Survival Analysis of Corporal Punishment Bans

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# Introduction

Corporal punishment is associated with a number of deleterious outcomes for children, including increases in behavior problems and mental health problems.

A number of countries have instituted country wide bans upon the use of corporal punishment with children.

Below, we employ a variety of empirical strategies to explore the institution of these bans.

# Get The Data

. use "../CPBans\_w\_AllCountries.dta", clear // data with ALL Countries; not just bans

NB It is important to have data with the *correct risk set* which includes *all countries*, not just *countries that eventually ban corporal punishment*.

# stset The Data

. replace year\_of\_prohibition = 2021 if year\_of\_prohibition == . // replace missing w/ current year  
(186 real changes made)

. generate f = type == "CP Ban" // "failure" variable

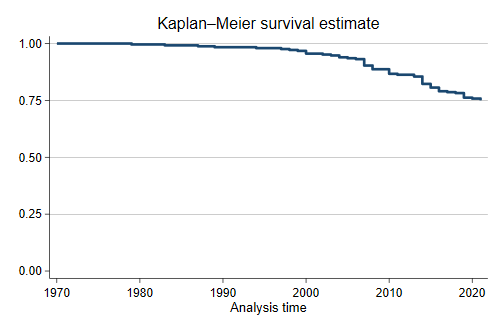
. stset year\_of\_prohibition, failure(f = 1) // stset the data with time and failure variables  
  
Survival-time data settings  
  
 Failure event: f==1  
Observed time interval: (0, year\_of\_prohibition]  
 Exit on or before: failure  
  
──────────────────────────────────────────────────────────────────────────  
 248 total observations  
 0 exclusions  
──────────────────────────────────────────────────────────────────────────  
 248 observations remaining, representing  
 62 failures in single-record/single-failure data  
 500,452 total analysis time at risk and under observation  
 At risk from t = 0  
 Earliest observed entry t = 0  
 Last observed exit t = 2,021

# Graphs

## Survival Function

. sts graph, scheme(michigan) tmin(1970) // Kaplan-Meier Survivor Function  
  
 Failure \_d: f==1  
 Analysis time \_t: year\_of\_prohibition

. graph export mysurvival.png, width(500) replace  
file mysurvival.png saved as PNG format

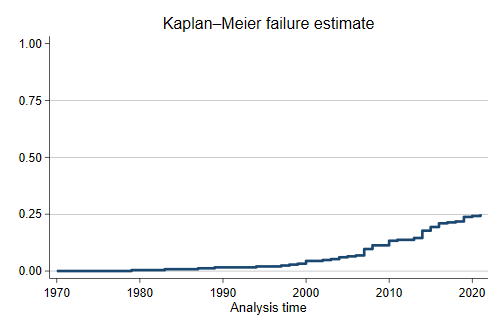


Kaplan-Meier Survivor Function

## Failure Function

. sts graph, failure scheme(michigan) tmin(1970) // Kaplan-Meier Failure Function  
  
 Failure \_d: f==1  
 Analysis time \_t: year\_of\_prohibition

. graph export myfailure.png, width(500) replace  
file myfailure.png saved as PNG format



Kaplan-Meier Failure Function

# Survival Analysis

Unlike other regression commands in Stata, survival analysis commands seem to require covariates.

## Data Wrangling

. encode continent, generate(continent\_NUMERIC) // numeric version of continent

Since Europe is where these bans started, we will use Europe (category 4) as the reference category.

## Parametric Survival Models

### Weibull

. streg ib4.continent\_NUMERIC, distribution(weibull) // Weibull distribution  
  
 Failure \_d: f==1  
 Analysis time \_t: year\_of\_prohibition  
  
Fitting constant-only model:  
Iteration 0: log likelihood = -148.2325  
Iteration 1: log likelihood = -86.999055  
Iteration 2: log likelihood = -27.073844  
Iteration 3: log likelihood = 29.365489  
Iteration 4: log likelihood = 77.015953  
Iteration 5: log likelihood = 106.62899  
Iteration 6: log likelihood = 115.32234  
Iteration 7: log likelihood = 115.88805  
Iteration 8: log likelihood = 115.89021  
Iteration 9: log likelihood = 115.89021  
  
Fitting full model:  
Iteration 0: log likelihood = 115.89021   
Iteration 1: log likelihood = 139.32561   
Iteration 2: log likelihood = 142.87372   
Iteration 3: log likelihood = 143.05492   
Iteration 4: log likelihood = 143.05732   
Iteration 5: log likelihood = 143.05732   
  
Weibull PH regression  
  
No. of subjects = 248 Number of obs = 248  
No. of failures = 62  
Time at risk = 500,452  
 LR chi2(5) = 54.33  
Log likelihood = 143.05732 Prob > chi2 = 0.0000  
  
──────────────────┬────────────────────────────────────────────────────────────────  
 \_t │ Haz. ratio Std. err. z P>|z| [95% conf. interval]  
──────────────────┼────────────────────────────────────────────────────────────────  
continent\_NUMERIC │  
 Africa │ .1684617 .0612563 -4.90 0.000 .0826011 .3435709  
 Americas │ .1938708 .0704541 -4.51 0.000 .0950997 .395226  
 Asia │ .1520997 .0603348 -4.75 0.000 .0698995 .3309653  
 NA │ .0916735 .0931508 -2.35 0.019 .0125119 .6716806  
 Oceania │ .0356574 .0362323 -3.28 0.001 .0048666 .2612621  
 │  
 \_cons │ 0 0 -8.57 0.000 0 0  
──────────────────┼────────────────────────────────────────────────────────────────  
 /ln\_p │ 5.278967 .1166492 45.26 0.000 5.050339 5.507596  
──────────────────┼────────────────────────────────────────────────────────────────  
 p │ 196.1672 22.88274 156.0754 246.5576  
 1/p │ .0050977 .0005946 .0040558 .0064072  
──────────────────┴────────────────────────────────────────────────────────────────  
Note: \_cons estimates baseline hazard.

### Exponential

. streg ib4.continent\_NUMERIC, distribution(exponential) // Exponential distribution  
  
 Failure \_d: f==1  
 Analysis time \_t: year\_of\_prohibition  
  
Iteration 0: log likelihood = -148.2325   
Iteration 1: log likelihood = -139.40941   
Iteration 2: log likelihood = -131.58499   
Iteration 3: log likelihood = -131.55897   
Iteration 4: log likelihood = -131.55892   
Iteration 5: log likelihood = -131.55892   
  
Exponential PH regression  
  
No. of subjects = 248 Number of obs = 248  
No. of failures = 62  
Time at risk = 500,452  
 LR chi2(5) = 33.35  
Log likelihood = -131.55892 Prob > chi2 = 0.0000  
  
──────────────────┬────────────────────────────────────────────────────────────────  
 \_t │ Haz. ratio Std. err. z P>|z| [95% conf. interval]  
──────────────────┼────────────────────────────────────────────────────────────────  
continent\_NUMERIC │  
 Africa │ .2736219 .099129 -3.58 0.000 .134516 .5565804  
 Americas │ .3052592 .1105907 -3.28 0.001 .1500692 .6209345  
 Asia │ .2489781 .0984172 -3.52 0.000 .1147345 .5402914  
 NA │ .1586176 .1610769 -1.81 0.070 .0216746 1.160782  
 Oceania │ .061017 .061963 -2.75 0.006 .0083378 .4465293  
 │  
 \_cons │ .000312 .0000552 -45.67 0.000 .0002206 .0004412  
──────────────────┴────────────────────────────────────────────────────────────────  
Note: \_cons estimates baseline hazard.

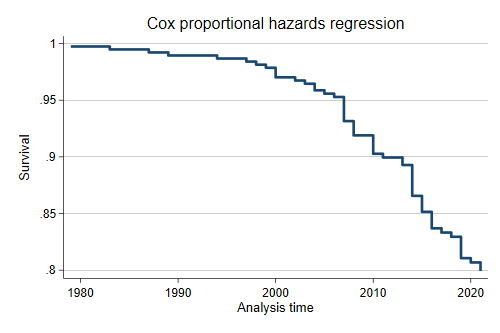
## Cox Proportional Hazards Model

. stcox ib4.continent\_NUMERIC // Cox Proportional Hazards Model  
  
 Failure \_d: f==1  
 Analysis time \_t: year\_of\_prohibition  
  
Iteration 0: log likelihood = -333.92184  
Iteration 1: log likelihood = -317.94407  
Iteration 2: log likelihood = -308.96171  
Iteration 3: log likelihood = -308.00801  
Iteration 4: log likelihood = -308.00737  
Refining estimates:  
Iteration 0: log likelihood = -308.00737  
  
Cox regression with Breslow method for ties  
  
No. of subjects = 248 Number of obs = 248  
No. of failures = 62  
Time at risk = 500,452  
 LR chi2(5) = 51.83  
Log likelihood = -308.00737 Prob > chi2 = 0.0000  
  
──────────────────┬────────────────────────────────────────────────────────────────  
 \_t │ Haz. ratio Std. err. z P>|z| [95% conf. interval]  
──────────────────┼────────────────────────────────────────────────────────────────  
continent\_NUMERIC │  
 Africa │ .1769827 .0643396 -4.76 0.000 .0867938 .3608887  
 Americas │ .2023186 .0735008 -4.40 0.000 .0992661 .4123544  
 Asia │ .1610376 .0638871 -4.60 0.000 .0740009 .3504428  
 NA │ .0969297 .0984941 -2.30 0.022 .0132287 .7102257  
 Oceania │ .0380401 .038653 -3.22 0.001 .0051919 .2787139  
──────────────────┴────────────────────────────────────────────────────────────────

### Survival Curves

. stcurve, survival scheme(michigan) // survival curve

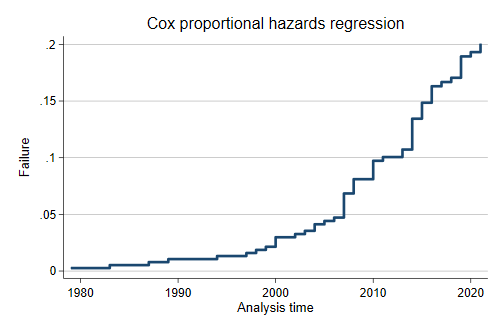
. graph export survival1A.png, width(500) replace  
file survival1A.png saved as PNG format



Survival Curve

. stcurve, failure scheme(michigan) // failure curve

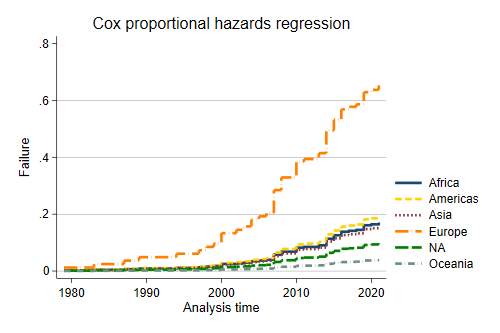
. graph export survival1B.png, width(500) replace  
file survival1B.png saved as PNG format



Failure Curve

. stcurve, failure at(continent\_NUMERIC= (1 2 3 4 5 6)) ///  
> legend(order(1 "Africa" 2 "Americas" 3 "Asia" ///  
> 4 "Europe" 5 "NA" 6 "Oceania")) ///  
> scheme(michigan) // survival curve by continent

. graph export survival2.png, width(500) replace  
file survival2.png saved as PNG format



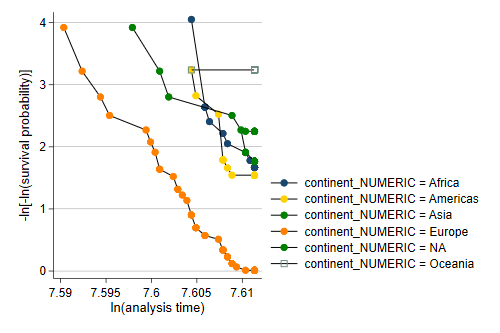
Failure Curve By Continent

### Proportional Hazards Assumption

. estat phtest // formal test of PH assumption  
  
Test of proportional-hazards assumption  
  
Time function: Analysis time  
─────────────┬──────────────────────────────────  
 │ chi2 df Prob>chi2  
─────────────┼──────────────────────────────────  
 Global test │ 6.20 5 0.2870  
─────────────┴──────────────────────────────────

. stphplot, by(continent\_NUMERIC) scheme(michigan) // graphical test of PH assumption  
  
 Failure \_d: f==1  
 Analysis time \_t: year\_of\_prohibition

. graph export ph.png, width(500) replace  
file ph.png saved as PNG format

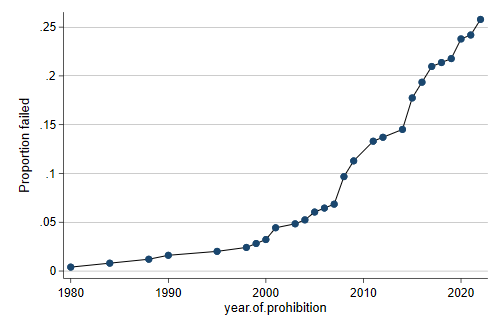


Graphical Test of Proportional Hazards Assumption

# Life Table

. ltable year\_of\_prohibition f, graph failure scheme(michigan) // lifetable  
  
 Beg. Cum. Std.  
 Interval Total Deaths Lost Failure Error [95% Conf. Int.]  
───────────────────────────────────────────────────────────────────────────────  
 1979 1980 248 1 0 0.0040 0.0040 0.0006 0.0283  
 1983 1984 247 1 0 0.0081 0.0057 0.0020 0.0319  
 1987 1988 246 1 0 0.0121 0.0069 0.0039 0.0370  
 1989 1990 245 1 0 0.0161 0.0080 0.0061 0.0424  
 1994 1995 244 1 0 0.0202 0.0089 0.0084 0.0478  
 1997 1998 243 1 0 0.0242 0.0098 0.0109 0.0531  
 1998 1999 242 1 0 0.0282 0.0105 0.0136 0.0583  
 1999 2000 241 1 0 0.0323 0.0112 0.0163 0.0635  
 2000 2001 240 3 0 0.0444 0.0131 0.0248 0.0787  
 2002 2003 237 1 0 0.0484 0.0136 0.0278 0.0836  
 2003 2004 236 1 0 0.0524 0.0142 0.0308 0.0886  
 2004 2005 235 2 0 0.0605 0.0151 0.0369 0.0983  
 2005 2006 233 1 0 0.0645 0.0156 0.0400 0.1032  
 2006 2007 232 1 0 0.0685 0.0160 0.0432 0.1080  
 2007 2008 231 7 0 0.0968 0.0188 0.0659 0.1409  
 2008 2009 224 4 0 0.1129 0.0201 0.0794 0.1593  
 2010 2011 220 5 0 0.1331 0.0216 0.0965 0.1820  
 2011 2012 215 1 0 0.1371 0.0218 0.1000 0.1865  
 2013 2014 214 2 0 0.1452 0.0224 0.1069 0.1955  
 2014 2015 212 8 0 0.1774 0.0243 0.1352 0.2309  
 2015 2016 204 4 0 0.1935 0.0251 0.1496 0.2484  
 2016 2017 200 4 0 0.2097 0.0258 0.1641 0.2658  
 2017 2018 196 1 0 0.2137 0.0260 0.1677 0.2701  
 2018 2019 195 1 0 0.2177 0.0262 0.1713 0.2745  
 2019 2020 194 5 0 0.2379 0.0270 0.1897 0.2960  
 2020 2021 189 1 0 0.2419 0.0272 0.1934 0.3002  
 2021 2022 188 2 186 0.2579 0.0289 0.2062 0.3196  
───────────────────────────────────────────────────────────────────────────────

. graph export myltable.png, width(500) replace  
file myltable.png saved as PNG format



Graph Of Life Table