Modelo Cox - Análisis de Recesión

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```
import pandas as pd
import numpy as np
import statsmodels.api as sm
from lifelines import ExponentialFitter, WeibullFitter, CoxPHFitter
```

```
%store -r df_cox
```

```
df_cox = df_cox[df_cox['duration']>0]
df_cox
```

	id	duration	event	GDP	Personal_Income	TasaDesempleo
0	Alabama	6	0	12.201847	11.960909	6.514286
1	Alaska	6	0	10.849222	10.386709	6.914286
2	Arizona	6	0	12.599076	12.301745	6.414286
3	Arkansas	1	1	11.639422	11.429038	6.033333
4	Arkansas	3	0	11.639422	11.429038	6.033333
5	California	6	0	14.592066	14.268346	8.085714
6	Colorado	5	0	12.544146	12.240387	5.561905
7	Connecticut	5	0	12.520222	12.264476	6.104762
8	Delaware	5	0	11.110545	10.504757	5.533333
9	Florida	6	0	13.689441	13.479767	6.938095
10	Georgia	6	0	13.077425	12.715427	7.057143
11	Hawaii	6	0	11.241114	10.921744	4.561905
12	Idaho	6	0	11.051280	10.811885	5.871429
13	Illinois	6	0	13.534252	13.205027	7.147619

	id	duration	event	GDP	Personal_Income	TasaDesempleo
14	Indiana	5	0	12.662003	12.317330	6.961905
15	Iowa	5	0	11.977516	11.646228	4.771429
16	Kansas	3	0	11.885837	11.636067	5.128571
17	Kentucky	5	0	12.122737	11.843797	7.476190
18	Louisiana	4	0	12.377734	12.030670	5.057143
19	Maine	5	0	10.992849	10.797344	6.200000
20	Maryland	4	0	12.725343	12.530460	4.871429
21	Massachusetts	5	0	13.005651	12.709697	5.900000
22	Michigan	5	0	13.006494	12.765162	9.409524
23	Minnesota	6	0	12.628095	12.309289	6.019048
24	Mississippi	4	0	11.592888	11.406308	7.152381
25	Missouri	6	0	12.593369	12.290600	6.790476
26	Montana	6	0	10.639781	10.442901	5.323810
27	Nebraska	1	1	11.510557	11.180059	3.576190
28	Nebraska	1	1	11.510557	11.180059	3.576190
29	Nebraska	1	0	11.510557	11.180059	3.576190
30	Nevada	6	0	11.921339	11.525735	7.580952
31	New Hampshire	5	0	11.167790	10.993463	4.252381
32	New Jersey	5	0	13.243331	13.002644	6.009524
33	New Mexico	5	0	11.402448	11.108296	4.819048
34	New York	5	0	14.104821	13.724008	6.019048
35	North Carolina	5	0	13.088234	12.748435	7.176190
36	North Dakota	3	1	10.461764	10.183948	3.380952
37	North Dakota	1	0	10.461764	10.183948	3.380952
38	Ohio	5	0	13.258656	12.940773	7.452381
39	Oklahoma	3	0	11.970499	11.844932	4.366667
40	Oregon	5	0	12.115819	11.828550	7.433333
41	Pennsylvania	5	0	13.397488	13.156190	6.004762
42	Rhode Island	6	0	10.910017	10.674697	8.295238
43	South Carolina	5	0	12.156773	11.907118	7.738095
44	South Dakota	1	1	10.672802	10.377444	3.504762
45	South Dakota	2	0	10.672802	10.377444	3.504762
46	Tennessee	6	0	12.596771	12.288290	7.338095
47	Texas	3	0	14.068470	13.761129	5.338095
48	Utah	5	0	11.799462	11.393184	4.338095
49	Vermont	5	0	10.303385	10.134928	5.004762
50	Virginia	5	0	13.039653	12.771494	4.676190
51	Washington	5	0	12.894910	12.560785	5.980952
52	West Virginia	2	1	11.170139	10.961594	5.380952
53	West Virginia	1	0	11.170139	10.961594	5.380952
54	Wisconsin	1	1	12.554521	12.287387	5.952381

	id	duration	event	GDP	Personal_Income	TasaDesempleo
55	Wisconsin	3	0	12.554521	12.287387	5.952381
56	Wyoming	5	0	10.636569	10.176667	3.723810

```
#Modelo Exponencial
exp_model = ExponentialFitter()
exp_model.fit(df_cox['duration'], event_observed=df_cox['event'])
summary = exp_model.summary
print(summary)
```

```
              coef   se(coef)  coef lower 95%  coef upper 95%  cmp to  \
lambda_  35.285742  13.336768        9.146158       61.425326     0.0

                z         p  -log2(p)
lambda_  2.645749  0.008151  6.938803
```

```
# Weibull
weibull_model = WeibullFitter()
weibull_model.fit(df_cox['duration'], event_observed=df_cox['event'])
summary = weibull_model.summary
print(summary)
```

```
              coef   se(coef)  coef lower 95%  coef upper 95%  cmp to  \
lambda_  61.305417  64.313598      -64.746919      187.357753     1.0
rho_      0.785060   0.282946        0.230496        1.339625     1.0

                z         p  -log2(p)
lambda_  0.937678  0.348410  1.521141
rho_    -0.759648  0.447465  1.160154
```

```
#CoX
cox = CoxPHFitter()
cox.fit(df_cox, duration_col='duration', event_col='event', formula="GDP")
summary = cox.summary
print(summary)
```

```
               coef  exp(coef)  se(coef)  coef lower 95%  coef upper 95%  \
covariate
GDP       -0.856497   0.424647   0.44908       -1.736679        0.023684
```

```
           exp(coef) lower 95%  exp(coef) upper 95%  cmp to         z  \
covariate
GDP                   0.176104             1.023967     0.0 -1.907225

                  p  -log2(p)
covariate
GDP        0.056491  4.145823
```

```
    #CoX
    cox = CoxPHFitter()
    cox.fit(df_cox, duration_col='duration', event_col='event', formula="GDP+Personal_Income'
    summary = cox.summary
    print(summary)
```

```
                     coef  exp(coef)  se(coef)  coef lower 95%  \
covariate
GDP             -2.136533   0.118063  4.062284      -10.098462
Personal_Income  1.290194   3.633491  4.078726       -6.703962

                 coef upper 95%  exp(coef) lower 95%  exp(coef) upper 95%  \
covariate
GDP                    5.825396             0.000041           338.795387
Personal_Income        9.284349             0.001226         10768.165446

                 cmp to         z         p  -log2(p)
covariate
GDP                 0.0 -0.525944  0.598927  0.739547
Personal_Income     0.0  0.316323  0.751758  0.411661
```

```
    #CoX
    cox = CoxPHFitter()
    cox.fit(df_cox, duration_col='duration', event_col='event', formula="GDP+Personal_Income+
    summary = cox.summary
    print(summary)
```

```
                     coef  exp(coef)  se(coef)  coef lower 95%  \
covariate
GDP             -3.183116   0.041456  4.740928      -12.475165
Personal_Income  2.967573  19.444669  4.764808       -6.371278
TasaDesempleo   -0.833100   0.434700  0.456800       -1.728411
```

```
                 coef upper 95%  exp(coef) lower 95%  exp(coef) upper 95%  \
covariate
GDP                     6.108934             0.000004           449.858694
Personal_Income        12.306424             0.001710        221111.918190
TasaDesempleo           0.062212             0.177566             1.064188

                 cmp to         z         p  -log2(p)
covariate
GDP                 0.0 -0.671412  0.501958  0.994361
Personal_Income     0.0  0.622811  0.533409  0.906686
TasaDesempleo       0.0 -1.823774  0.068186  3.874375
```

```
    #CoX
    cox = CoxPHFitter()
    cox.fit(df_cox, duration_col='duration', event_col='event', formula="GDP+TasaDesempleo")
    summary = cox.summary
    print(summary)
```

```
                   coef  exp(coef)  se(coef)  coef lower 95%  coef upper 95%  \
covariate
GDP           -0.241261   0.785636  0.542918       -1.305362        0.822839
TasaDesempleo -0.784094   0.456533  0.444180       -1.654670        0.086482

               exp(coef) lower 95%  exp(coef) upper 95%  cmp to         z  \
covariate
GDP                       0.271074             2.276955     0.0 -0.444379
TasaDesempleo             0.191155             1.090332     0.0 -1.765264

                     p  -log2(p)
covariate
GDP           0.656769  0.606542
TasaDesempleo 0.077519  3.689298
```