Title: Selection, Patience, and the Interest Rate
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1. Instructions to run data and model outputs

1. Software and Operating System Used: Mathematica 13.2 (16 Kernels); Stata/MP 16.1 for Mac; Microsoft Excel for Mac 16.76; MacOS Ventura 13.4.1
2. Note that the folder structure within `/Outputs/` folder will need to be set up for code to run: `/Data/`, `/Graphs/`, `/Model/Baseline/`, `/Model/FixedCapital/`, `/Model/Full/`, `/Tables/`. Please see folder `Outputs_generated` for a working example including output files.
3. Using Stata run `master0.do` — be sure to set the base directory which is the directory that contains the master0.do file. This inputs raw data and generates all output data used in the paper, regressions, Tables etc. (with the exception of the SOEP data which is proprietary - although we include the do file for that analysis)
4. Using Mathematica run all cells in `master0.nb`. This solves the various versions of the model and it generates all tables and figures used in the paper and the online appendices.
5. Expected Computation Time: Stata code runs in less than a minute. Mathematica code runs in approximately in 1 hour.

2. Folders

This file contains a description of the folders and files used to solve the various models, as well as generate the images and the tables used throughout the paper. If a file does not contain a description below, see individual file for more details.

InputData

This folder contains the raw data processed by Stata, Mathematica and Excel:

- `a-millennium-of-macroeconomic-data-for-the-uk.xlsx` from Thomas and Dimsdale (2017)
- `Clark1988-RentChargesCrossCountryClean.xlsx` from Clark (1988)
- `Data_Schmelzing25.csv` (25 year medians calculated in `Figure1A_Schmelzing25.xlsx`)
- `eight-centuries-of-global-real-interest-rates-r-g-and-the-suprasecular-decline-1311-2018-data.xlsx` is the data appendix to Schmelzing (2020)
- `Figure1A_Schmelzing25.xlsx` is an extract of the data appendix to Schmelzing (2020) and the calculation of 25 year medians for `Data_Schmelzing25.csv`
- `Figure1B_Data_Clark.csv` extracted from Clark (2010) Figure 5
- `Figure7C_gdp` components.xlsx is extraction from Broadberry and de Plejt (2021) Figure 5b, extraction from Thomas and Dimsdale (2017), and calculation of investment share for Figure 7C
- `individual_v11.dta` is individual level dataset from Falk et al. (2018)
- `FeatherstoneBaker1987_USFarmLandReturns.xlsx` from Featherstone and Baker (1987)
- `LongRunLifeExpectanciesByCountry.xlsx` from https://ourworldindata.org/grapher/life-expectancy
- `maddison.csv` from The Maddison Project (2013)
- `maddison_pop.csv` extraction from The Maddison Project (2013)
- `popWDI2000.dta` from World Development Indicators
- `GDPCONSWDI.dta` from created using
- `longRunReturnsData.dta` from Dimson et al. (2002)
- `hna_gbr_09.xls` from Smits et al. (2009)
- `10SD_jan15.dta` from Timmer et al. (2015)
- `2000submitteddata_allcountries.xls` from Buera and Kaboski (2012)

Outputs

This folder is the target for the outputs generated by Stata and Mathematica and initially contains nothing but various empty folders: Data, Graphs, Model, Tables. After running the different code, these folders get populated with the model and data outputs. Each of the files used in the analysis of the paper are referred to elsewhere in this readme.

Outputs_generated

This folder contains an instance of all outputs generated by running the Stata, Excel and Mathematica files described.

MathematicaCode

Each of the following are called from `master0.nb` in the root folder and contain comments in the notebooks.

- `Baseline.nb` calculates model outputs under $\omega = 1$ assumption
- `Decomposition.nb` calculates model outputs under different assumptions for Section 5.1 and Table 2
- `DefineMethods.nb` contains solvers, modules and helpers used in other files
- `FixedCapital.nb` calculations model outputs under fixed capital assumption (Appendix G)
- `Full.nb` calculates model outputs under $\omega = 0$ assumption
- `Mutations.nb` calculates model outputs related to mutations described in section 6 and Appendix F
- `RobustnessGammaDelta.nb` calculates model outputs for robustness exercise described in Appendix D

StataCode

Each of the following are called from `master0.do` in the root folder.

- `Figure7B_UKSectoralPrices.do` calculates relative prices using `InputData/10SD_jan15.dta`, `InputData/hna_gbr_09.xls` and `/InputData/a-millennium...dta` to create `Outputs/Data/ChildPrices.csv` for Figure 7
- `FigureA1_DrawSchemlzingDataAppendix.do` extracts various interest rate series from `/InputData/eight-centuries...xlsx` and `InputData/Clark1988...xlsx` to create figures in `/Outputs/Graphs/` for Appendix A
- `FigureA2_UKSurvivalProbabilities.do` calculates the life expectancy series using `InputData/LongRunLifeExpectanciesByCountry.xlsx` to create `/Outputs/Data/UkSurvProb.csv`
- `globalGDPPop.do` uses `maddison.csv` to create various data series in `Outputs/Data/popgdppcIndex.csv` and `/Outputs/Data/grPopGdppc.csv`
- `ObtainCleanDenormPatienceGPS.do` denormalizes the Falk et al. (2018) data using `InputData/individual_v11.dta` and `InputData/popWDI2000.dta` to create `Outputs/Data/denormpatience.csv` and `Outputs/Data/sdByCountry.csv`
- `ObtainCleanPopulationMaddison.do` interpolates a population series using `/InputData/maddison_pop.csv` to create `Outputs/Data/maddison_pop.csv`
- `ObtainCleanRatesOfReturnEBT.do` uses `/Outputs/Tables/lrinterestrate` to create `Outputs/Data/longRunReturnsData.dta`
- `ObtainLongRunConsShare.do` constructs the long run global consumption share using `InputData/GDPCONSWDI.dta` to create `Outputs/Tables/lrconsshare`
- `ObtainRateOfReturnpost2000EBT.do` uses `Outputs/Data/longRunReturnsData.dta` to create `/Outputs/Tables/lrinterestrate`
- `TableA3-A4_PatienceSOEP.do` calculates regression output in Table A3-A4. Proprietary SOEP data is available on license from the provider.
- `TablesA5-A6_LongRunReturnsEBT.do` constructs summary statistics for long run rates of return in equities, bonds and treasures (Tables A5 and A6)

3. Outputs used in paper

The following gives the relationship between each figure or table in the printed paper and the data and outputs files

Figures

Main paper

- Figure 1A uses `InputData/Data_Schmelzing25.csv` as calculated from Schmelzing (2020) in `InputData/Figure1A_Schmelzing25.xlsx`

- Figure 1B uses `InputData/Figure1B_Data_Clark.csv` extracted from Clark (2010)
- Figure 2A uses $((g_D^{(1/25))} - 1) * 100$ from `Outputs/Model/Baseline/modelOutputs.csv` and `Outputs/Model/Full/modelOutputs.csv`
- Figure 2B uses `a` from `Outputs/Model/Baseline/modelOutputs.csv` and `Outputs/Model/Full/modelOutputs.csv`
- Figure 2C uses `pie` from `Outputs/Model/Baseline/modelOutputs.csv` and `Outputs/Model/Full/modelOutputs.csv`
- Figure 3A uses `socbetamodel` from `Outputs/Model/Full/PatiencePopCapitalShares.csv`
- Figure 3B uses `distXXXX` from `Outputs/Model/Full/patienceDistributionOverTime.csv`
- Figure 3C uses `nqXmodel` from `Outputs/Model/Full/patienceDistributionOverTime.csv`
- Figure 3D uses `kqXmodel` from `Outputs/Model/Full/patienceDistributionOverTime.csv`
- Figure 4A uses `gdppc` from `Outputs/Model/Baseline/modelOutputs.csv` and `Outputs/Model/Full/modelOutputs.csv`
- Figure 4B uses `pop` from `Outputs/Model/Baseline/modelOutputs.csv` and `Outputs/Model/Full/modelOutputs.csv`
- Figure 4C uses `fert` from `Outputs/Model/Baseline/modelOutputs.csv` and `Outputs/Model/Full/modelOutputs.csv` and fertility calculated using the population and life expectancy data: $f_t = N_{t+1}/N_t - \pi_t$
- Figure 5A uses `InputData/Data_Schmelzing25.csv` and calculations on `r` from `Outputs/Model/Baseline/modelOutputs.csv` and `Outputs/Model/Full/modelOutputs.csv`
- Figure 5B uses `InputData/Data_Schmelzing25.csv` and calculations on `rHomo` from `Outputs/Model/Baseline/modelOutputs.csv` and `Outputs/Model/Full/modelOutputs.csv`
- Figure 5C uses `InputData/Data_Schmelzing25.csv` and calculations on `r` and `rHomo` from `Outputs/Model/Baseline/modelOutputs.csv` and `Outputs/Model/Full/modelOutputs.csv`
- Figure 6 uses `r` (Full model), `rConsPop` (Fixed N), `rConsProd` (Fixed D), `rConsProb` (Fixed π), `rConsPopProbProd` (Selection only) and `rFullHomo` (Fixed β) from `Outputs/Model/Full/modelOutputsDecomposition.csv`
- Figure 7A uses `fert` and `gdppc` in `Outputs/Model/Baseline/modelOutputs.csv` and `Outputs/Model/Full/modelOutputs.csv`; fertility data calculated using the population and life expectancy data: $f_t = N_{t+1}/N_t - \pi_t$
- Figure 7B uses `qrelPaas` in `Outputs/Model/Baseline/modelOutputs.csv` and `Outputs/Model/Full/modelOutputs.csv` and `rel_ps_cpi_hp` in `Outputs/Data/ChildPrices.csv`
- Figure 7C uses `savrate` in `Outputs/Model/Baseline/modelOutputs.csv` and `Outputs/Model/Full/modelOutputs.csv` and `InputData/Data_BdP.csv`

Online appendix

- Figure A1 uses the figures in `/Outputs/Graphs/` generated by `FigureA1_DrawSchemlzingDataAppendix.do`
- Figure A2 uses data from `UkSurvProb.csv` and smoothed `pie*100` from `Model/Outputs/Baseline/modelOutputs.csv`, as calculated in `FigureA2_UKSurvivalProbabilities.do`
- Figure A3 uses equivalent `/Baseline/` output to Figure 3 described above
- Figure A4 uses `variance` and `selection` from `Model/Outputs/Full/varyGammaToExport.csv` and `Model/Outputs/Full/varyDeltaToExport.csv`
- Figure A5 uses `RA`, `RB`, `RC`, `RBaseline`, `SA`, SB and `SC` from `Model/Outputs/Full/mutations.csv`
- Figure A6 uses `R1`, `R2`, `R3`, `RBaseline`, `S1`, `S2` and `S3` from `Model/Outputs/Full/mutations.csv`
- Figure A7 uses `InputData/Data_Schmelzing25.csv` and calculations on `r` and `rHomo` from `Outputs/Model/Fixed/modelOutputs.csv`

Tables

Main paper

- Table 1 using numbers in `Outputs/Model/Baseline/CalibParameters.csv` and `Outputs/Model/Full/CalibParameters.csv`
- Table 2 using numbers as calculated in `Decomposition.nb` and contained in `Outputs/Model/Full/decompout.csv`

Online appendix

- Table A1 contains summary detail on the Schmelzing (2020) 'safe rate'
- Table A2 reports various interest rates from sources noted below the Table
- Table A3 reports regression output of `TableA3-A4_PatienceSOEP.do`
- Table A4 reports regression output of `TableA3-A4_PatienceSOEP.do`
- Table A5 uses `Tables/sumstatsrirA.csv`
- Table A6 uses `Tables/sumstatsrirG.csv`
- Table A7 contains parameter values used in the fixed capital version of the model