]
wrds_ret['Date'] = wrds_ret['Date'].apply(lambda x: datetime.strptime(x, "%Y
wrds_ret.set_index('Date', inplace=True)
wrds_ret.head()
```

Out[ ]:

Date	MKT COMPOSITE RETURN	S&P RETURN	FAMA-FRENCH MARKET FACTOR	RISK-FREE RATE	FAMA-FRENCH SIZE FACTOR (SMB)	FAMA-FRENCH VALUE FACTOR (HML)	MOMENTUM FACTOR	BIOGEN INC	J J
1963-01-01	NaN	0.0491	0.0493	0.0025	0.0307	0.0222	-0.0210	NaN	
1963-02-01	NaN	-0.0289	-0.0238	0.0023	0.0050	0.0217	0.0252	NaN	
1963-03-01	NaN	0.0355	0.0308	0.0023	-0.0260	0.0207	0.0156	NaN	
1963-04-01	NaN	0.0485	0.0451	0.0025	-0.0131	0.0099	-0.0008	NaN	
1963-05-01	NaN	0.0143	0.0176	0.0024	0.0112	0.0253	0.0037	NaN	

5 rows × 27 columns

Historical data window (2001 to 2020)

Using historical data all the way back to 1960s may not be a good idea for several reasons:

Market Structure Changes: The financial markets have undergone substantial structural changes since the 1960s, including regulatory shifts, technological advancements, and the globalization of markets.

Incomplete Data: Many equities in today's portfolios did not exist back then, leading to incomplete datasets that do not reflect the modern market.

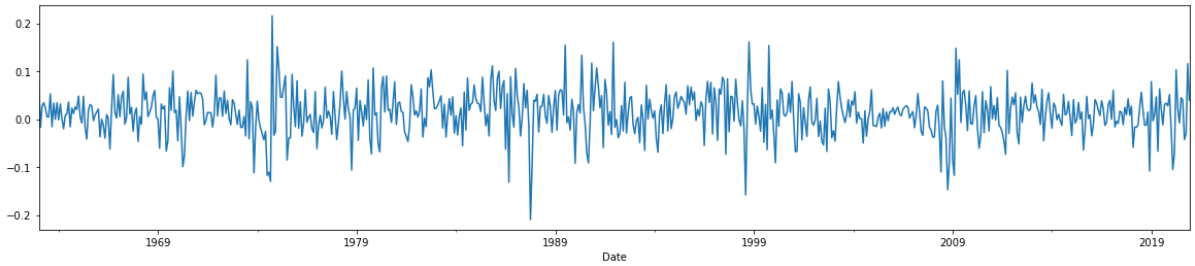
Evolved Trading Practices: Trading practices have significantly evolved, with electronic and algorithmic trading replacing manual trading, affecting market liquidity and volatility.

Reliability and Relevance: Older data may lack the reliability and relevance needed for accurate contemporary analysis due to changes in economic indicators and corporate governance standards.

Volatility Consistency: The standard deviation of the portfolio has changed over time, with more recent data (post-2001) providing volatility patterns more aligned with current market behavior, see plot 2.

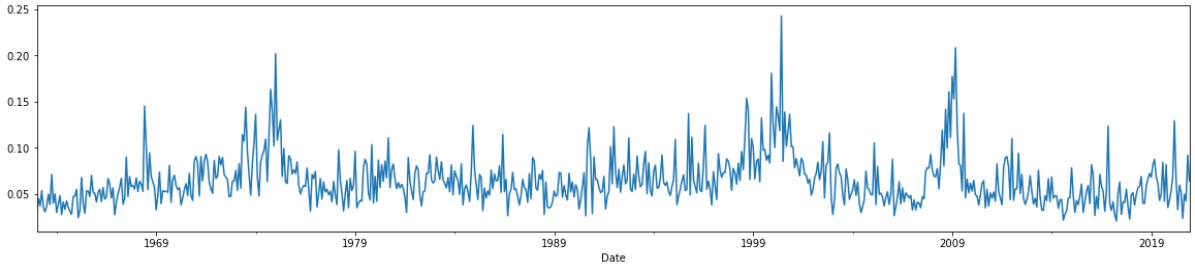
In [ ]:
```
wrds_ret.iloc[:,7:].mean(axis=1).plot(figsize=(20,4))
```

Out[ ]:
```
<AxesSubplot:xlabel='Date'>
```



In [ ]:
```
wrds_ret.iloc[:,7:].std(axis=1).plot(figsize=(20,4))
```

Out[ ]:
```
<AxesSubplot:xlabel='Date'>
```



In [ ]:
```
cumulative_returns = (1 + wrds_ret).cumprod()
quarterly_cumulative_returns = cumulative_returns.resample('Q').last()
overall_quarterly_return = quarterly_cumulative_returns.pct_change()
port_ret_Q = overall_quarterly_return['2001':]
port_ret_Q.index = port_ret_Q.index.to_period('Q').strftime('%YQ%q')
```

In [ ]:
```
factors = port_ret_Q.iloc[:,:7]
factors
```

Out[ ]:

Date	MKT COMPOSITE RETURN	S&P RETURN	FAMA-FRENCH MARKET FACTOR	RISK-FREE RATE	FAMA-FRENCH SIZE FACTOR (SMB)	FAMA-FRENCH VALUE FACTOR (HML)	MOMENTUM FACTOR
2001Q1	-0.093196	-0.121184	-0.139693	0.013459	0.060646	0.135285	-0.086325
2001Q2	0.043914	0.055234	0.066081	0.009932	0.096026	-0.027615	-0.056994
2001Q3	-0.125345	-0.149845	-0.169206	0.008926	-0.079890	0.094972	0.241586
2001Q4	0.084564	0.102981	0.119595	0.005410	0.121815	-0.048164	-0.162852
2002Q1	0.017980	-0.000699	0.003862	0.004005	0.042414	0.068059	0.088505
...	...	...	...	...	...	...	...
2019Q4	0.069790	0.085269	0.089462	0.004106	0.018299	-0.020558	-0.045349
2020Q1	-0.259558	-0.199961	-0.205097	0.003705	-0.070162	-0.225160	0.141705
2020Q2	0.154560	0.199516	0.229435	0.000200	0.081623	-0.085701	-0.055704
2020Q3	0.067990	0.084803	0.097078	0.000300	-0.023660	-0.066915	0.114577
2020Q4	0.143471	0.116772	0.152061	0.000300	0.154622	0.047804	-0.169680

80 rows × 7 columns

In [ ]:
```
factors['FAMA-FRENCH MKT-RF'] = factors['FAMA-FRENCH MARKET FACTOR']-factors
```

Segementation

Segmenting the portfolio into pharmaceutical, banking, and consumer goods industries is beneficial for precision in risk assessment, capitalizing on industry-specific growth opportunities, and aligning investment strategies with distinct sector dynamics. Each industry responds differently to economic indicators, has its own regulatory challenges, and operates with different business models and cycles, which can significantly affect performance and stock returns.

The Industry mapping we have chosen is as follow:

```
'BIOGEN INC': 'Pharmaceutical',
'JOHNSON & JOHNSON': 'Pharmaceutical',
'LILLY (ELI) & CO': 'Pharmaceutical',
'MERCK & CO': 'Pharmaceutical',
'PFIZER INC': 'Pharmaceutical',

'BANK OF AMERICA CORP': 'Banking and Financial Services',
'CITIGROUP INC': 'Banking and Financial Services',
'GOLDMAN SACHS GROUP INC': 'Banking and Financial Services',
'JPMORGAN CHASE & CO': 'Banking and Financial Services',
'MORGAN STANLEY': 'Banking and Financial Services',
```

```
    'ARCHER-DANIELS-MIDLAND CO': 'Consumer Goods/Food',
    'CONAGRA BRANDS INC': 'Consumer Goods/Food',
    'COLGATE-PALMOLIVE CO': 'Consumer Goods/Food',
    'CAMPBELL SOUP CO': 'Consumer Goods/Food',
    'KELLOGG CO': 'Consumer Goods/Food',
    'KRAFT HEINZ CO': 'Consumer Goods/Food',
    'COCA-COLA CO': 'Consumer Goods/Food',
    'PROCTER & GAMBLE CO': 'Consumer Goods/Food',
    'TYSON FOODS INC  -CL A': 'Consumer Goods/Food',
    'WALMART INC': 'Consumer Goods/Food'
```

We have chosen that instead of using each company's return as given in the data to determine the industry or portfolio return,we will get industry price history and then get the percentage change as this will reflect the "weights" of each stock within each industry since they have very different prices

In [ ]:
```
pharmaceutical_tickers = [
    "BIIB", "JNJ", "LLY", "MRK", "PFE"
]
banking_tickers = [
    "BAC", "C", "GS", "JPM", "MS"
]
consumer_goods_tickers = [
    "ADM", "CAG", "CL", "CPB", "K",
    "KHC", "KO", "PG", "TSN", "WMT"
]
```

In [ ]:
```
all_tickers = pharmaceutical_tickers + banking_tickers + consumer_goods_tick

start_date = "2000-09-30"
end_date = pd.Timestamp.today()  # Current date

def get_quarterly_stock_prices(tickers, start, end):
    prices = {}
    for ticker in tickers:
        stock_data = yf.download(ticker, start=start, end=end, progress=Fals
        quarterly_data = stock_data['Adj Close'].resample('Q').last()
        prices[ticker] = quarterly_data
    return prices

df = get_quarterly_stock_prices(all_tickers, start_date, end_date)
port_price_Q = pd.DataFrame(df)
```

In [ ]:
```
industry_ret_Q = pd.DataFrame({
    'Pharmaceuticals': port_price_Q[pharmaceutical_tickers].sum(axis=1).pct_
    'Banking': port_price_Q[banking_tickers].sum(axis=1).pct_change(),
    'Consumer Goods': port_price_Q[consumer_goods_tickers].sum(axis=1).pct_c
})
industry_ret_Q.dropna(inplace=True)
industry_ret_Q.index = industry_ret_Q.index.to_period('Q').strftime('%YQ%q')
```

In [ ]:
```
industry_ret_Q
```

Out[ ]:

Date	Pharmaceuticals	Banking	Consumer Goods
2001Q1	-0.230054	-0.136200	-0.120151
2001Q2	0.163776	0.138855	-0.022278
2001Q3	-0.056992	-0.216600	0.055591
2001Q4	0.104331	0.238734	0.084010
2002Q1	-0.014463	-0.009276	0.053914
...	...	...	...
2022Q4	0.114105	0.177823	0.130009
2023Q1	-0.055123	-0.024400	-0.028160
2023Q2	0.164294	0.020074	-0.013283
2023Q3	0.016873	-0.006522	-0.038857
2023Q4	0.009102	-0.012828	0.004849

92 rows × 3 columns

In [ ]:
```
his_ind_ret = industry_ret_Q['2001Q1':'2020Q4']
test_ind_ret = industry_ret_Q['2020Q4':]
```

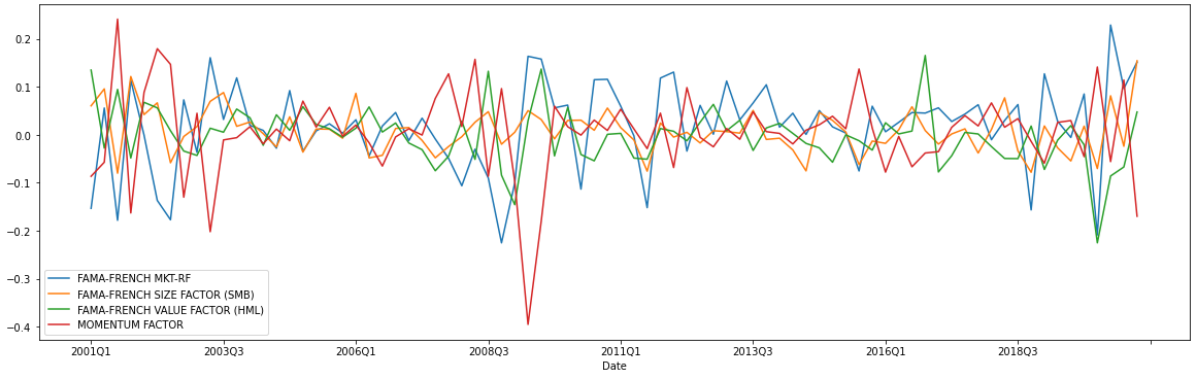
In [ ]:
```
his_ind_ret.plot(figsize=(20,4))
```

Out[ ]:
```
<AxesSubplot:xlabel='Date'>
```

Variable selection - Fama French 3 Factors + Momentum

In [ ]:
```
factor = factors[['FAMA-FRENCH MKT-RF','FAMA-FRENCH SIZE FACTOR (SMB)','FAMA
factor.plot(figsize=(20, 6))
```

Out[ ]:
```
<AxesSubplot:xlabel='Date'>
```



In [ ]:
```
sectors = his_ind_ret.columns
rf = factors['RISK-FREE RATE']

reg_lst= []
for sector in sectors:
    fund_ret = his_ind_ret[sector]
    reg = regression_based_performance(factor,fund_ret,rf)
    beta_mkt = reg[0][0]
    beta_smb = reg[0][1]
    beta_hml = reg[0][2]
    beta_momentum = reg[0][3]
    treynor_ratio = reg[1]
    information_ratio = reg[2]
    alpha = reg[3]
    r_squared = reg[4]
    reg_lst.append(pd.DataFrame([[beta_mkt,beta_smb,beta_hml, beta_momentum,
```

In [ ]:
```
reg_performance = pd.concat(reg_lst)
reg_performance
```

Out[ ]:

	FAMA-FRENCH MKT-RF	FAMA-FRENCH SIZE FACTOR (SMB)	FAMA-FRENCH VALUE FACTOR (HML)	MOMENTUM FACTOR	Alpha	R-Squared	Treyr Ra
Pharmaceuticals	0.672857	-0.307757	-0.341404	0.076810	0.119460	0.339670	0.0245
Banking	1.276111	-0.070031	0.704486	-0.398079	-0.030912	0.805399	0.0096
Consumer Goods	0.530003	-0.283009	0.224961	0.087569	0.169884	0.514211	0.0325

In [ ]:
```
print(f"MAE: {reg_performance['Alpha'].abs().mean()}")
```

```
MAE: 0.106752
```

Overall, the Market Factor is the strongest performer with a good balance of absolute and risk-adjusted returns. The Size Factor also shows a good risk-adjusted return but with a lower explanation of variance. The Value Factor and Momentum Factor show some weaknesses, especially the former with its negative alpha and Information Ratio.

Stationarity test(s) on the MEVs

In [ ]:
```
his_MEVs = pd.read_csv('2021-table_1a_historic_domestic.csv')
his_MEVs.drop(columns='Scenario Name', inplace=True)
```

In [ ]:
```
def parse_quarter(q):
    year, qtr = q.split('Q')
    qtr = int(qtr)
    dt = f"{year}-{(qtr-1)*3+1:02d}-01"
    return pd.to_datetime(dt).to_period('Q').strftime('%YQ%q')
his_MEVs['Date'] = his_MEVs['Date'].apply(parse_quarter)
his_MEVs.set_index('Date', inplace=True)
his_MEVs=his_MEVs['2001Q1':]
```

In [ ]:
```
his_MEVs
```

Out[ ]:

Date	Real GDP growth	Nominal GDP growth	Real disposable income growth	Nominal disposable income growth	Unemployment rate	CPI inflation rate	3-month Treasury rate	5-Trea y
2001Q1	-1.1	1.3	3.7	6.5	4.2	3.9	4.8	
2001Q2	2.4	4.9	-0.7	1.2	4.4	2.8	3.7	
2001Q3	-1.6	-0.1	9.6	9.8	4.8	1.1	3.2	
2001Q4	1.1	2.4	-5.0	-4.7	5.5	-0.3	1.9	
2002Q1	3.5	4.9	9.3	10.1	5.7	1.3	1.7	
...	...	...	...	...	...	...	...	
2019Q4	2.4	3.9	1.9	3.4	3.6	2.4	1.6	
2020Q1	-5.0	-3.4	2.6	3.9	3.8	1.2	1.1	
2020Q2	-31.4	-32.8	48.5	46.2	13.1	-3.5	0.1	
2020Q3	33.4	38.3	-16.3	-13.2	8.8	5.2	0.1	
2020Q4	3.7	5.5	-8.1	-7.5	6.8	2.2	0.1	

80 rows × 16 columns

In [ ]:
```
adf_kpss_test(his_MEVs)
```

Out[ ]:

	Variable	ADF Statistic	ADF p-value	ADF 1%	ADF 5%	ADF 10%	KPSS Statistic	KPS
0	Real GDP growth	-7.251098	1.779241e-10	-3.517114	-2.899375	-2.586955	0.065460	0.10
1	Nominal GDP growth	-3.825464	2.657270e-03	-3.518281	-2.899878	-2.587223	0.085209	0.10
2	Real disposable income growth	-8.143987	1.010402e-12	-3.517114	-2.899375	-2.586955	0.184642	0.10
3	Nominal disposable income growth	-7.784308	8.257727e-12	-3.517114	-2.899375	-2.586955	0.096673	0.10
4	Unemployment rate	-2.136268	2.301834e-01	-3.519481	-2.900395	-2.587498	0.185995	0.10
5	CPI inflation rate	-7.619154	2.151476e-11	-3.515977	-2.898886	-2.586694	0.274276	0.10
6	3-month Treasury rate	-2.479173	1.206244e-01	-3.519481	-2.900395	-2.587498	0.454840	0.05
7	5-year Treasury yield	-1.505300	5.308880e-01	-3.519481	-2.900395	-2.587498	0.969140	0.01
8	10-year Treasury yield	-1.071729	7.262133e-01	-3.519481	-2.900395	-2.587498	1.272613	0.01
9	BBB corporate yield	-1.804485	3.782374e-01	-3.517114	-2.899375	-2.586955	1.021208	0.01
10	Mortgage rate	-0.982018	7.597664e-01	-3.518281	-2.899878	-2.587223	1.260574	0.01
11	Prime rate	-2.323541	1.644880e-01	-3.519481	-2.900395	-2.587498	0.446587	0.05
12	Dow Jones Total Stock Market Index (Level)	2.054416	9.987396e-01	-3.526005	-2.903200	-2.588995	1.246697	0.01
13	House Price Index (Level)	-1.637051	4.638022e-01	-3.520713	-2.900925	-2.587781	0.686626	0.01
14	Commercial Real Estate Price Index (Level)	-0.829337	8.103524e-01	-3.517114	-2.899375	-2.586955	0.999175	0.01
15	Market Volatility Index (Level)	-2.371578	1.499194e-01	-3.521980	-2.901470	-2.588072	0.084526	0.10

In the context of using macroeconomic variables (MEVs) to project multi-factors for stock return prediction, stationarity testing might not be as critical, depending on the modeling approach used. If the MEVs are used as exogenous inputs to a model that focuses on capturing the relationship between these variables and stock returns, rather than forecasting the MEVs themselves, the non-stationarity of MEVs may not have a

significant impact. This is because the model is concerned with the relationship at each point in time, which can be assumed to be relatively stable in the short term, rather than with the long-term trend of the MEVs.

Transform MEVs using standard scaler

Applying standard scaling to Macroeconomic Variables (MEVs) before regression ensures that all variables are on a comparable scale, which aids in the stability and efficiency of the regression analysis. It facilitates a more meaningful comparison of coefficients and can enhance the performance of models that are sensitive to variable scales. This step is critical for accurate model interpretation and reliable predictions.

In [ ]:
```
scaler = StandardScaler()
his_MEVs = pd.DataFrame(scaler.fit_transform(his_MEVs), columns=his_MEVs.col
```

In [ ]:
```
his_MEVs
```

Out[ ]:

Date	Real GDP growth	Nominal GDP growth	Real disposable income growth	Nominal disposable income growth	Unemployment rate	CPI inflation rate	3-month Treasury rate
2001Q1	-0.535780	-0.412333	0.153152	0.313908	-0.960698	0.824041	2.29001
2001Q2	0.085671	0.164693	-0.494020	-0.493720	-0.858631	0.330066	1.55907
2001Q3	-0.624558	-0.636732	1.020950	0.816771	-0.654499	-0.433351	1.22682
2001Q4	-0.145153	-0.236020	-1.126483	-1.392778	-0.297268	-1.062048	0.36298
2002Q1	0.280985	0.164693	0.976824	0.862486	-0.195201	-0.343538	0.23008
...	...	...	...	...	...	...	...
2019Q4	0.085671	0.004408	-0.111600	-0.158478	-1.266896	0.150438	0.16363
2020Q1	-1.228254	-1.165672	-0.008641	-0.082287	-1.164830	-0.388444	-0.16861
2020Q2	-5.915771	-5.878049	6.742533	6.363503	3.581246	-2.499067	-0.83311
2020Q3	5.589953	5.518210	-2.788536	-2.688031	1.386824	1.407830	-0.83311
2020Q4	0.316496	0.260864	-1.582444	-1.819450	0.366162	0.060624	-0.83311

80 rows × 16 columns

Project Fama-French factors against MEVs in the Fed scenario using Random Forest

In [ ]:
```
base_MEVs = pd.read_csv('2021-table_2a_supervisory_baseline_domestic.csv')
base_MEVs.drop(columns='Scenario Name', inplace=True)
base_MEVs['Date'] = base_MEVs['Date'].apply(parse_quarter)
base_MEVs.set_index('Date', inplace=True)

base_MEVs = pd.DataFrame(scaler.fit_transform(base_MEVs), columns=base_MEVs.

MEVs = pd.read_csv('2021-table_3a_supervisory_severely_adverse_domestic.csv'
MEVs.drop(columns='Scenario Name', inplace=True)
MEVs['Date'] = MEVs['Date'].apply(parse_quarter)
MEVs.set_index('Date', inplace=True)

MEVs = pd.DataFrame(scaler.fit_transform(MEVs), columns=MEVs.columns, index=

from sklearn.ensemble import RandomForestRegressor
from sklearn.model_selection import GridSearchCV

multi_factors = factor.columns

pred_factors_base = pd.DataFrame(index=MEVs.index)
pred_factors = pd.DataFrame(index=MEVs.index)
model_factors = pd.DataFrame(index=his_MEVs.index)

for fac in multi_factors:
    Y_train = factor[fac]
    X_train = his_MEVs
    X_test_base = base_MEVs
    X_test = MEVs
    rf = RandomForestRegressor(n_estimators=100, random_state=42)
    rf.fit(X_train, Y_train)

    param_grid = {
    'n_estimators': [100, 200, 300],
    'max_depth': [None, 10, 20, 30],
    'min_samples_split': [2, 5, 10],
    'min_samples_leaf': [1, 2, 4]
    }

    # Initialize the grid search with cross-validation
    grid_search = GridSearchCV(estimator=rf, param_grid=param_grid, cv=5, n_

    # Perform grid search
    grid_search.fit(X_train, Y_train)

    # Get the best estimator
    best_rf = grid_search.best_estimator_

    # Predict on the test data using the best estimator
    y_pred_base = best_rf.predict(X_test_base)
    y_pred = best_rf.predict(X_test)
    y_model = best_rf.predict(X_train)

    pred_factors_base[fac] = y_pred_base
    pred_factors[fac] = y_pred
    model_factors[fac] = y_model
```

```
Fitting 5 folds for each of 108 candidates, totalling 540 fits
Fitting 5 folds for each of 108 candidates, totalling 540 fits
Fitting 5 folds for each of 108 candidates, totalling 540 fits
Fitting 5 folds for each of 108 candidates, totalling 540 fits
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
```

```
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
```

```
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
```

```
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
```

```
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
```

```
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
```

```
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
```

```
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
```

```
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.6s
```

```
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
```

```
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
```

```
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
```

```
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
```

```
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
```

```
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
```

```
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
```

```
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
```

```
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
```

```
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
```

```
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
```

```
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
```

```
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
```

```
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
```

```
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
```

```
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
```

```
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
```

```
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
```

```
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
```

```
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
```

```
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
```

```
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
```

```
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
```

```
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
```

```
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
```

```
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
```

```
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
```

```
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
```

```
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
```

```
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
```

```
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
```

```
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
```

```
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
```

```
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
```

```
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
```

```
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
```

```
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
```

3.3 Combine regressions into the model and project the time 1 portfolio value

Projection using scaled baseline MEVs at time 1

In [ ]:
```
base_MEVs.head()
```

Out[ ]:

Date	Real GDP growth	Nominal GDP growth	Real disposable income growth	Nominal disposable income growth	Unemployment rate	CPI inflation rate	3-month Treasury rate
2021Q1	-0.757467	-1.096454	2.764122	2.713052	2.274770	-0.288675	-0.903713
2021Q2	1.619413	1.681848	-2.191258	-2.254508	1.613943	-3.103258	-0.903713
2021Q3	2.072152	2.165031	-0.718802	-0.709045	0.953116	0.649519	-0.903713
2021Q4	1.393043	1.198665	-0.152473	-0.157094	0.457496	-0.288675	-0.903713
2022Q1	0.374380	0.353095	0.045742	0.036089	0.127082	-0.288675	-0.903713

In [ ]:
```
pred_factors_base
```

Out[ ]:

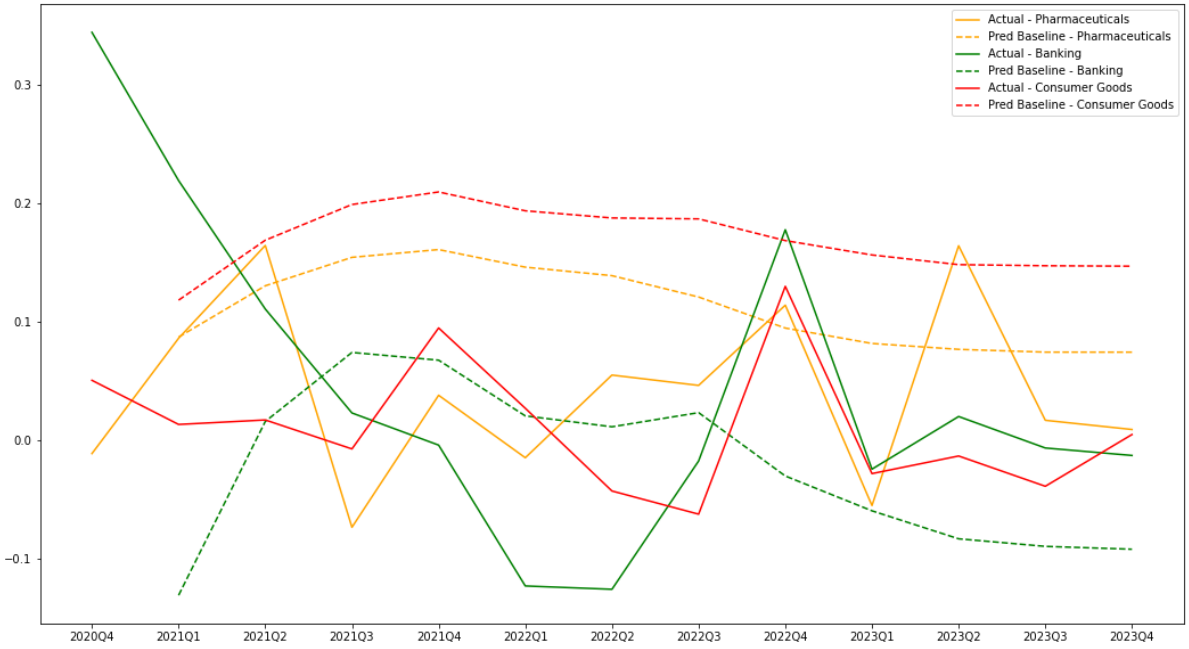
Date	FAMA-FRENCH MKT-RF	FAMA-FRENCH SIZE FACTOR (SMB)	FAMA-FRENCH VALUE FACTOR (HML)	MOMENTUM FACTOR
2021Q1	-0.061797	0.015534	-0.049501	-0.037164
2021Q2	0.027016	0.023942	-0.014167	-0.060230
2021Q3	0.071329	0.027341	0.007079	-0.027581
2021Q4	0.071421	0.006313	0.014528	0.005956
2022Q1	0.042008	0.002590	0.005250	0.014086
2022Q2	0.033888	0.007387	0.005044	0.010011
2022Q3	0.020769	0.000994	0.032921	-0.011602
2022Q4	-0.021243	-0.007701	0.036466	-0.004052
2023Q1	-0.043080	-0.009548	0.032640	-0.006611
2023Q2	-0.056060	-0.011319	0.023732	-0.004282
2023Q3	-0.059427	-0.010753	0.025231	0.003521
2023Q4	-0.060938	-0.012982	0.024325	0.003522
2024Q1	-0.070796	-0.003920	0.038670	-0.004237

In [ ]:
```
projected_base_ret_df = pd.DataFrame(index=base_MEVs.index)

for sec in sectors:
    projected_base_ret_df[sec] = reg_performance.loc[sec, 'Alpha']

    for beta in reg_performance.iloc[:,:4]:
        projected_base_ret_df[sec] += reg_performance.loc[sec, beta] * pred_

projected_base_ret_df
```

Out[ ]:

Date	Pharmaceuticals	Banking	Consumer Goods
2021Q1	0.087144	-0.130938	0.118345
2021Q2	0.130480	0.015882	0.168965
2021Q3	0.154505	0.074164	0.199128
2021Q4	0.161071	0.067651	0.209741
2022Q1	0.146218	0.020604	0.193830
2022Q2	0.139035	0.011383	0.187765
2022Q3	0.120998	0.023333	0.187000
2022Q4	0.094776	-0.030178	0.168653
2023Q1	0.081760	-0.059593	0.156517
2023Q2	0.076792	-0.083235	0.148339
2023Q3	0.074440	-0.089621	0.147415
2023Q4	0.074418	-0.092032	0.147041
2024Q1	0.059504	-0.092052	0.141800

In [ ]:
```
plt.figure(figsize=(18, 10))

colors = ['orange', 'green', 'red']

num_sectors = projected_base_ret_df[:'2023Q4'].shape[1]
if num_sectors > len(colors):
    raise ValueError("Not enough colors defined for the number of sectors.")

for i, sector in enumerate(projected_base_ret_df[:'2023Q4'].columns):
    plt.plot(test_ind_ret.index, test_ind_ret[sector], label=f'Actual - {sec
    plt.plot(projected_base_ret_df[:'2023Q4'].index, projected_base_ret_df[:

plt.legend()
plt.show()
```



Projection using scaled severe MEVs at time 1

In [ ]:
```
MEVs.head()
```

Out[ ]:

Date	Real GDP growth	Nominal GDP growth	Real disposable income growth	Nominal disposable income growth	Unemployment rate	CPI inflation rate	3-month Treasury rate
2021Q1	-1.573698	-1.516480	0.370406	0.297331	-1.350038	-0.590167	-1.0
2021Q2	-1.253039	-1.250840	-2.657021	-2.596125	-0.578588	-1.357384	-1.0
2021Q3	-1.103398	-1.155969	-1.274417	-1.292966	0.096431	-1.357384	-1.0
2021Q4	-0.611720	-0.681613	-0.440086	-0.497817	0.482157	-0.845906	-1.0
2022Q1	-0.611720	-0.624690	-0.225544	-0.299030	0.867882	-0.845906	-1.0

In [ ]:
```
pred_factors
```

Out[ ]:

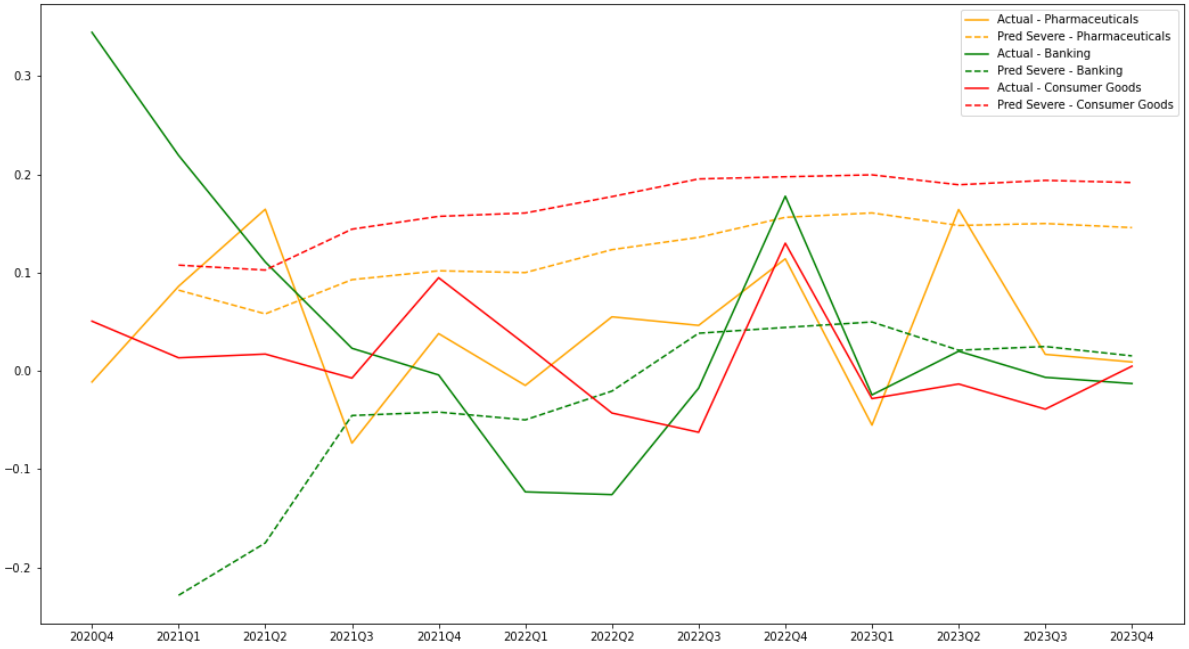
Date	FAMA-FRENCH MKT-RF	FAMA-FRENCH SIZE FACTOR (SMB)	FAMA-FRENCH VALUE FACTOR (HML)	MOMENTUM FACTOR
2021Q1	-0.103408	-0.016366	-0.070242	0.042934
2021Q2	-0.102836	0.006465	-0.035895	-0.032302
2021Q3	-0.030462	0.007455	-0.004965	-0.071434
2021Q4	-0.023260	-0.007830	0.003942	-0.038681
2022Q1	-0.025392	-0.008759	0.012224	-0.010730
2022Q2	0.007757	-0.001495	0.008066	0.013300
2022Q3	0.039010	0.002279	0.025804	-0.003716
2022Q4	0.060776	0.015000	-0.001494	0.000697
2023Q1	0.066764	0.016746	-0.004501	0.000292
2023Q2	0.044999	0.011851	-0.005102	0.002528
2023Q3	0.049239	0.012228	0.000084	0.015776
2023Q4	0.041681	0.008216	0.001754	0.019147
2024Q1	0.045401	0.010990	0.013766	0.017713

In [ ]:
```
projected_ret_df = pd.DataFrame(index=MEVs.index)

for sec in sectors:
    projected_ret_df[sec] = reg_performance.loc[sec, 'Alpha']

    for beta in reg_performance.iloc[:,:4]:
        projected_ret_df[sec] += reg_performance.loc[sec, beta] * pred_factc

projected_ret_df
```

Out[ ]:

Date	Pharmaceuticals	Banking	Consumer Goods
2021Q1	0.082197	-0.228302	0.107667
2021Q2	0.058050	-0.175024	0.102647
2021Q3	0.092877	-0.045368	0.144257
2021Q4	0.101902	-0.041871	0.157272
2022Q1	0.100073	-0.049819	0.160715
2022Q2	0.123407	-0.020520	0.177398
2022Q3	0.135912	0.038367	0.195394
2022Q4	0.156301	0.044264	0.197575
2023Q1	0.160788	0.049826	0.199543
2023Q2	0.148027	0.021081	0.189453
2023Q3	0.150011	0.024845	0.193920
2023Q4	0.145849	0.015316	0.191721
2024Q1	0.143287	0.028901	0.195484

In [ ]:
```
plt.figure(figsize=(18, 10))

colors = ['orange', 'green', 'red']

num_sectors = projected_ret_df['2023Q4'].shape[1]
if num_sectors > len(colors):
    raise ValueError("Not enough colors defined for the number of sectors.")

for i, sector in enumerate(projected_ret_df['2023Q4'].columns):
    plt.plot(test_ind_ret.index, test_ind_ret[sector], label=f'Actual - {sec
    plt.plot(projected_ret_df['2023Q4'].index, projected_ret_df['2023Q4'][

plt.legend()
plt.show()
```



Model risk assessment and controls

In [ ]:
```
model_factors
```

Out[ ]:

Date	FAMA-FRENCH MKT-RF	FAMA-FRENCH SIZE FACTOR (SMB)	FAMA-FRENCH VALUE FACTOR (HML)	MOMENTUM FACTOR
2001Q1	-0.121682	0.038024	0.072152	-0.007571
2001Q2	0.014240	0.041371	0.004344	0.005297
2001Q3	-0.145590	-0.001799	0.057674	0.067708
2001Q4	0.037027	0.041456	0.015839	-0.050292
2002Q1	-0.003803	0.054224	0.042964	0.060290
...	...	...	...	...
2019Q4	0.064109	-0.003772	-0.006763	-0.017006
2020Q1	-0.148399	-0.031088	-0.076939	0.045210
2020Q2	0.069906	0.031237	-0.088574	-0.013130
2020Q3	0.110540	0.028498	-0.013412	0.000729
2020Q4	0.119721	0.041319	0.006131	-0.036910

80 rows × 4 columns

In [ ]:
```
is_projected_ret_df = pd.DataFrame(index=his_MEVs.index)

for sec in sectors:
    is_projected_ret_df[sec] = reg_performance.loc[sec, 'Alpha']
```

```
    for beta in reg_performance.iloc[:,:4]:
        is_projected_ret_df[sec] += reg_performance.loc[sec, beta] * model_f

is_projected_ret_df
```

Out[ ]:

Date	Pharmaceuticals	Banking	Consumer Goods
2001Q1	0.000669	-0.135011	0.110199
2001Q2	0.115233	-0.014686	0.167164
2001Q3	0.007563	-0.202898	0.112134
2001Q4	0.122345	0.044614	0.176935
2002Q1	0.090176	-0.033295	0.167467
...	...	...	...
2019Q4	0.164760	0.053168	0.201919
2020Q1	0.058916	-0.290308	0.086681
2020Q2	0.186115	-0.001064	0.177019
2020Q3	0.189702	0.098414	0.217452
2020Q4	0.182371	0.137984	0.219790

80 rows × 3 columns

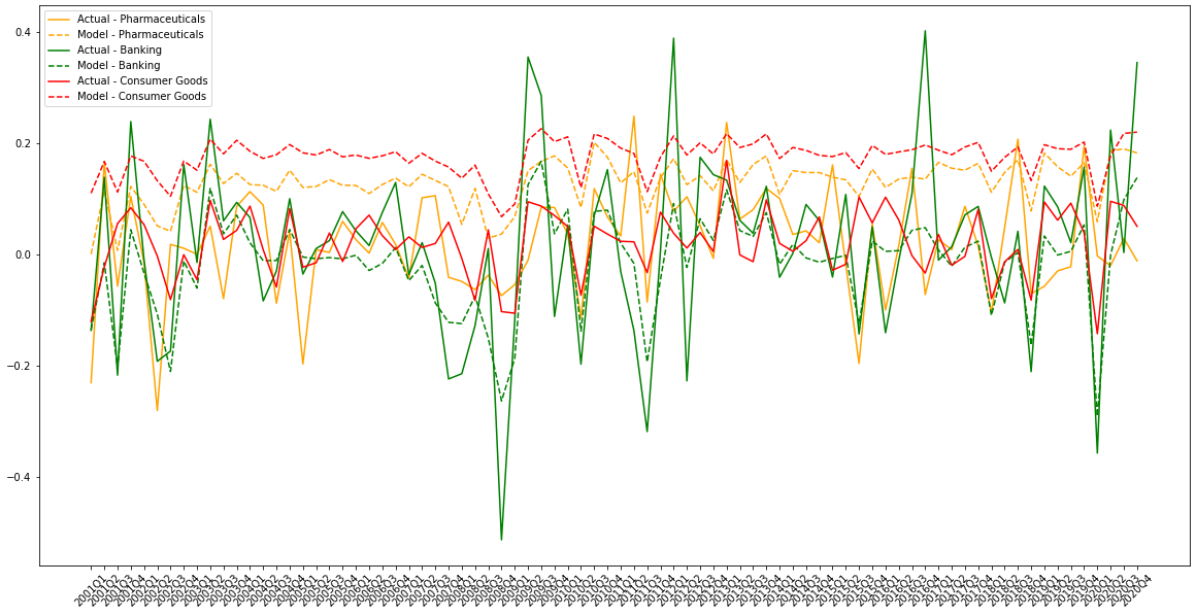
In [ ]:
```
his_ind_ret
```

Out[ ]:

Date	Pharmaceuticals	Banking	Consumer Goods
2001Q1	-0.230054	-0.136200	-0.120151
2001Q2	0.163776	0.138855	-0.022278
2001Q3	-0.056992	-0.216600	0.055591
2001Q4	0.104331	0.238734	0.084010
2002Q1	-0.014463	-0.009276	0.053914
...	...	...	...
2019Q4	0.194800	0.156758	0.038887
2020Q1	-0.002631	-0.356531	-0.142212
2020Q2	-0.019981	0.223430	0.095587
2020Q3	0.029126	0.003421	0.088100
2020Q4	-0.011274	0.344553	0.050641

80 rows × 3 columns

In [ ]:
```
plt.figure(figsize=(20, 10))

colors = ['orange', 'green', 'red']

num_sectors = his_ind_ret.shape[1]
if num_sectors > len(colors):
    raise ValueError("Not enough colors defined for the number of sectors.")

for i, sector in enumerate(his_ind_ret.columns):
    plt.plot(his_ind_ret.index, his_ind_ret[sector], label=f'Actual - {secto
    plt.plot(is_projected_ret_df.index, is_projected_ret_df[sector], label=f

plt.legend()
plt.xticks(rotation=45)
plt.show()
```



In [ ]:
```
for sector in is_projected_ret_df.columns:
    rmse = mean_squared_error(his_ind_ret[sector], is_projected_ret_df[secto
    print(f"{sector} - RMSE: {rmse:.4f}")
```

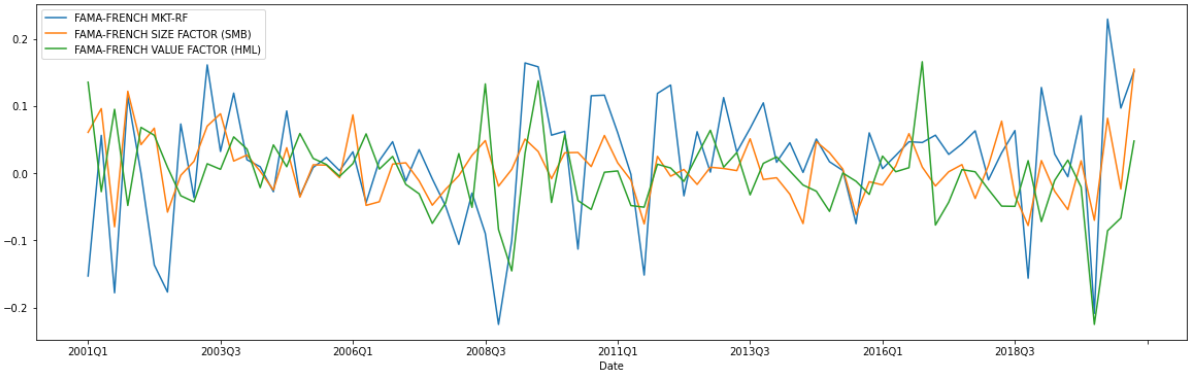
```
Pharmaceuticals - RMSE: 0.1359
Banking - RMSE: 0.1070
Consumer Goods - RMSE: 0.1610
```

Fama French 3 Factor Model - Moushumi Pardesi

Variable selection - Fama French 3 Factors

In [ ]:
```
factor = factors[['FAMA-FRENCH MKT-RF','FAMA-FRENCH SIZE FACTOR (SMB)','FAMA
factor.plot(figsize=(20, 6))
```

Out[ ]:
```
<AxesSubplot:xlabel='Date'>
```



In [ ]:
```
sectors = his_ind_ret.columns
rf = factors['RISK-FREE RATE']

reg_lst= []
for sector in sectors:
    fund_ret = his_ind_ret[sector]
    reg = regression_based_performance(factor,fund_ret,rf)
    beta_mkt = reg[0][0]
    beta_smb = reg[0][1]
    beta_hml = reg[0][2]
    treynor_ratio = reg[1]
    information_ratio = reg[2]
    alpha = reg[3]
    r_squared = reg[4]
    reg_lst.append(pd.DataFrame([[beta_mkt,beta_smb,beta_hml, alpha,r_square
```

In [ ]:
```
reg_performance = pd.concat(reg_lst)
reg_performance
```

Out[ ]:

	FAMA-FRENCH MKT-RF	FAMA-FRENCH SIZE FACTOR (SMB)	FAMA-FRENCH VALUE FACTOR (HML)	Alpha	R-Squared	Treynor Ratio	Informatic Rat
Pharmaceuticals	0.642483	-0.340238	-0.356310	0.131580	0.336240	0.025759	0.13836
Banking	1.433531	0.098308	0.781741	-0.093756	0.772414	0.008546	-0.10073
Consumer Goods	0.495374	-0.320040	0.207966	0.183708	0.502363	0.034876	0.36366

In [ ]:
```
print(f"MAE: {reg_performance['Alpha'].abs().mean()}")
```

```
MAE: 0.136348
```

The Market RF Factor is the strongest performer with good absolute and risk-adjusted returns. The Size Factor shows good risk-adjusted return and low explanation of variance. The Value Factor and Momentum Factor show some weaknesses.

Stationarity test(s) on the MEVs

In [ ]:
```
his_MEVs = pd.read_csv('2021-table_1a_historic_domestic.csv')
his_MEVs.drop(columns='Scenario Name', inplace=True)
```

In [ ]:
```
def parse_quarter(q):
    year, qtr = q.split('Q')
    qtr = int(qtr)
    dt = f"{year}-{(qtr-1)*3+1:02d}-01"
    return pd.to_datetime(dt).to_period('Q').strftime('%YQ%q')
his_MEVs['Date'] = his_MEVs['Date'].apply(parse_quarter)
his_MEVs.set_index('Date', inplace=True)
his_MEVs=his_MEVs['2001Q1':]
```

In [ ]:
```
his_MEVs
```

Out[ ]:

Date	Real GDP growth	Nominal GDP growth	Real disposable income growth	Nominal disposable income growth	Unemployment rate	CPI inflation rate	3-month Treasury rate	5- Trea y
2001Q1	-1.1	1.3	3.7	6.5	4.2	3.9	4.8	
2001Q2	2.4	4.9	-0.7	1.2	4.4	2.8	3.7	
2001Q3	-1.6	-0.1	9.6	9.8	4.8	1.1	3.2	
2001Q4	1.1	2.4	-5.0	-4.7	5.5	-0.3	1.9	
2002Q1	3.5	4.9	9.3	10.1	5.7	1.3	1.7	
...	...	...	...	...	...	...	...	
2019Q4	2.4	3.9	1.9	3.4	3.6	2.4	1.6	
2020Q1	-5.0	-3.4	2.6	3.9	3.8	1.2	1.1	
2020Q2	-31.4	-32.8	48.5	46.2	13.1	-3.5	0.1	
2020Q3	33.4	38.3	-16.3	-13.2	8.8	5.2	0.1	
2020Q4	3.7	5.5	-8.1	-7.5	6.8	2.2	0.1	

80 rows × 16 columns

In [ ]:
```
adf_kpss_test(his_MEVs)
```

Out[ ]:

	Variable	ADF Statistic	ADF p-value	ADF 1%	ADF 5%	ADF 10%	KPSS Statistic	KPS
0	Real GDP growth	-7.251098	1.779241e-10	-3.517114	-2.899375	-2.586955	0.065460	0.10
1	Nominal GDP growth	-3.825464	2.657270e-03	-3.518281	-2.899878	-2.587223	0.085209	0.10
2	Real disposable income growth	-8.143987	1.010402e-12	-3.517114	-2.899375	-2.586955	0.184642	0.10
3	Nominal disposable income growth	-7.784308	8.257727e-12	-3.517114	-2.899375	-2.586955	0.096673	0.10
4	Unemployment rate	-2.136268	2.301834e-01	-3.519481	-2.900395	-2.587498	0.185995	0.10
5	CPI inflation rate	-7.619154	2.151476e-11	-3.515977	-2.898886	-2.586694	0.274276	0.10
6	3-month Treasury rate	-2.479173	1.206244e-01	-3.519481	-2.900395	-2.587498	0.454840	0.05
7	5-year Treasury yield	-1.505300	5.308880e-01	-3.519481	-2.900395	-2.587498	0.969140	0.01
8	10-year Treasury yield	-1.071729	7.262133e-01	-3.519481	-2.900395	-2.587498	1.272613	0.01
9	BBB corporate yield	-1.804485	3.782374e-01	-3.517114	-2.899375	-2.586955	1.021208	0.01
10	Mortgage rate	-0.982018	7.597664e-01	-3.518281	-2.899878	-2.587223	1.260574	0.01
11	Prime rate	-2.323541	1.644880e-01	-3.519481	-2.900395	-2.587498	0.446587	0.05
12	Dow Jones Total Stock Market Index (Level)	2.054416	9.987396e-01	-3.526005	-2.903200	-2.588995	1.246697	0.01
13	House Price Index (Level)	-1.637051	4.638022e-01	-3.520713	-2.900925	-2.587781	0.686626	0.01
14	Commercial Real Estate Price Index (Level)	-0.829337	8.103524e-01	-3.517114	-2.899375	-2.586955	0.999175	0.01
15	Market Volatility Index (Level)	-2.371578	1.499194e-01	-3.521980	-2.901470	-2.588072	0.084526	0.10

Stationarity test may not be very useful for MEVs. Utilizing MEVs as external inputs in a model to explain the correlation between variables and stock returns, instead of predicting the MEVs, might actually lessen impact of MEV non-stationarity. This is cos the model's focuses on short-term stability of relationship over long term MEV trends.

Transform MEVs using standard scaler

Scaling MEVs before regression is crucial to ensure comparable variable units, stable and efficient model training, and meaningful interpretation of coefficients. It improves algorithm convergence, prevents dominance by variables with larger scales, and enhances the overall performance and accuracy of the regression model.

In [ ]:
```
scaler = StandardScaler()
his_MEVs = pd.DataFrame(scaler.fit_transform(his_MEVs), columns=his_MEVs.col
```

In [ ]:
```
his_MEVs
```

Out[ ]:

Date	Real GDP growth	Nominal GDP growth	Real disposable income growth	Nominal disposable income growth	Unemployment rate	CPI inflation rate	3-montl Treasur rat
2001Q1	-0.535780	-0.412333	0.153152	0.313908	-0.960698	0.824041	2.29001
2001Q2	0.085671	0.164693	-0.494020	-0.493720	-0.858631	0.330066	1.55907
2001Q3	-0.624558	-0.636732	1.020950	0.816771	-0.654499	-0.433351	1.22682
2001Q4	-0.145153	-0.236020	-1.126483	-1.392778	-0.297268	-1.062048	0.36298
2002Q1	0.280985	0.164693	0.976824	0.862486	-0.195201	-0.343538	0.23008
...	...	...	...	...	...	...	...
2019Q4	0.085671	0.004408	-0.111600	-0.158478	-1.266896	0.150438	0.16363
2020Q1	-1.228254	-1.165672	-0.008641	-0.082287	-1.164830	-0.388444	-0.16861
2020Q2	-5.915771	-5.878049	6.742533	6.363503	3.581246	-2.499067	-0.83311
2020Q3	5.589953	5.518210	-2.788536	-2.688031	1.386824	1.407830	-0.83311
2020Q4	0.316496	0.260864	-1.582444	-1.819450	0.366162	0.060624	-0.83311

80 rows × 16 columns

Project Fama-French factors against MEVs in the Fed scenario using Random Forest

In [ ]:
```
base_MEVs = pd.read_csv('2021-table_2a_supervisory_baseline_domestic.csv')
base_MEVs.drop(columns='Scenario Name', inplace=True)
base_MEVs['Date'] = base_MEVs['Date'].apply(parse_quarter)
base_MEVs.set_index('Date', inplace=True)

base_MEVs = pd.DataFrame(scaler.fit_transform(base_MEVs), columns=base_MEVs.
```

```
MEVs = pd.read_csv('2021-table_3a_supervisory_severely_adverse_domestic.csv'
MEVs.drop(columns='Scenario Name', inplace=True)
MEVs['Date'] = MEVs['Date'].apply(parse_quarter)
MEVs.set_index('Date', inplace=True)

MEVs = pd.DataFrame(scaler.fit_transform(MEVs), columns=MEVs.columns, index=

from sklearn.ensemble import RandomForestRegressor
from sklearn.model_selection import GridSearchCV

multi_factors = factor.columns

pred_factors_base = pd.DataFrame(index=MEVs.index)
pred_factors = pd.DataFrame(index=MEVs.index)
model_factors = pd.DataFrame(index=his_MEVs.index)

for fac in multi_factors:
    Y_train = factor[fac]
    X_train = his_MEVs
    X_test_base = base_MEVs
    X_test = MEVs
    rf = RandomForestRegressor(n_estimators=100, random_state=42)
    rf.fit(X_train, Y_train)

    param_grid = {
    'n_estimators': [100, 200, 300],
    'max_depth': [None, 10, 20, 30],
    'min_samples_split': [2, 5, 10],
    'min_samples_leaf': [1, 2, 4]
    }

    # Initialize the grid search with cross-validation
    grid_search = GridSearchCV(estimator=rf, param_grid=param_grid, cv=5, n_

    # Perform grid search
    grid_search.fit(X_train, Y_train)

    # Get the best estimator
    best_rf = grid_search.best_estimator_

    # Predict on the test data using the best estimator
    y_pred_base = best_rf.predict(X_test_base)
    y_pred = best_rf.predict(X_test)
    y_model = best_rf.predict(X_train)

    pred_factors_base[fac] = y_pred_base
    pred_factors[fac] = y_pred
    model_factors[fac] = y_model
```

```
Fitting 5 folds for each of 108 candidates, totalling 540 fits
Fitting 5 folds for each of 108 candidates, totalling 540 fits
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
```

```
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.5s
```

```
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
```

```
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.1s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.7s
```

```
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   1.0s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   1.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
```

```
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
```

```
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.6s
```

```
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
```

```
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
```

```
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.1s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
```

```
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   1.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   1.1s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   1.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.9s
```

```
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.1s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
```

```
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
```

```
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
```

```
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.7s
```

```
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   1.1s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   1.0s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.3s
```

```
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   1.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
```

```
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
```

```
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
```

```
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
```

```
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.4s
```

```
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   1.1s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   1.0s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   1.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
```

```
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
Fitting 5 folds for each of 108 candidates, totalling 540 fits
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
```

```
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
```

```
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
```

```
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.1s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
```

```
rs=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.1s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   1.0s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   1.1s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   1.0s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   1.0s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
```

```
ors=100; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   1.0s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.1s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
```

```
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
```

```
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
```

```
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
```

```
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.1s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
```

```
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   1.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   1.1s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   1.0s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
```

```
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.1s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
```

```
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
```

```
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
```

```
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
```

```
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.1s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
```

```
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   1.0s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   1.0s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   1.0s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
```

```
s=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
```

```
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
```

```
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
```

```
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
```

```
rs=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   1.1s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   1.0s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
```

```
tors=300; total time=   1.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
```

```
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
```

3.3 Combine regressions into the model and project the time 1 portfolio value

Projection using scaled baseline MEVs at time 1

In [ ]:
```
base_MEVs.head()
```

Out[ ]:

Date	Real GDP growth	Nominal GDP growth	Real disposable income growth	Nominal disposable income growth	Unemployment rate	CPI inflation rate	3-month Treasury rate
2021Q1	-0.757467	-1.096454	2.764122	2.713052	2.274770	-0.288675	-0.903713
2021Q2	1.619413	1.681848	-2.191258	-2.254508	1.613943	-3.103258	-0.903713
2021Q3	2.072152	2.165031	-0.718802	-0.709045	0.953116	0.649519	-0.903713
2021Q4	1.393043	1.198665	-0.152473	-0.157094	0.457496	-0.288675	-0.903713
2022Q1	0.374380	0.353095	0.045742	0.036089	0.127082	-0.288675	-0.903713

In [ ]:
```
pred_factors_base
```

Out[ ]:

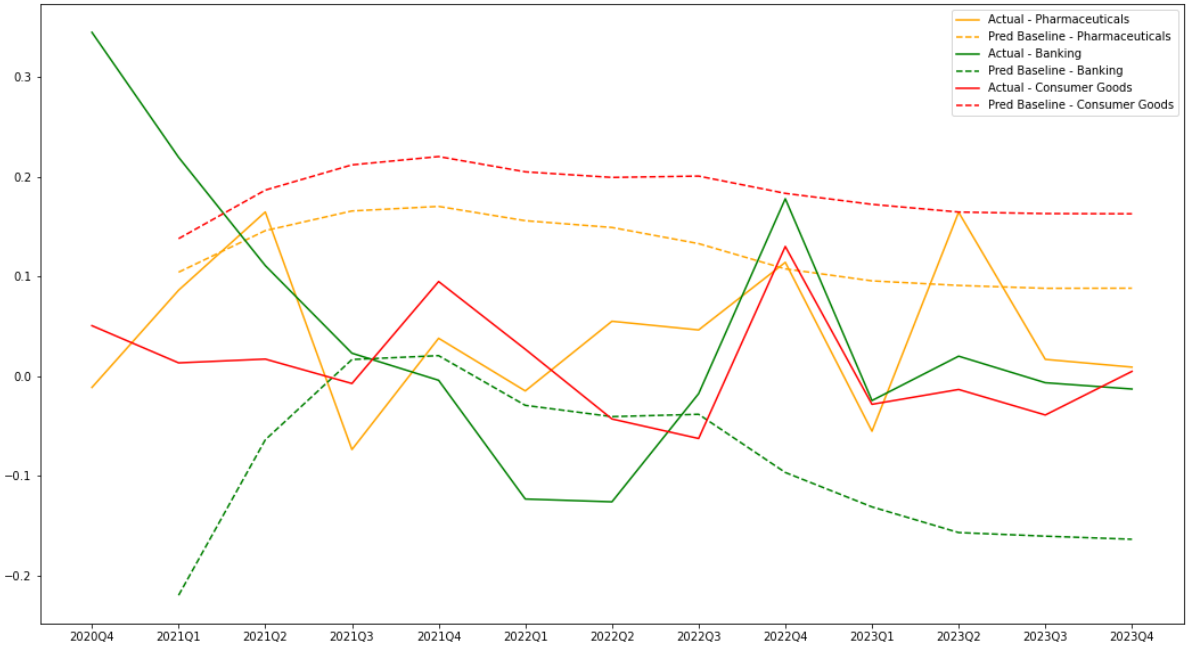
Date	FAMA-FRENCH MKT-RF	FAMA-FRENCH SIZE FACTOR (SMB)	FAMA-FRENCH VALUE FACTOR (HML)
2021Q1	-0.061797	0.015534	-0.049501
2021Q2	0.027016	0.023942	-0.014167
2021Q3	0.071329	0.027341	0.007079
2021Q4	0.071421	0.006313	0.014528
2022Q1	0.042008	0.002590	0.005250
2022Q2	0.033888	0.007387	0.005044
2022Q3	0.020769	0.000994	0.032921
2022Q4	-0.021243	-0.007701	0.036466
2023Q1	-0.043080	-0.009548	0.032640
2023Q2	-0.056060	-0.011319	0.023732
2023Q3	-0.059427	-0.010753	0.025231
2023Q4	-0.060938	-0.012982	0.024325
2024Q1	-0.070796	-0.003920	0.038670

In [ ]:
```
projected_base_ret_df = pd.DataFrame(index=base_MEVs.index)

for sec in sectors:
    projected_base_ret_df[sec] = reg_performance.loc[sec, 'Alpha']

    for beta in reg_performance.iloc[:,:3]:
        projected_base_ret_df[sec] += reg_performance.loc[sec, beta] * pred_

projected_base_ret_df
```

Out[ ]:

Date	Pharmaceuticals	Banking	Consumer Goods
2021Q1	0.104229	-0.219514	0.137830
2021Q2	0.145839	-0.063749	0.186482
2021Q3	0.165583	0.016719	0.211765
2021Q4	0.170142	0.020606	0.220089
2022Q1	0.155817	-0.029178	0.204780
2022Q2	0.149042	-0.040508	0.199180
2022Q3	0.132856	-0.038150	0.200525
2022Q4	0.107559	-0.096458	0.183233
2023Q1	0.095520	-0.130936	0.172211
2023Q2	0.090958	-0.156680	0.164495
2023Q3	0.088068	-0.160279	0.162958
2023Q4	0.088177	-0.163373	0.162734
2024Q1	0.073650	-0.165400	0.157934

In [ ]:
```
plt.figure(figsize=(18, 10))

colors = ['orange', 'green', 'red']

num_sectors = projected_base_ret_df[:'2023Q4'].shape[1]
if num_sectors > len(colors):
    raise ValueError("Not enough colors defined for the number of sectors.")

for i, sector in enumerate(projected_base_ret_df[:'2023Q4'].columns):
    plt.plot(test_ind_ret.index, test_ind_ret[sector], label=f'Actual - {sec
    plt.plot(projected_base_ret_df[:'2023Q4'].index, projected_base_ret_df[:

plt.legend()
plt.show()
```



Projection using scaled severe MEVs at time 1

In [ ]:
```
MEVs.head()
```

Out[ ]:

Date	Real GDP growth	Nominal GDP growth	Real disposable income growth	Nominal disposable income growth	Unemployment rate	CPI inflation rate	3-month Treasury rate
2021Q1	-1.573698	-1.516480	0.370406	0.297331	-1.350038	-0.590167	-1.0
2021Q2	-1.253039	-1.250840	-2.657021	-2.596125	-0.578588	-1.357384	-1.0
2021Q3	-1.103398	-1.155969	-1.274417	-1.292966	0.096431	-1.357384	-1.0
2021Q4	-0.611720	-0.681613	-0.440086	-0.497817	0.482157	-0.845906	-1.0
2022Q1	-0.611720	-0.624690	-0.225544	-0.299030	0.867882	-0.845906	-1.0

In [ ]:
```
pred_factors
```

Out[ ]:

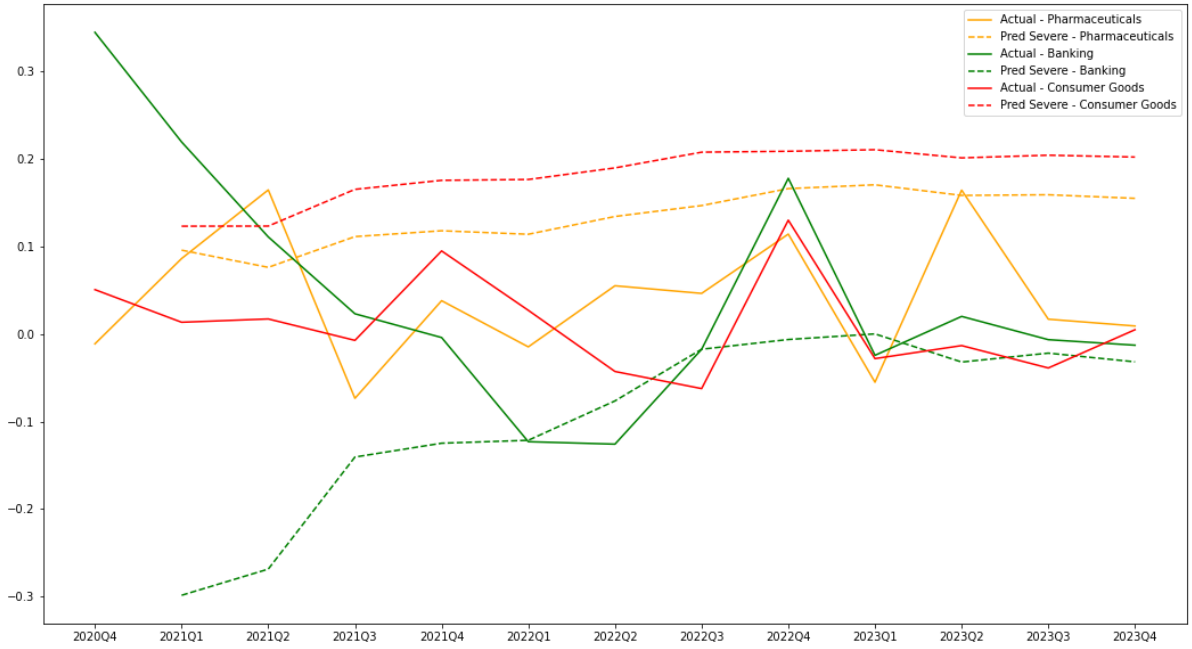
Date	FAMA-FRENCH MKT-RF	FAMA-FRENCH SIZE FACTOR (SMB)	FAMA-FRENCH VALUE FACTOR (HML)
2021Q1	-0.103408	-0.016366	-0.070242
2021Q2	-0.102836	0.006465	-0.035895
2021Q3	-0.030462	0.007455	-0.004965
2021Q4	-0.023260	-0.007830	0.003942
2022Q1	-0.025392	-0.008759	0.012224
2022Q2	0.007757	-0.001495	0.008066
2022Q3	0.039010	0.002279	0.025804
2022Q4	0.060776	0.015000	-0.001494
2023Q1	0.066764	0.016746	-0.004501
2023Q2	0.044999	0.011851	-0.005102
2023Q3	0.049239	0.012228	0.000084
2023Q4	0.041681	0.008216	0.001754
2024Q1	0.045401	0.010990	0.013766

In [ ]:
```
projected_ret_df = pd.DataFrame(index=MEVs.index)

for sec in sectors:
    projected_ret_df[sec] = reg_performance.loc[sec, 'Alpha']

    for beta in reg_performance.iloc[:,:3]:
        projected_ret_df[sec] += reg_performance.loc[sec, beta] * pred_factc

projected_ret_df
```

Out[ ]:

Date	Pharmaceuticals	Banking	Consumer Goods
2021Q1	0.095739	-0.298515	0.123112
2021Q2	0.076100	-0.268600	0.123232
2021Q3	0.111241	-0.140573	0.165199
2021Q4	0.117895	-0.124788	0.175511
2022Q1	0.113891	-0.121461	0.176475
2022Q2	0.134198	-0.076477	0.189707
2022Q3	0.146674	-0.017438	0.207669
2022Q4	0.166056	-0.006326	0.208703
2023Q1	0.170381	0.000079	0.210485
2023Q2	0.158277	-0.032072	0.201145
2023Q3	0.159025	-0.021903	0.204204
2023Q4	0.154939	-0.031826	0.202091
2024Q1	0.152105	-0.016831	0.205544

In [ ]:
```
plt.figure(figsize=(18, 10))

colors = ['orange', 'green', 'red']

num_sectors = projected_ret_df['2023Q4'].shape[1]
if num_sectors > len(colors):
    raise ValueError("Not enough colors defined for the number of sectors.")

for i, sector in enumerate(projected_ret_df['2023Q4'].columns):
    plt.plot(test_ind_ret.index, test_ind_ret[sector], label=f'Actual - {sec
    plt.plot(projected_ret_df['2023Q4'].index, projected_ret_df['2023Q4'][

plt.legend()
plt.show()
```



Model risk assessment and controls

In [ ]:
```
model_factors
```

Out[ ]:

Date	FAMA-FRENCH MKT-RF	FAMA-FRENCH SIZE FACTOR (SMB)	FAMA-FRENCH VALUE FACTOR (HML)
2001Q1	-0.121682	0.038024	0.072152
2001Q2	0.014240	0.041371	0.004344
2001Q3	-0.145590	-0.001799	0.057674
2001Q4	0.037027	0.041456	0.015839
2002Q1	-0.003803	0.054224	0.042964
...	...	...	...
2019Q4	0.064109	-0.003772	-0.006763
2020Q1	-0.148399	-0.031088	-0.076939
2020Q2	0.069906	0.031237	-0.088574
2020Q3	0.110540	0.028498	-0.013412
2020Q4	0.119721	0.041319	0.006131

80 rows × 3 columns

In [ ]:
```
is_projected_ret_df = pd.DataFrame(index=his_MEVs.index)

for sec in sectors:
    is_projected_ret_df[sec] = reg_performance.loc[sec, 'Alpha']
```

```
    for beta in reg_performance.iloc[:,:3]:
        is_projected_ret_df[sec] += reg_performance.loc[sec, beta] * model_f

is_projected_ret_df
```

Out[ ]:

Date	Pharmaceuticals	Banking	Consumer Goods
2001Q1	0.014756	-0.208049	0.126266
2001Q2	0.125105	-0.065879	0.178425
2001Q3	0.018104	-0.257554	0.124157
2001Q4	0.135621	-0.024219	0.192077
2002Q1	0.095379	-0.060290	0.173405
...	...	...	...
2019Q4	0.176462	-0.007511	0.215267
2020Q1	0.074227	-0.369693	0.104144
2020Q2	0.197426	-0.059715	0.189920
2020Q3	0.197683	0.057023	0.226557
2020Q4	0.192256	0.086722	0.231066

80 rows × 3 columns

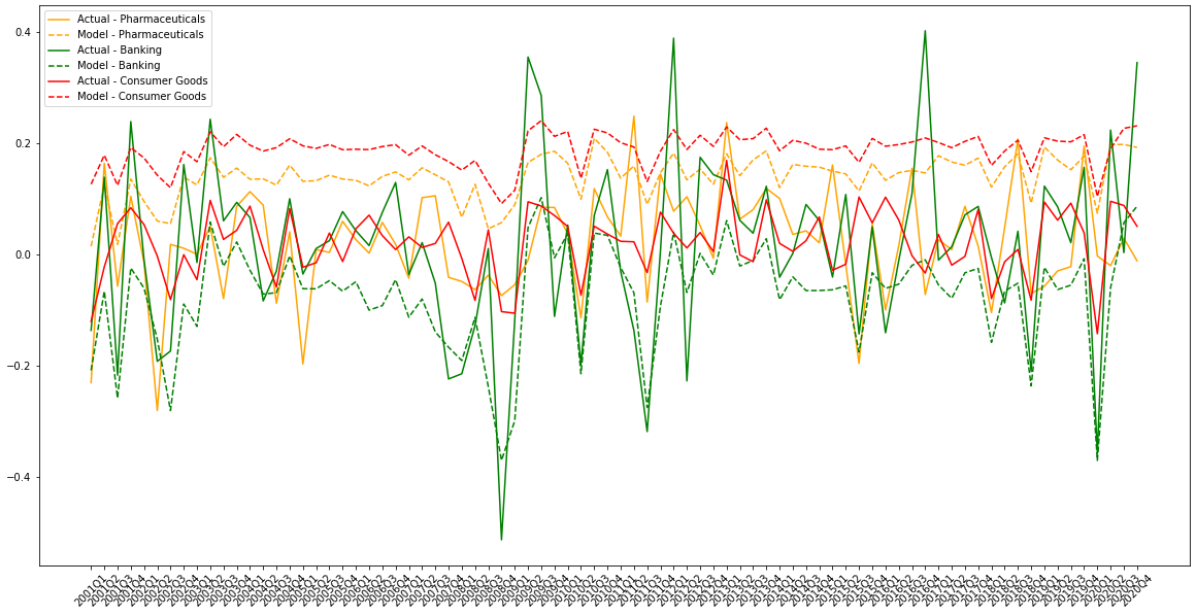
In [ ]:
```
his_ind_ret
```

Out[ ]:

Date	Pharmaceuticals	Banking	Consumer Goods
2001Q1	-0.230054	-0.136200	-0.120151
2001Q2	0.163776	0.138855	-0.022278
2001Q3	-0.056992	-0.216600	0.055591
2001Q4	0.104331	0.238734	0.084010
2002Q1	-0.014463	-0.009276	0.053914
...	...	...	...
2019Q4	0.194800	0.156758	0.038887
2020Q1	-0.002631	-0.356531	-0.142212
2020Q2	-0.019981	0.223430	0.095587
2020Q3	0.029126	0.003421	0.088100
2020Q4	-0.011274	0.344553	0.050641

80 rows × 3 columns

In [ ]:
```
plt.figure(figsize=(20, 10))

colors = ['orange', 'green', 'red']

num_sectors = his_ind_ret.shape[1]
if num_sectors > len(colors):
    raise ValueError("Not enough colors defined for the number of sectors.")

for i, sector in enumerate(his_ind_ret.columns):
    plt.plot(his_ind_ret.index, his_ind_ret[sector], label=f'Actual - {secto
    plt.plot(is_projected_ret_df.index, is_projected_ret_df[sector], label=f

plt.legend()
plt.xticks(rotation=45)
plt.show()
```



In [ ]:
```
for sector in is_projected_ret_df.columns:
    rmse = mean_squared_error(his_ind_ret[sector], is_projected_ret_df[secto
    print(f"{sector} - RMSE: {rmse:.4f}")
```

```
Pharmaceuticals - RMSE: 0.1451
Banking - RMSE: 0.1368
Consumer Goods - RMSE: 0.1735
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
```

```
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
```

```
rs=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
```

```
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   1.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
```

```
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
```

```
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
```

```
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   1.0s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
```

```
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
```

```
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   1.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
```

```
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
```

```
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
```

```
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   1.0s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
```

```
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
```

```
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
```

```
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
```

```
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
```

```
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
```

```
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   1.0s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
```

```
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
```

```
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   1.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
```

```
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
```

```
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
```

```
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
```

```
tors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   1.0s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
```

```
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
```

```
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
```

```
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
```

```
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
```

```
tors=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
```

```
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
```

```
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   1.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
```

```
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
```

```
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
```

```
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
```

```
rs=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
```

```
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   1.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
```

```
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
```

```
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
```

```
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
```

```
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
```

```
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
```

```
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
```

```
rs=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
```

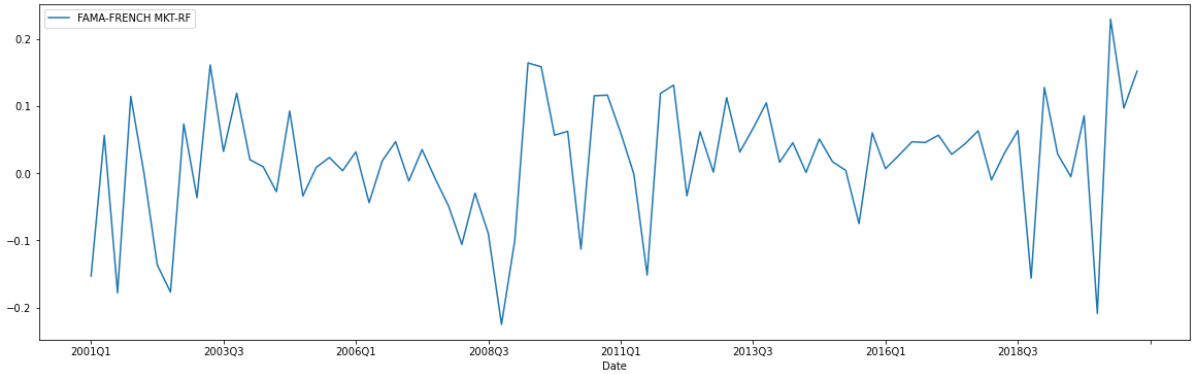
```
rs=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.4s
```

Capital Asset Pricing Model - Elie Kostenbaum

Variable selection - Only Market Factor

In [ ]:
```
factor = factors[['FAMA-FRENCH MKT-RF']]
factor.plot(figsize=(20, 6))
```

Out[ ]:
```
<AxesSubplot:xlabel='Date'>
```



In [ ]:
```
sectors = his_ind_ret.columns
rf = factors['RISK-FREE RATE']

reg_lst= []
for sector in sectors:
    fund_ret = his_ind_ret[sector]
    reg = regression_based_performance(factor,fund_ret,rf)
    beta_mkt = reg[0][0]
    treynor_ratio = reg[1]
    information_ratio = reg[2]
    alpha = reg[3]
    r_squared = reg[4]
    reg_lst.append(pd.DataFrame([[beta_mkt,alpha,r_squared,treynor_ratio,inf
```

In [ ]:
```
reg_performance = pd.concat(reg_lst)
reg_performance
```

Out[ ]:

	FAMA-FRENCH MKT-RF	Alpha	R-Squared	Treynor Ratio	Information Ratio
Pharmaceuticals	0.547987	0.127248	0.261073	0.030200	0.126820
Banking	1.488741	-0.116616	0.689795	0.008229	-0.107325
Consumer Goods	0.428816	0.160332	0.424811	0.040289	0.295230

In [ ]:
```
print(f"MAE: {reg_performance['Alpha'].abs().mean()}")
```

```
MAE: 0.134732
```

We see that as for the other models, the Market Factor is the strongest for the Banking Industry and shows good absolute and risk-adjusted returns

Stationarity test(s) on the MEVs

In [ ]:
```
his_MEVs = pd.read_csv('2021-table_1a_historic_domestic.csv')
his_MEVs.drop(columns='Scenario Name', inplace=True)
```

In [ ]:
```
def parse_quarter(q):
    year, qtr = q.split('Q')
    qtr = int(qtr)
```

```
    dt = f"{year}-{(qtr-1)*3+1:02d}-01"
    return pd.to_datetime(dt).to_period('Q').strftime('%YQ%q')
his_MEVs['Date'] = his_MEVs['Date'].apply(parse_quarter)
his_MEVs.set_index('Date', inplace=True)
his_MEVs=his_MEVs['2001Q1':]
```

In [ ]:
```
his_MEVs
```

Out[ ]:

Date	Real GDP growth	Nominal GDP growth	Real disposable income growth	Nominal disposable income growth	Unemployment rate	CPI inflation rate	3-month Treasury rate	5- Trea y
2001Q1	-1.1	1.3	3.7	6.5	4.2	3.9	4.8	
2001Q2	2.4	4.9	-0.7	1.2	4.4	2.8	3.7	
2001Q3	-1.6	-0.1	9.6	9.8	4.8	1.1	3.2	
2001Q4	1.1	2.4	-5.0	-4.7	5.5	-0.3	1.9	
2002Q1	3.5	4.9	9.3	10.1	5.7	1.3	1.7	
...	...	...	...	...	...	...	...	
2019Q4	2.4	3.9	1.9	3.4	3.6	2.4	1.6	
2020Q1	-5.0	-3.4	2.6	3.9	3.8	1.2	1.1	
2020Q2	-31.4	-32.8	48.5	46.2	13.1	-3.5	0.1	
2020Q3	33.4	38.3	-16.3	-13.2	8.8	5.2	0.1	
2020Q4	3.7	5.5	-8.1	-7.5	6.8	2.2	0.1	

80 rows × 16 columns

In [ ]:
```
adf_kpss_test(his_MEVs)
```

Out[ ]:

	Variable	ADF Statistic	ADF p-value	ADF 1%	ADF 5%	ADF 10%	KPSS Statistic	KPS
0	Real GDP growth	-7.251098	1.779241e-10	-3.517114	-2.899375	-2.586955	0.065460	0.10(
1	Nominal GDP growth	-3.825464	2.657270e-03	-3.518281	-2.899878	-2.587223	0.085209	0.10(
2	Real disposable income growth	-8.143987	1.010402e-12	-3.517114	-2.899375	-2.586955	0.184642	0.10(
3	Nominal disposable income growth	-7.784308	8.257727e-12	-3.517114	-2.899375	-2.586955	0.096673	0.10(
4	Unemployment rate	-2.136268	2.301834e-01	-3.519481	-2.900395	-2.587498	0.185995	0.10(
5	CPI inflation rate	-7.619154	2.151476e-11	-3.515977	-2.898886	-2.586694	0.274276	0.10(
6	3-month Treasury rate	-2.479173	1.206244e-01	-3.519481	-2.900395	-2.587498	0.454840	0.05
7	5-year Treasury yield	-1.505300	5.308880e-01	-3.519481	-2.900395	-2.587498	0.969140	0.01(
8	10-year Treasury yield	-1.071729	7.262133e-01	-3.519481	-2.900395	-2.587498	1.272613	0.01(
9	BBB corporate yield	-1.804485	3.782374e-01	-3.517114	-2.899375	-2.586955	1.021208	0.01(
10	Mortgage rate	-0.982018	7.597664e-01	-3.518281	-2.899878	-2.587223	1.260574	0.01(
11	Prime rate	-2.323541	1.644880e-01	-3.519481	-2.900395	-2.587498	0.446587	0.05
12	Dow Jones Total Stock Market Index (Level)	2.054416	9.987396e-01	-3.526005	-2.903200	-2.588995	1.246697	0.01(
13	House Price Index (Level)	-1.637051	4.638022e-01	-3.520713	-2.900925	-2.587781	0.686626	0.01
14	Commercial Real Estate Price Index (Level)	-0.829337	8.103524e-01	-3.517114	-2.899375	-2.586955	0.999175	0.01(
15	Market Volatility Index (Level)	-2.371578	1.499194e-01	-3.521980	-2.901470	-2.588072	0.084526	0.10(

Transform MEVs using standard scaler

In [ ]:
```
scaler = StandardScaler()
his_MEVs = pd.DataFrame(scaler.fit_transform(his_MEVs), columns=his_MEVs.col
```

In [ ]:
```
his_MEVs
```

Out[ ]:

Date	Real GDP growth	Nominal GDP growth	Real disposable income growth	Nominal disposable income growth	Unemployment rate	CPI inflation rate	3-month Treasury rate
2001Q1	-0.535780	-0.412333	0.153152	0.313908	-0.960698	0.824041	2.29001
2001Q2	0.085671	0.164693	-0.494020	-0.493720	-0.858631	0.330066	1.55907
2001Q3	-0.624558	-0.636732	1.020950	0.816771	-0.654499	-0.433351	1.22682
2001Q4	-0.145153	-0.236020	-1.126483	-1.392778	-0.297268	-1.062048	0.36298
2002Q1	0.280985	0.164693	0.976824	0.862486	-0.195201	-0.343538	0.23008
...	...	...	...	...	...	...	...
2019Q4	0.085671	0.004408	-0.111600	-0.158478	-1.266896	0.150438	0.16363
2020Q1	-1.228254	-1.165672	-0.008641	-0.082287	-1.164830	-0.388444	-0.16861
2020Q2	-5.915771	-5.878049	6.742533	6.363503	3.581246	-2.499067	-0.83311
2020Q3	5.589953	5.518210	-2.788536	-2.688031	1.386824	1.407830	-0.83311
2020Q4	0.316496	0.260864	-1.582444	-1.819450	0.366162	0.060624	-0.83311

80 rows × 16 columns

Project factor against MEVs in the Fed scenario using Random Forest

In [ ]:
```
base_MEVs = pd.read_csv('2021-table_2a_supervisory_baseline_domestic.csv')
base_MEVs.drop(columns='Scenario Name', inplace=True)
base_MEVs['Date'] = base_MEVs['Date'].apply(parse_quarter)
base_MEVs.set_index('Date', inplace=True)

base_MEVs = pd.DataFrame(scaler.fit_transform(base_MEVs), columns=base_MEVs.

MEVs = pd.read_csv('2021-table_3a_supervisory_severely_adverse_domestic.csv'
MEVs.drop(columns='Scenario Name', inplace=True)
MEVs['Date'] = MEVs['Date'].apply(parse_quarter)
MEVs.set_index('Date', inplace=True)

MEVs = pd.DataFrame(scaler.fit_transform(MEVs), columns=MEVs.columns, index=

from sklearn.ensemble import RandomForestRegressor
from sklearn.model_selection import GridSearchCV

multi_factors = factor.columns

pred_factors_base = pd.DataFrame(index=MEVs.index)
```

```
pred_factors = pd.DataFrame(index=MEVs.index)
model_factors = pd.DataFrame(index=his_MEVs.index)

for fac in multi_factors:
    Y_train = factor[fac]
    X_train = his_MEVs
    X_test_base = base_MEVs
    X_test = MEVs
    rf = RandomForestRegressor(n_estimators=100, random_state=42)
    rf.fit(X_train, Y_train)

    param_grid = {
    'n_estimators': [100, 200, 300],
    'max_depth': [None, 10, 20, 30],
    'min_samples_split': [2, 5, 10],
    'min_samples_leaf': [1, 2, 4]
    }

    # Initialize the grid search with cross-validation
    grid_search = GridSearchCV(estimator=rf, param_grid=param_grid, cv=5, n_

    # Perform grid search
    grid_search.fit(X_train, Y_train)

    # Get the best estimator
    best_rf = grid_search.best_estimator_

    # Predict on the test data using the best estimator
    y_pred_base = best_rf.predict(X_test_base)
    y_pred = best_rf.predict(X_test)
    y_model = best_rf.predict(X_train)

    pred_factors_base[fac] = y_pred_base
    pred_factors[fac] = y_pred
    model_factors[fac] = y_model
```

```
Fitting 5 folds for each of 108 candidates, totalling 540 fits
```

3.3 Combine regressions into the model and project the time 1 portfolio value

Projection using scaled baseline MEVs at time 1

In [ ]:
```
base_MEVs.head()
```

Out[ ]:

Date	Real GDP growth	Nominal GDP growth	Real disposable income growth	Nominal disposable income growth	Unemployment rate	CPI inflation rate	3-month Treasury rate
2021Q1	-0.757467	-1.096454	2.764122	2.713052	2.274770	-0.288675	-0.903713
2021Q2	1.619413	1.681848	-2.191258	-2.254508	1.613943	-3.103258	-0.903713
2021Q3	2.072152	2.165031	-0.718802	-0.709045	0.953116	0.649519	-0.903713
2021Q4	1.393043	1.198665	-0.152473	-0.157094	0.457496	-0.288675	-0.903713
2022Q1	0.374380	0.353095	0.045742	0.036089	0.127082	-0.288675	-0.903713

In [ ]:
```
pred_factors_base
```

Out[ ]:

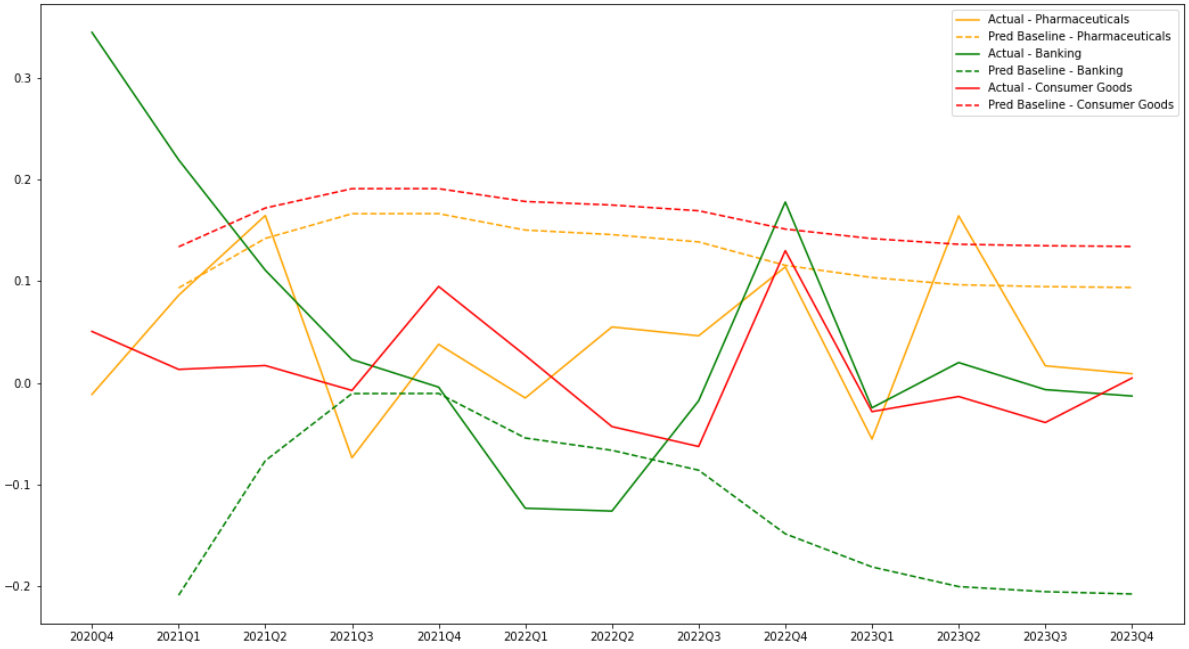
Date	FAMA-FRENCH MKT-RF
2021Q1	-0.061797
2021Q2	0.027016
2021Q3	0.071329
2021Q4	0.071421
2022Q1	0.042008
2022Q2	0.033888
2022Q3	0.020769
2022Q4	-0.021243
2023Q1	-0.043080
2023Q2	-0.056060
2023Q3	-0.059427
2023Q4	-0.060938
2024Q1	-0.070796

In [ ]:
```
projected_base_ret_df = pd.DataFrame(index=base_MEVs.index)

for sec in sectors:
    projected_base_ret_df[sec] = reg_performance.loc[sec, 'Alpha']

    for beta in reg_performance.iloc[:,:1]:
        projected_base_ret_df[sec] += reg_performance.loc[sec, beta] * pred_

projected_base_ret_df
```

Out[ ]:

Date	Pharmaceuticals	Banking	Consumer Goods
2021Q1	0.093384	-0.208615	0.133833
2021Q2	0.142052	-0.076397	0.171917
2021Q3	0.166336	-0.010425	0.190919
2021Q4	0.166386	-0.010289	0.190958
2022Q1	0.150268	-0.054078	0.178346
2022Q2	0.145818	-0.066166	0.174864
2022Q3	0.138629	-0.085696	0.169238
2022Q4	0.115607	-0.148241	0.151223
2023Q1	0.103641	-0.180751	0.141858
2023Q2	0.096528	-0.200075	0.136293
2023Q3	0.094683	-0.205087	0.134849
2023Q4	0.093855	-0.207338	0.134201
2024Q1	0.088453	-0.222013	0.129974

In [ ]:
```
plt.figure(figsize=(18, 10))

colors = ['orange', 'green', 'red']

num_sectors = projected_base_ret_df[:'2023Q4'].shape[1]
if num_sectors > len(colors):
    raise ValueError("Not enough colors defined for the number of sectors.")

for i, sector in enumerate(projected_base_ret_df[:'2023Q4'].columns):
    plt.plot(test_ind_ret.index, test_ind_ret[sector], label=f'Actual - {sec
    plt.plot(projected_base_ret_df[:'2023Q4'].index, projected_base_ret_df[:

plt.legend()
plt.show()
```



Projection using scaled severe MEVs at time 1

In [ ]:
```
MEVs.head()
```

Out[ ]:

Date	Real GDP growth	Nominal GDP growth	Real disposable income growth	Nominal disposable income growth	Unemployment rate	CPI inflation rate	3-month Treasury rate
2021Q1	-1.573698	-1.516480	0.370406	0.297331	-1.350038	-0.590167	-1.0
2021Q2	-1.253039	-1.250840	-2.657021	-2.596125	-0.578588	-1.357384	-1.0
2021Q3	-1.103398	-1.155969	-1.274417	-1.292966	0.096431	-1.357384	-1.0
2021Q4	-0.611720	-0.681613	-0.440086	-0.497817	0.482157	-0.845906	-1.0
2022Q1	-0.611720	-0.624690	-0.225544	-0.299030	0.867882	-0.845906	-1.0

In [ ]:
```
pred_factors
```

Out[ ]:

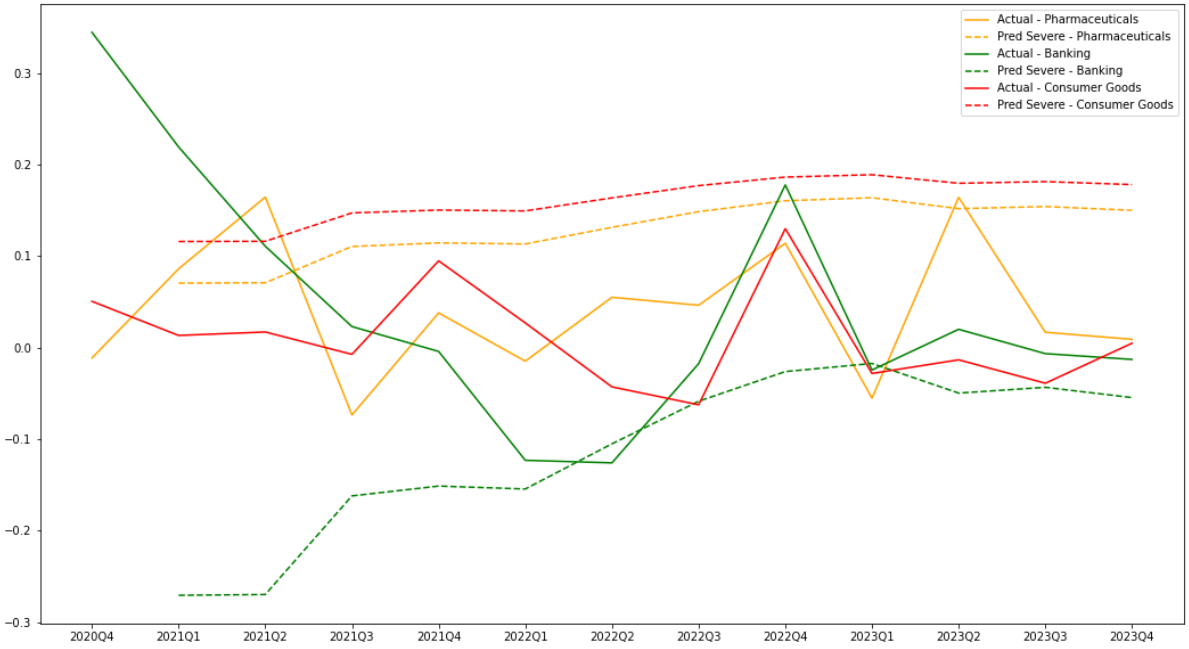
Date	FAMA-FRENCH MKT-RF
2021Q1	-0.103408
2021Q2	-0.102836
2021Q3	-0.030462
2021Q4	-0.023260
2022Q1	-0.025392
2022Q2	0.007757
2022Q3	0.039010
2022Q4	0.060776
2023Q1	0.066764
2023Q2	0.044999
2023Q3	0.049239
2023Q4	0.041681
2024Q1	0.045401

In [ ]:
```
projected_ret_df = pd.DataFrame(index=MEVs.index)

for sec in sectors:
    projected_ret_df[sec] = reg_performance.loc[sec, 'Alpha']

    for beta in reg_performance.iloc[:,:1]:
        projected_ret_df[sec] += reg_performance.loc[sec, beta] * pred_factc

projected_ret_df
```

Out[ ]:

Date	Pharmaceuticals	Banking	Consumer Goods
2021Q1	0.070582	-0.270564	0.115989
2021Q2	0.070895	-0.269712	0.116234
2021Q3	0.110555	-0.161966	0.147269
2021Q4	0.114502	-0.151244	0.150358
2022Q1	0.113334	-0.154418	0.149444
2022Q2	0.131499	-0.105067	0.163658
2022Q3	0.148625	-0.058540	0.177060
2022Q4	0.160552	-0.026137	0.186394
2023Q1	0.163834	-0.017222	0.188961
2023Q2	0.151907	-0.049624	0.179628
2023Q3	0.154230	-0.043312	0.181446
2023Q4	0.150089	-0.054564	0.178205
2024Q1	0.152127	-0.049026	0.179800

In [ ]:
```
plt.figure(figsize=(18, 10))

colors = ['orange', 'green', 'red']

num_sectors = projected_ret_df[:'2023Q4'].shape[1]
if num_sectors > len(colors):
    raise ValueError("Not enough colors defined for the number of sectors.")

for i, sector in enumerate(projected_ret_df[:'2023Q4'].columns):
    plt.plot(test_ind_ret.index, test_ind_ret[sector], label=f'Actual - {sec
    plt.plot(projected_ret_df[:'2023Q4'].index, projected_ret_df[:'2023Q4'][

plt.legend()
plt.show()
```


Actual - Pharmaceuticals
Pred Severe - Pharmaceuticals
Actual - Banking
Pred Severe - Banking
Actual - Consumer Goods
Pred Severe - Consumer Goods
0.3
0.2
0.1
0.0
−0.1
−0.2
−0.3
2020Q4
2021Q1
2021Q2
2021Q3
2021Q4
2022Q1
2022Q2
2022Q3
2022Q4
2023Q1
2023Q2
2023Q3
2023Q4

```
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   1.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.8s
```

```
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.1s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   1.1s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.8s
```

```
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   1.1s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   1.1s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.6s
```

```
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.8s
```

```
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   1.1s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   1.1s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.9s
```

```
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   1.1s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
```

```
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
```

```
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   1.1s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   1.0s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.7s
```

```
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.7s
```

```
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.2s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   1.1s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   1.0s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.4s
```

```
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
```

```
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   1.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.2s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.1s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=300; total time=   0.9s
```

```
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   1.1s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   1.2s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.4s
```

```
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.9s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   1.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
```

```
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=100; total time=   0.3s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=300; total time=   1.1s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   1.0s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=200; total time=   0.4s
```

```
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
```

```
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   1.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=5, n_estimat
ors=300; total time=   0.6s
```

```
[CV] END max_depth=None, min_samples_leaf=1, min_samples_split=10, n_estima
tors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=2, n_estimat
ors=200; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=100; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=5, n_estimat
ors=200; total time=   0.6s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=100; total time=   0.5s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=200; total time=   0.8s
[CV] END max_depth=None, min_samples_leaf=2, min_samples_split=10, n_estima
tors=300; total time=   0.9s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=2, n_estimat
ors=300; total time=   0.7s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=5, n_estimat
ors=200; total time=   0.4s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=100; total time=   0.2s
[CV] END max_depth=None, min_samples_leaf=4, min_samples_split=10, n_estima
tors=300; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.8s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=10, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.4s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=10, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.1s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=2, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.2s
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
```

```
[CV] END max_depth=10, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=2, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=100; total time=   0.2s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=5, n_estimator
s=300; total time=   0.9s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.7s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=5, n_estimator
s=300; total time=   1.1s
[CV] END max_depth=20, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=300; total time=   1.2s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.5s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   1.0s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.8s
[CV] END max_depth=20, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   1.0s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=2, n_estimator
s=300; total time=   1.2s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=5, n_estimator
s=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=1, min_samples_split=10, n_estimato
rs=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=2, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=5, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=100; total time=   0.4s
[CV] END max_depth=30, min_samples_leaf=2, min_samples_split=10, n_estimato
rs=200; total time=   0.8s
```

```
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=2, n_estimator
s=200; total time=   0.6s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=100; total time=   0.3s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=5, n_estimator
s=300; total time=   0.8s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=200; total time=   0.5s
[CV] END max_depth=30, min_samples_leaf=4, min_samples_split=10, n_estimato
rs=300; total time=   0.5s
```

Model risk assessment and controls

In [ ]:
```
model_factors
```

Out[ ]:

	FAMA-FRENCH MKT-RF
Date	
2001Q1	-0.121682
2001Q2	0.014240
2001Q3	-0.145590
2001Q4	0.037027
2002Q1	-0.003803
...	...
2019Q4	0.064109
2020Q1	-0.148399
2020Q2	0.069906
2020Q3	0.110540
2020Q4	0.119721

80 rows × 1 columns

In [ ]:
```
is_projected_ret_df = pd.DataFrame(index=his_MEVs.index)

for sec in sectors:
    is_projected_ret_df[sec] = reg_performance.loc[sec, 'Alpha']

    for beta in reg_performance.iloc[:,:1]:
        is_projected_ret_df[sec] += reg_performance.loc[sec, beta] * model_f

is_projected_ret_df
```

Out[ ]:

Date	Pharmaceuticals	Banking	Consumer Goods
2001Q1	0.060568	-0.297769	0.108153
2001Q2	0.135051	-0.095416	0.166438
2001Q3	0.047467	-0.333361	0.097901
2001Q4	0.147538	-0.061492	0.176210
2002Q1	0.125164	-0.122277	0.158701
...	...	...	...
2019Q4	0.162379	-0.021174	0.187823
2020Q1	0.045927	-0.337544	0.096696
2020Q2	0.165556	-0.012544	0.190309
2020Q3	0.187822	0.047949	0.207733
2020Q4	0.192853	0.061617	0.211670

80 rows × 3 columns

In [ ]:
```
his_ind_ret
```

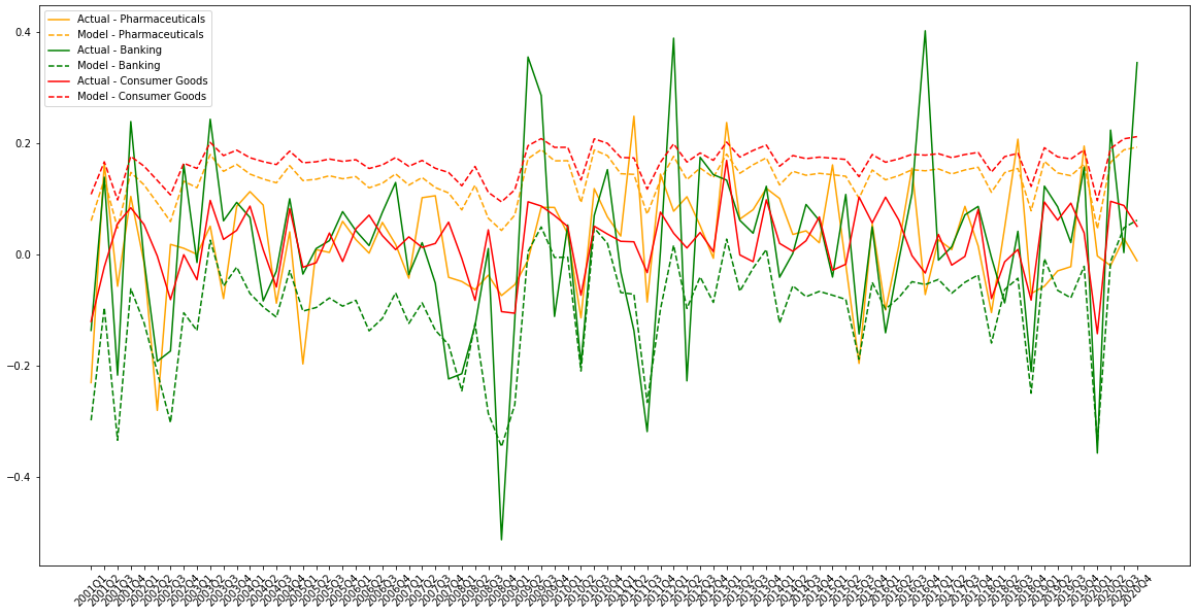
Out[ ]:

Date	Pharmaceuticals	Banking	Consumer Goods
2001Q1	-0.230054	-0.136200	-0.120151
2001Q2	0.163776	0.138855	-0.022278
2001Q3	-0.056992	-0.216600	0.055591
2001Q4	0.104331	0.238734	0.084010
2002Q1	-0.014463	-0.009276	0.053914
...	...	...	...
2019Q4	0.194800	0.156758	0.038887
2020Q1	-0.002631	-0.356531	-0.142212
2020Q2	-0.019981	0.223430	0.095587
2020Q3	0.029126	0.003421	0.088100
2020Q4	-0.011274	0.344553	0.050641

80 rows × 3 columns

In [ ]:
```
plt.figure(figsize=(20, 10))

colors = ['orange', 'green', 'red']

num_sectors = his_ind_ret.shape[1]
```

```
if num_sectors > len(colors):
    raise ValueError("Not enough colors defined for the number of sectors.")

for i, sector in enumerate(his_ind_ret.columns):
    plt.plot(his_ind_ret.index, his_ind_ret[sector], label=f'Actual - {secto
    plt.plot(is_projected_ret_df.index, is_projected_ret_df[sector], label=f

plt.legend()
plt.xticks(rotation=45)
plt.show()
```



In [ ]:
```
for sector in is_projected_ret_df.columns:
    rmse = mean_squared_error(his_ind_ret[sector], is_projected_ret_df[secto
    print(f"{sector} - RMSE: {rmse:.4f}")
```

```
Pharmaceuticals - RMSE: 0.1431
Banking - RMSE: 0.1547
Consumer Goods - RMSE: 0.1536
```

2. i.

We see from the plots of backtesting that all three of our models do provide reasonable projections and estimates. Interestingly enough, the Pharmaceutical industry is the one that is best projected and estimated while in general, we get the worst results out of the three industries for the Consumer goods industry.

Based on the three models, we see that in general, the multi-factor model has the best and lowest scores for Root Mean Squared Error

Reasons for such result might be that:

- The multi-factor model includes factors that better capture the scenarios and relationship with variable. Also, since it is more complex, it captures more interactions among variables that simpler models like the CAPM or FF 3 might miss.

In a way, adding more "reasonable" factors gives best results since our interactions are best explained and captured.

ii.

Model search might cause uncertainties in the forecasts due to various reasons like:

- overfitting, where the model would perform well in sample, on the training data, bu then fails to generalize to out of sample, unseen data.
- data mining bias where repeatedly testing multiple models on the same dataset could lead to data mining bias where basically the selected model appears effective by chance but then fails in reality to capture the effects and to produce coherent forecasts.
- sample variability.
- selection bias in the model choice.

In terms of which model is more prone to the Law of small numbers, we would assume that the more variables we have the more prone we will be to overfitting. In that regard, Multi-factor model would be more prone to the Law of Small Numbers since it has more paramaters and more variables that are trying to capture an effect, which might not be justified by the data. In addtion, our random forest model was helpful since it is less concerned by the problems of overfitting.

In [ ]: