Demographic Methods Project

Christine Leibbrand

March 1, 2017

#Reading in data  
library(data.table)  
hmd\_data <- read.table("c:/users/leibbrce/Documents/Demographic Methods/Population2.txt", header=T)  
  
#Creating input variables for 1 year interval  
age <- as.numeric(as.character(hmd\_data$Age))  
age[is.na(age)] <- 110  
year <- hmd\_data$Year  
nmx <- hmd\_data$mx  
  
#Lifetable function  
lt <- function(year,age, nmx){  
interval <- c(diff(age),999)  
nax <- (c(diff(age),999))/2  
age\_lead <- c(tail(age,-1),rep(NA,1))   
age\_lead[is.na(age\_lead)] <- 0  
nax[age\_lead==1] <- (.07+(1.7\*nmx[age==min(age)])) #Keyfitz and Flieger 1968 equation for calculating nax in first year of life   
nax[age==max(age)] <- 1/nmx[age==max(age)] #Calculating nax for last interval  
if(interval==4 & age\_lead==5) { nax <- 1.5 }  
nqx <- (interval\*nmx)/(1+(nax\*nmx))  
nqx[age==max(age)] <- 1 #nqx for last interval=1 because everyone dies in last interval  
lx <- NULL  
for(i in year){  
lx[year==i] <- (c(1,cumprod(1-nqx[year==i])))\*100000  
 }  
ndx <- -(c(diff(lx),999))  
ndx[age==max(age)] <- lx[age==max(age)] #because everyone dies in last interval, death count in last interval=number of initial survivors in that period  
lx\_lead <- c(tail(lx,-1),rep(NA,1)) #creating lead variable for lx (lx[\_n+1])  
nLx <- (interval\*lx\_lead)+(nax\*ndx)  
nLx[age==max(age)] <- (nax[age==max(age)]\*ndx[age==max(age)]) #There is no lead lx for the last interval, so the first half of the equation is removed  
Tx <- NULL  
for(i in year){  
Tx[year==i] <- rev(cumsum(rev(nLx[year==i])))  
}  
ex <- Tx/lx  
ex\_plusx <- ex+age  
lifetable <- data.frame(year=year, age=age, mx=nmx, qx=nqx,  
 ax=nax, lx=lx, dx=ndx, Lx=nLx, Tx=Tx, ex=ex, lifeexp=ex\_plusx)  
}  
  
#Creating lifetable  
life <- lt(year,age, nmx)

#Comparing results  
tail(life)

## year age mx qx ax lx dx Lx Tx ex lifeexp  
## 9097 2014 105 0.53930 0.4247627 0.500000 238.33768 101.23696 187.71920 415.18428 1.742000 106.7420  
## 9098 2014 106 0.57147 0.4444695 0.500000 137.10072 60.93709 106.63217 227.46508 1.659109 107.6591  
## 9099 2014 107 0.60309 0.4633647 0.500000 76.16363 35.29154 58.51786 120.83291 1.586491 108.5865  
## 9100 2014 108 0.63390 0.4813395 0.500000 40.87209 19.67335 31.03542 62.31505 1.524636 109.5246  
## 9101 2014 109 0.66369 0.4983238 0.500000 21.19874 10.56384 15.91682 31.27963 1.475542 110.4755  
## 9102 2014 110 0.69225 1.0000000 1.444565 10.63491 10.63491 15.36281 15.36281 1.444565 111.4446

tail(hmd\_data)

## Year Age mx qx ax lx dx Lx Tx ex  
## 9097 2014 105 0.53930 0.42477 0.50 238 101 188 415 1.74  
## 9098 2014 106 0.57147 0.44447 0.50 137 61 107 227 1.66  
## 9099 2014 107 0.60309 0.46336 0.50 76 35 59 121 1.59  
## 9100 2014 108 0.63390 0.48134 0.50 41 20 31 62 1.52  
## 9101 2014 109 0.66369 0.49832 0.50 21 11 16 31 1.48  
## 9102 2014 110+ 0.69225 1.00000 1.44 11 11 15 15 1.44

head(life)

## year age mx qx ax lx dx Lx Tx ex lifeexp  
## 1 1933 0 0.06167 0.061012147 0.174839 100000.00 6101.2147 94965.52 6073705 60.73705 60.73705  
## 2 1933 1 0.00946 0.009415465 0.500000 93898.79 884.1007 93456.73 5978739 63.67217 64.67217  
## 3 1933 2 0.00435 0.004340559 0.500000 93014.68 403.7358 92812.82 5885282 63.27262 65.27262  
## 4 1933 3 0.00310 0.003095202 0.500000 92610.95 286.6496 92467.62 5792470 62.54627 65.54627  
## 5 1933 4 0.00239 0.002387147 0.500000 92324.30 220.3917 92214.10 5700002 61.73891 65.73891  
## 6 1933 5 0.00197 0.001968061 0.500000 92103.91 181.2662 92013.27 5607788 60.88545 65.88545

head(hmd\_data)

## Year Age mx qx ax lx dx Lx Tx ex  
## 1 1933 0 0.06167 0.05883 0.22 100000 5883 95405 6087969 60.88  
## 2 1933 1 0.00946 0.00941 0.50 94117 886 93674 5992564 63.67  
## 3 1933 2 0.00435 0.00434 0.50 93231 405 93028 5898890 63.27  
## 4 1933 3 0.00310 0.00310 0.50 92826 288 92682 5805862 62.55  
## 5 1933 4 0.00239 0.00238 0.50 92538 221 92428 5713180 61.74  
## 6 1933 5 0.00197 0.00197 0.50 92318 182 92227 5620752 60.88