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	10	0	12.196037	11.964237	8.009091
1	Alaska	10	0	10.863448	10.404198	7.351515
2	Arizona	10	0	12.574947	12.289487	7.875758
3	Arkansas	1	1	11.629167	11.427889	6.681818
4	California	10	0	14.582742	14.266541	9.578788
5	Colorado	9	0	12.538412	12.228448	6.684848
6	Connecticut	9	0	12.509942	12.270401	7.203030
7	Delaware	9	0	11.120425	10.504921	6.612121
8	Florida	10	0	13.672976	13.472931	8.463636
9	Georgia	10	0	13.068082	12.713747	8.266667
10	Hawaii	10	1	11.233874	10.924578	5.345455
11	Idaho	10	0	11.043447	10.806564	7.151515
12	Illinois	10	0	13.530172	13.195753	8.466667
13	Indiana	9	0	12.655854	12.319331	8.187879

	id	duration	event	GDP	Personal_Income	TasaDesempleo
14	Iowa	9	0	11.979158	11.646409	5.360606
15	Kansas	7	1	11.877897	11.630400	5.890909
16	Kentucky	9	0	12.117988	11.849883	8.651515
17	Louisiana	8	0	12.393479	12.029710	5.772727
18	Maine	9	0	10.993381	10.804696	7.036364
19	Maryland	8	0	12.733998	12.536470	5.896970
20	Massachusetts	9	0	13.010134	12.716271	6.824242
21	Michigan	9	0	12.990805	12.758253	10.996970
22	Minnesota	10	0	12.622804	12.304616	6.603030
23	Mississippi	8	0	11.584078	11.408196	8.206061
24	Missouri	10	0	12.591244	12.291466	7.763636
25	Montana	10	0	10.638472	10.445304	6.024242
26	Nebraska	1	1	11.518610	11.186013	4.012121
27	Nevada	10	0	11.894895	11.514505	9.393939
28	New Hampshire	9	0	11.173738	11.000698	5.027273
29	New Jersey	9	0	13.235134	13.001712	7.366667
30	New Mexico	9	0	11.405901	11.115575	5.896970
31	New York	9	0	14.128133	13.729350	7.048485
32	North Carolina	9	0	13.086100	12.746720	8.548485
33	North Dakota	3	1	10.483193	10.203878	3.530303
34	Ohio	9	0	13.246421	12.937403	8.551515
35	Oklahoma	7	1	11.966133	11.829367	5.239394
36	Oregon	9	0	12.106556	11.824306	8.600000
37	Pennsylvania	9	0	13.394662	13.158647	6.818182
38	Rhode Island	10	0	10.914361	10.679802	9.506061
39	South Carolina	9	0	12.148602	11.907656	9.072727
40	South Dakota	1	1	10.683103	10.382696	3.957576
41	Tennessee	10	1	12.588919	12.295014	8.436364
42	Texas	7	0	14.072110	13.758478	6.415152
43	Utah	9	0	11.794488	11.385811	5.745455
44	Vermont	9	0	10.307443	10.138916	5.539394
45	Virginia	9	0	13.045591	12.774823	5.521212
46	Washington	9	0	12.893091	12.553836	7.463636
47	West Virginia	2	1	11.167021	10.971535	6.506061
48	Wisconsin	1	1	12.553049	12.289708	7.054545
49	Wyoming	9	0	10.610985	10.158213	4.957576

```
#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         z  \
lambda_  41.1  12.996961       15.626424       66.573576     0.0  3.162278

                p  -log2(p)
lambda_  0.001565  9.319251
```

```
    # 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_  51.013950  33.072391      -13.806746      115.834645     1.0
rho_      0.877066   0.268032        0.351733        1.402399     1.0

                z         p  -log2(p)
lambda_  1.512257  0.130469  2.938226
rho_    -0.458655  0.646482  0.629318
```

```
    #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       -0.675568   0.508867  0.342842       -1.347525       -0.003611

           exp(coef) lower 95%  exp(coef) upper 95%  cmp to         z  \
covariate
GDP                   0.259883             0.996396     0.0 -1.970495

                  p  -log2(p)
covariate
GDP        0.048782  4.357518
```

```
    #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             -4.597705   0.010075  3.932998      -12.306239
Personal_Income  3.976648  53.337967  3.997968       -3.859224

                 coef upper 95%  exp(coef) lower 95%  exp(coef) upper 95%  \
covariate
GDP                    3.110830             0.000005            22.439662
Personal_Income       11.812521             0.021084        134931.275090

                 cmp to         z         p  -log2(p)
covariate
GDP                 0.0 -1.169008  0.242401  2.044535
Personal_Income     0.0  0.994667  0.319898  1.644316
```

```
    #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             -4.763167    0.008539  4.160908      -12.918397
Personal_Income  4.816902  123.581643  4.218673       -3.451546
TasaDesempleo   -0.910240    0.402428  0.341099       -1.578782

                 coef upper 95%  exp(coef) lower 95%  exp(coef) upper 95%  \
covariate
GDP                    3.392063             0.000002            29.727202
Personal_Income       13.085350             0.031697        481831.489049
TasaDesempleo         -0.241698             0.206226             0.785293

                 cmp to         z         p  -log2(p)
covariate
```

```
GDP                 0.0 -1.144742  0.252316  1.986697
Personal_Income     0.0  1.141805  0.253535  1.979743
TasaDesempleo       0.0 -2.668550  0.007618  7.036385
```

```
    #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           -0.002251   0.997751  0.416038       -0.817671        0.813169
TasaDesempleo -0.884599   0.412880  0.332099       -1.535501       -0.233696

               exp(coef) lower 95%  exp(coef) upper 95%  cmp to         z  \
covariate
GDP                         0.441458             2.255042     0.0 -0.005411
TasaDesempleo               0.215348             0.791602     0.0 -2.663658

                     p  -log2(p)
covariate
GDP           0.995682  0.006242
TasaDesempleo 0.007730  7.015389
```