REPLICATION FILE FOR: THE STOCHASTIC AND DETERMINISTIC COMPONENTS OF MORTALITY RATES.

LAURENT CALLOT, NIELS HALDRUP, AND MALENE KALLESTRUP LAMB.

This document is generated from a **knitr** file which contains all the code necessary to replicate the plots and tables in the paper. To replicate these results, simply compile the file with the **knitr** package for **R**.

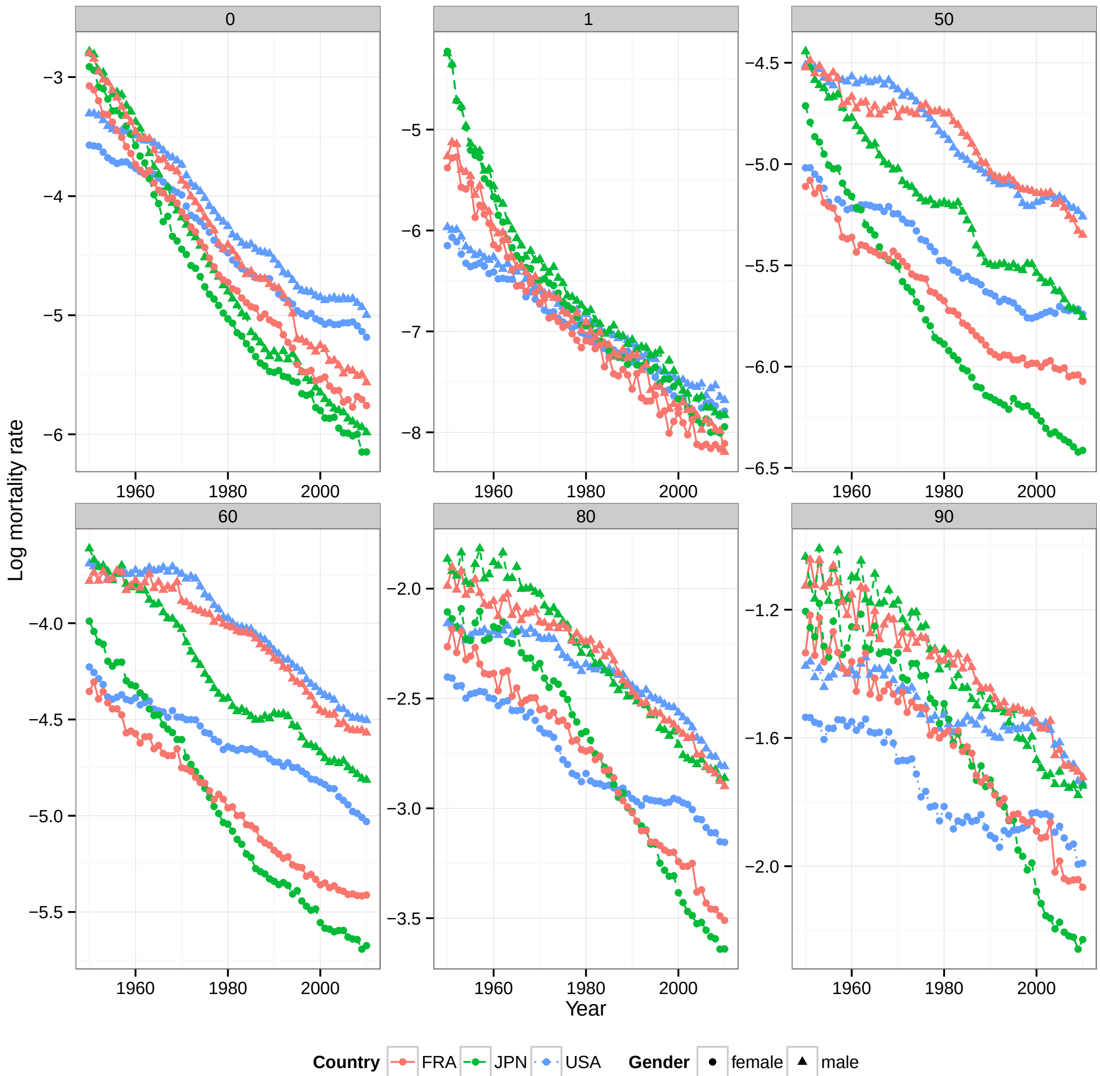
Here is the sample used.

```
# Defining the sample:
smpl = list(cn = NULL, gen = NULL, startyear = 1950, endyear = 2010, minage = 0,
    maxage = 90)

cnall <- c("USA", "JPN", "FRA")
```

FIGURE 1A

Log-mortality rates for selected countries and ages.



Date: October 3, 2014.

Figure 1b

Slope of an age specific linear trend for selected countries.

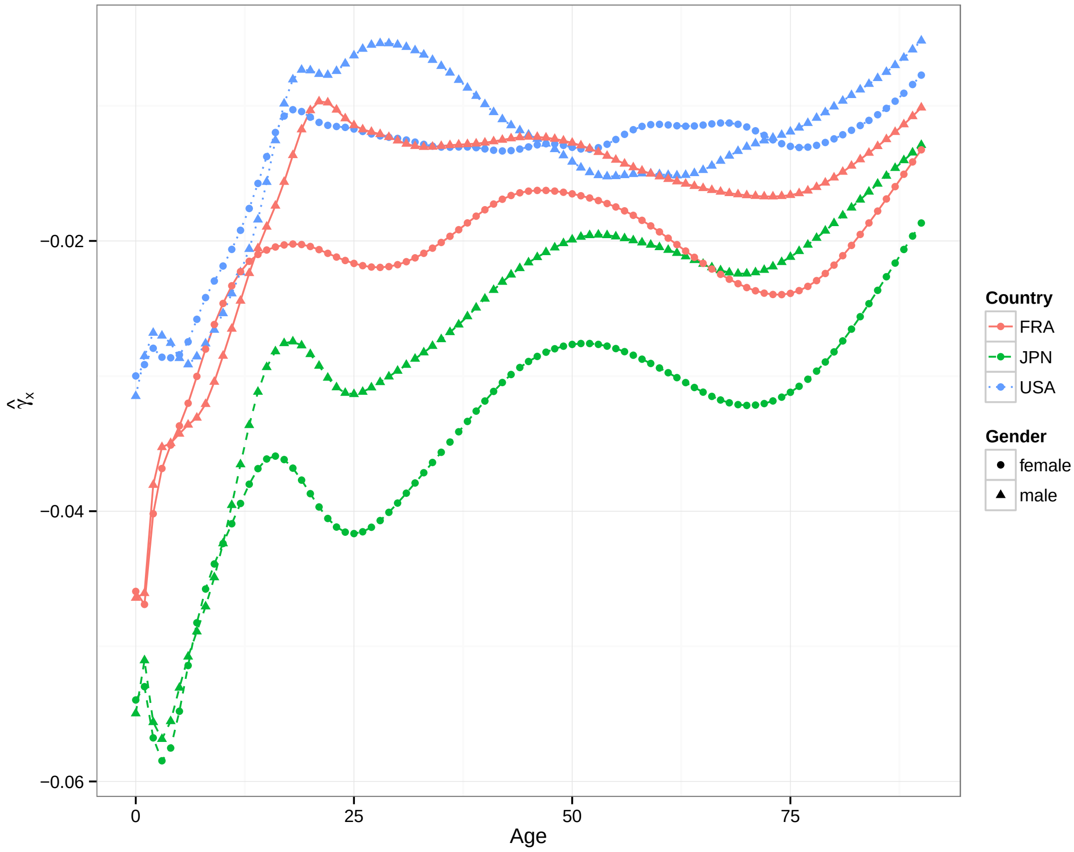
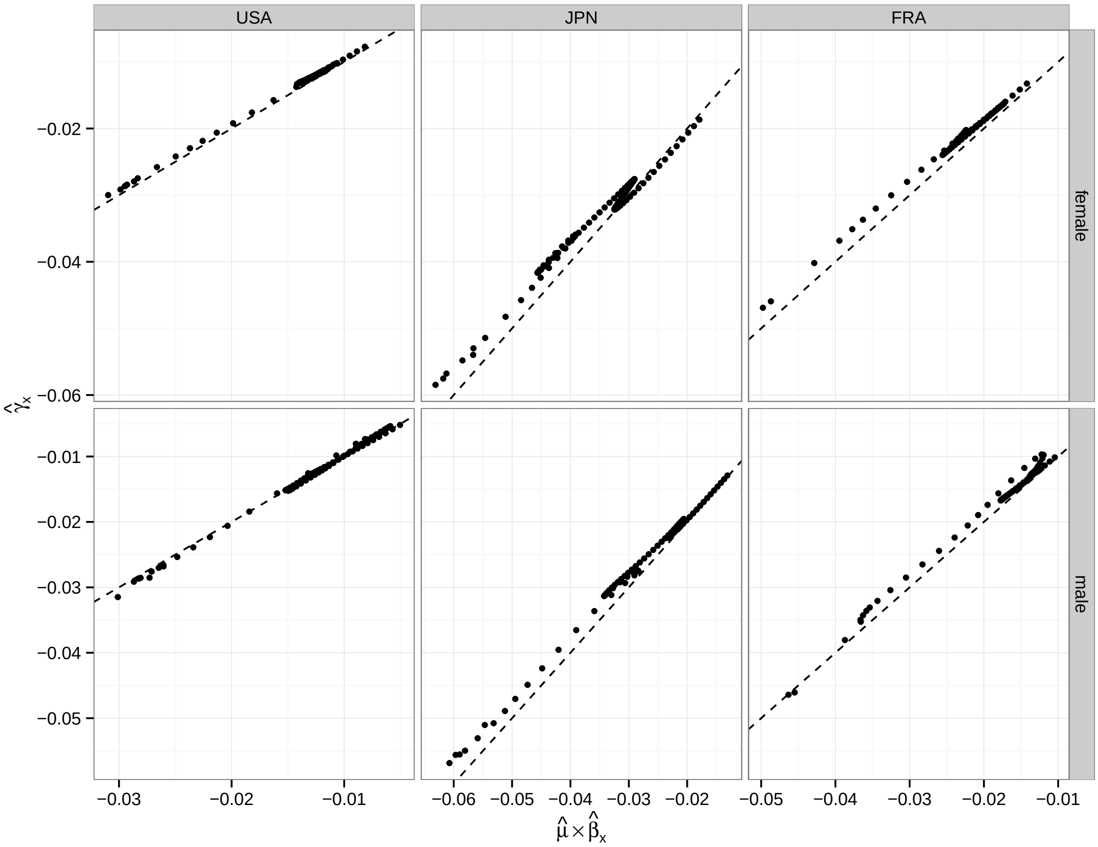


Figure 2

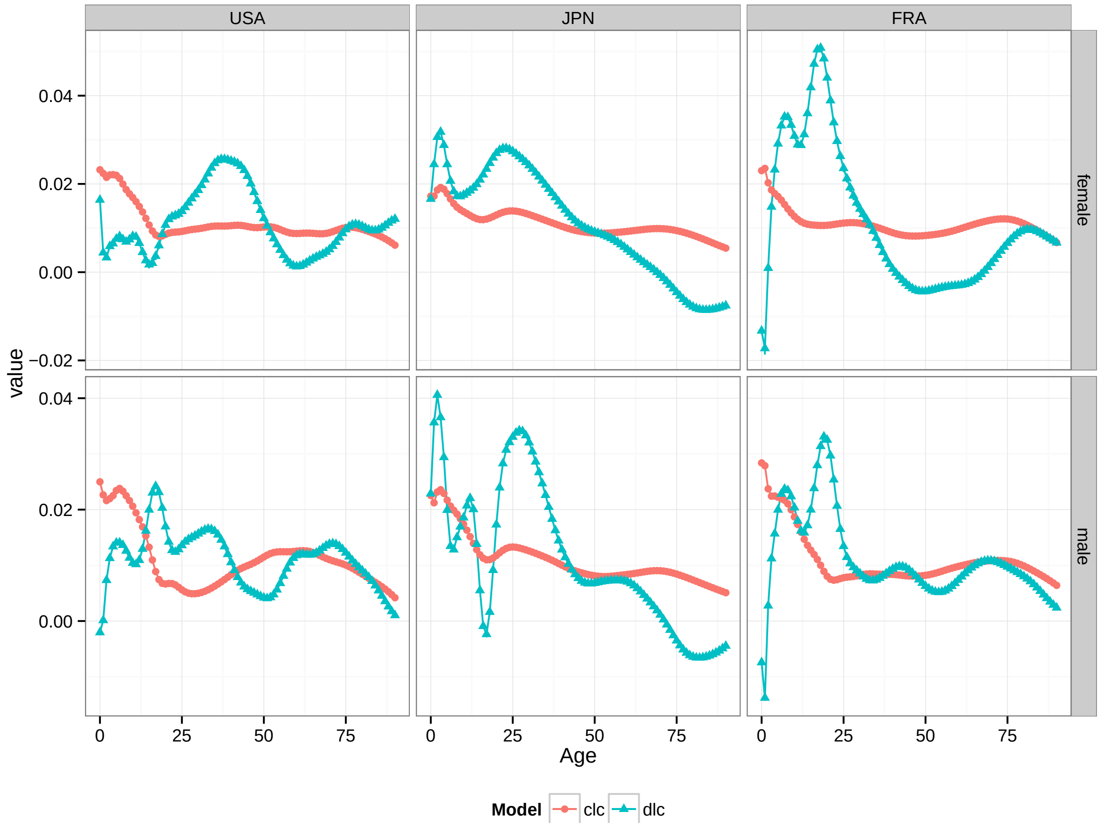
Scatter plot of $\hat{\mu}\hat{\beta}_{CLC}$ versus $\hat{\gamma}_{DLC}$.




```
##     Age        bm        gm Country Gender ratio
## 181  18 -0.008961 -0.008054     USA   male 1.113
## 191  19 -0.008149 -0.007340     USA   male 1.110
## 202  20 -0.042582 -0.038703     JPN female 1.100
## 213  21 -0.043682 -0.039687     JPN female 1.101
## 222  22 -0.044601 -0.040539     JPN female 1.100
## 164  16 -0.022573 -0.020448     FRA female 1.104
## 174  17 -0.022458 -0.020296     FRA female 1.107
## 184  18 -0.022389 -0.020228     FRA female 1.107
## 194  19 -0.022393 -0.020265     FRA female 1.105
## 204  20 -0.022486 -0.020413     FRA female 1.102
## 165  16 -0.019500 -0.017396     FRA   male 1.121
## 175  17 -0.018050 -0.015636     FRA   male 1.154
## 185  18 -0.016332 -0.013657     FRA   male 1.196
## 195  19 -0.014558 -0.011751     FRA   male 1.239
## 205  20 -0.013094 -0.010334     FRA   male 1.267
## 219  21 -0.012217 -0.009678     FRA   male 1.262
## 225  22 -0.011955 -0.009757     FRA   male 1.225
## 235  23 -0.012116 -0.010292     FRA   male 1.177
## 245  24 -0.012428 -0.010935     FRA   male 1.137
## 255  25 -0.012691 -0.011442     FRA   male 1.109
```

Figure 3

CLC and DLC loadings on the Lee-Carter trend, $\widehat{\beta}$ and $\widehat{\widetilde{\beta}}$. The standard errors are too small to be visible.



It looks like the constraints imposed by the classical Lee Carter relative to the detrended version leads to over estimating the reduction of mortality for young people and under estimate the decrease for older age groups.

Figure 4

Plots of the detrended stochastic component $(k_t - \mu t)$ of the 'classic' Lee Carter (CLC) model and stochastic component of the Detrended Lee Carter (DLC) model.

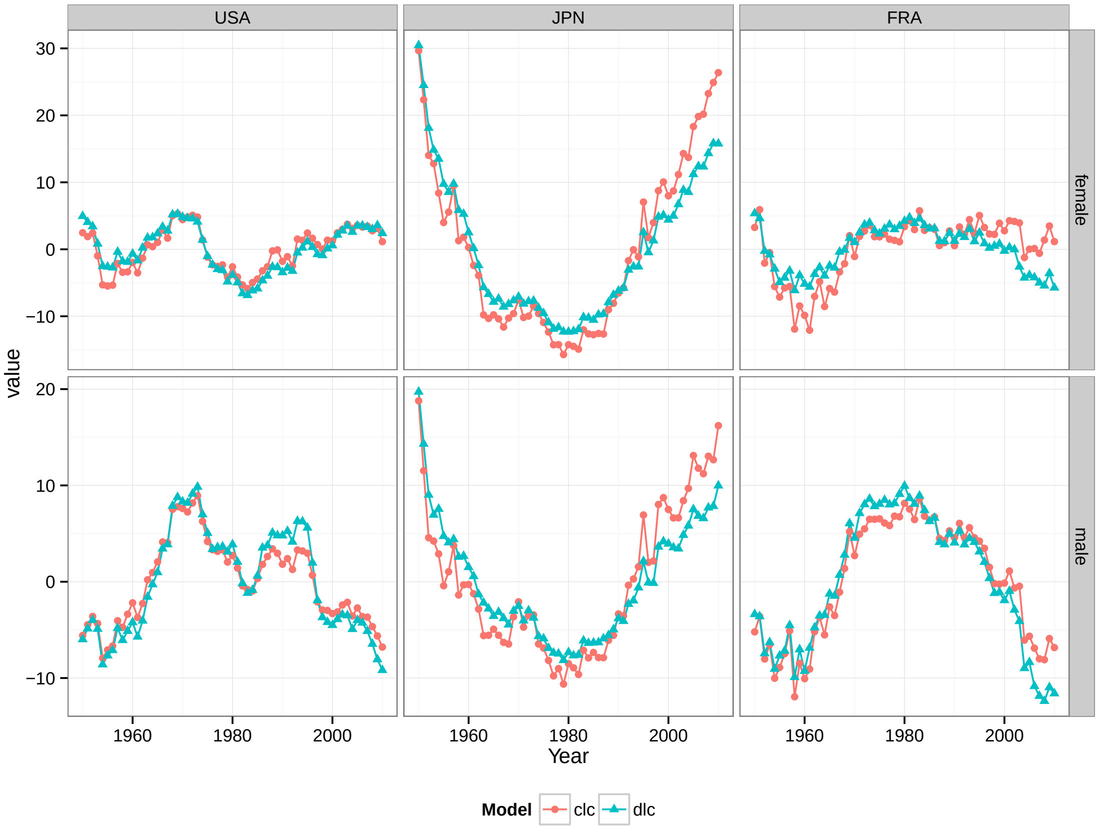


Table X

AR(1) parameter for k_t and $\tilde{k}_t$.

Country	Gender	clc	dlc
USA	female	0.993	0.919
USA	male	1.015	0.968
JPN	female	0.968	0.925
JPN	male	0.973	0.898
FRA	female	0.993	0.915
FRA	male	1.011	0.988

Table 1. AR(1) parameter.

Table Y

We now compute the R^2 for the three models, and also for the CLC and DLC relative to detrended data.

	clc/dm	dlc/dm	det/dm	clc/dt	dlc/dt
USA_female	0.966	0.976	0.949	0.337	0.520
USA_male	0.951	0.970	0.915	0.421	0.646
USA_total	0.965	0.975	0.946	0.349	0.541
JPN_female	0.970	0.994	0.925	0.594	0.925
JPN_male	0.975	0.988	0.949	0.502	0.767
JPN_total	0.974	0.991	0.940	0.564	0.857
FRA_female	0.965	0.980	0.955	0.235	0.552
FRA_male	0.941	0.971	0.901	0.402	0.705
FRA_total	0.956	0.978	0.932	0.355	0.681

Notice how the DLC strongly dominates the CLC when compared to detrended data.

1. Figure 6?

This figure shows the trend estimates ($\hat{\mu}\hat{\beta}_t$ for the CLC, $\hat{\gamma}$ for the DLC) considering different starting years for the data (1850,1900,1950) for France.

It appears clearly that the starting year of the data has a huge impact on the estimated slope of the (implied for the CLC) linear trend. This in turn would result in very different forecasts, those being predominantly driven by the linear trend. This is clearly not a desirable property.