Replication Instructions for Lleras-Muney and Moreau (2022) *Demography*

1-Data
The data for this project comes from the Human Mortality Database and is publicly available but requires registration. The data can be downloaded from https://www.mortality.org/

2-Codes
There are several codes to produce the results of the paper.

    a. **STATA codes**

1-`hmd_read.do`: this file reads in data downloaded from the Human Mortality Database and outputs a data set called hmd_drate.dta
the input files are labeled Mx_1x1 in the website. The program assumes these have been read into STATA and the first few lines of text have been removed.
For simplicity these figures use the mortality rates that the human mortality database provides, that is we do not re-compute these rates for these figures.

2-`Figures_AERI.do`
*uses data from the Human Mortality Database (saved as .dta by hmd.do) to produce Figure 1 and Appendix Figure 11
*simulates data to produce Figures 4b, 4d, and 5d and Appendix Figures 7, 8, 9, 14, 15, 16 and 17. The seed and parameters used in the simulations are in the code.

3. `GeneratetargetMRv4.do`
    This code generare mortality rate series in correct format that can be used for matlab estimation. Outputs one csv file per cohort, with format 'MR_FRA_YYYY_Fq.csv'where YYYY is the year

    b. **Matlab codes:**
    1- `main_figuresv5_hoff_V21.m` produces all the figures based on estimated series

    2– `hof_timeseriesv6_L.m` is a wrapper that runs the estimation for all series using the Hoffman server and saves the data in a table, launching the estimation recursively
        `TS_fun_kII.m` function that estimates for a given cohort based on a guess it uses the following ancillary functions. From the year the function will automatically pick up the corresponding data file saved locally.

        `Criterion_s.m` wrapper, forms the squared errors with the empirical survival curve to minimize

        `Crit_fun.m` wrapper, forms the squared errors with the empirical mortality curve to minimize

`Trunc_data.m`   truncates the mortality rate data to avoid the last years that are extrapolated (see Human Mortality Database Documentation)

`Survivalcurve.m`   compute the survival curve from the log mortality rates

`Powell.m`   a routine to improve on Matlab's default maximization algorithms

`Life_exp4.m`   compute the life expectancy

`logMR_IIk.m`   mortality model with 2 investment shocks and one accident shock through lifteime

`logMR_add.m`   used for the monkeys

`logMR.m` is the most basic version of the 5-parameter model.

<u>Example</u>: To estimate a single series

```
year = 1816
init_guess = [0.3665 0.00047854 0.83838  1.7934 0.91652  0.3665  0.0093653 0.3665]

[res,fit_S,LMR1,S1,LE1,fit0]=TSfun_kII(year,init_guess)

% figure(),
% subplot(1,2,1)
% plot(LMR1)
% subplot(1,2,2)
% plot(S1)
```

    c.   Excel code: Figure 13 is simulated in excel using the estimated parameters.