RagePackageTest

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Multi Month Closures

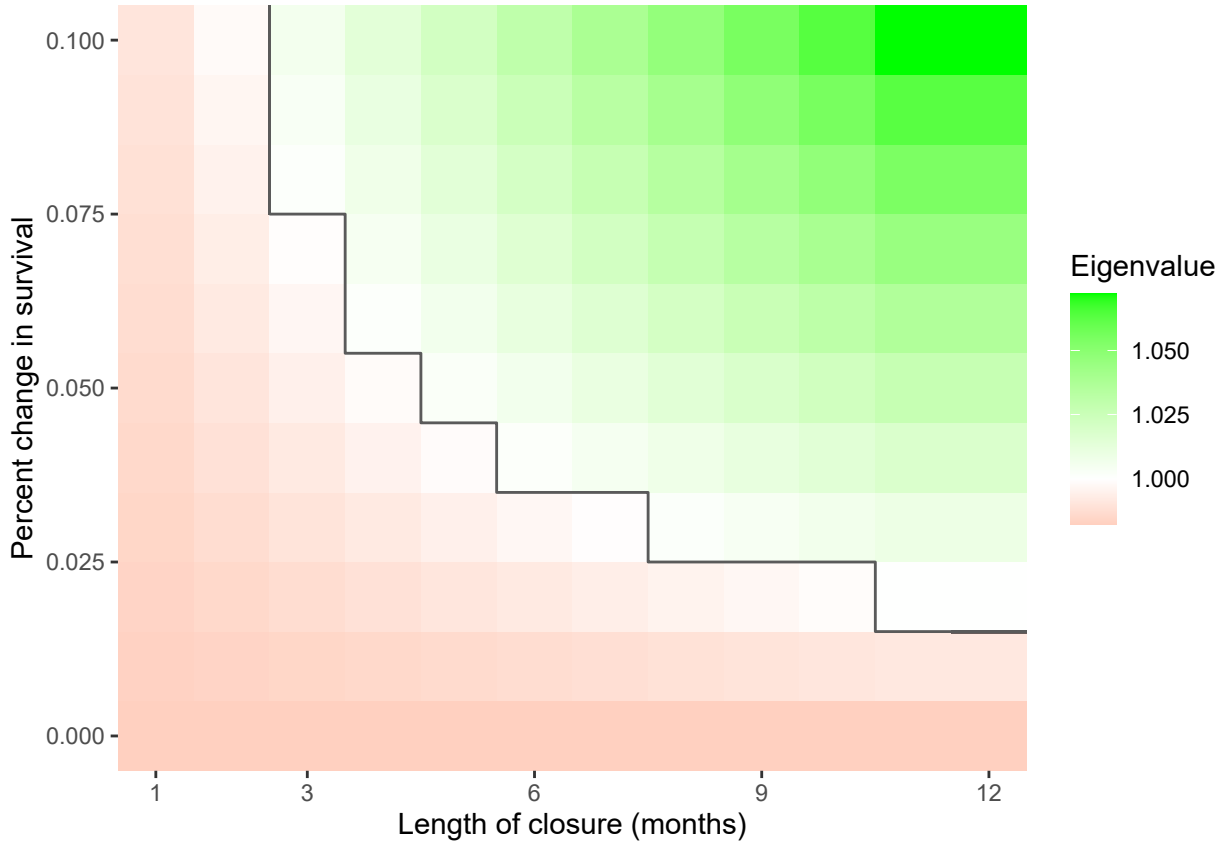

Figure 1: Projections of different lengths of closures. Agrees with the 7% increase needed for 3 month closures. Double check with other graph.

Rage Package info

This package also has the following functions I didn't bother with:

- mpm_collapse which collapses a matrix population model to a smaller number of stages
- mpm_rearrange which rearranges stages of a matrix population model to segregate reproductive and non-reproductive stages
- name_stages allows user to name stages
- perturb_stochastic calculates stochastic elasticities from a time-series of matrix population models and corresponding population vectors
- pop_vectors derives a hypothetical set of population vectors corresponding to a time-series of matrix population models
- repro_stages Identify which stages in a matrix population model are reproductive
- shape_rep Calculate shape of reproduction over age. TBH I just didn't get this one
- shape_surv Calculate shape of survival over age. Same as above
- standard_stages Identify stages corresponding to different parts of the reproductive life cycle

Note: Not using the default matU or matR. Double check that

Age from Stage

Age specific calculations from Rage package

Age	Reproduction	Survivorship	SurvivalProb	MortalityHazard
1	0.0000000	1.0000000	0.9048003	0.1000411
2	0.0000000	0.9048003	0.7670599	0.2651903
3	0.0000000	0.6940360	0.7123393	0.3392010
4	0.1801271	0.4943891	0.6830319	0.3812137
5	0.4417776	0.3376835	0.6650848	0.4078408
6	0.7077949	0.2245882	0.6533941	0.4255748
7	0.9405289	0.1467446	0.6455709	0.4376202
8	1.1279077	0.0947340	0.6402850	0.4458419
9	1.2709528	0.0606568	0.6367104	0.4514404
10	1.3761398	0.0386208	0.6343017	0.4552305
11	1.4513443	0.0244972	0.6326881	0.4577777
12	1.5039407	0.0154991	0.6316142	0.4594765
13	1.5400772	0.0097895	NA	NA

Life Expectancy and longevity

Life expectancy applies Markov chain approaches to calculate. Longevity - (the age x at which survivorship for a synthetic cohort falls below some critical proportion (in this case 0.01).

Note: Life expectancy and longevity are very different. Wut?

X1	X2
Life Expectancy	4.062737
Life Exp Variance	5.865930
longevity	12.000000

Life Table

- x age at the start of the age interval [x, x+1)
- Nx The number of individuals alive at age x. The initial number is set with radix
- Dx proportion of original cohort dying during the age interval [x, x+1)
- lx survivorship, defined as the proportion of initial cohort surviving to the start of age interval [x, x+1)
- dx proportion of original cohort dying in the age interval [x, x+1)
- ax The average time survived within the interval by those that die during the age interval [x, x+1). Assumed to be 0.5
- hx force of mortality (hazard) during the age interval [x, x+1)
- qx probability of death during the interval [x, x+1) for those entering the interval
- px probability of survival for the interval [x, x+1) for those entering the interval
- Lx total person-years lived during the interval [x, x+1)
- Tx total person years lived beyond age x
- ex remaining life expectancy at age x
- mx per-capita rate of sexual reproduction during the interval [x, x+1)
- lxmx expected number of sexual offspring per original cohort member produced during the interval [x, x+1)

x	lx	dx	hx	qx	px	ex	mx	lxmx
0	1.0000000	0.0951997	0.0999577	0.0951997	0.9048003	3.546039	0.0000000	0.0000000
1	0.9048003	0.2107642	0.2636471	0.2329401	0.7670599	2.866532	0.0000000	0.0000000
2	0.6940360	0.1996469	0.3359857	0.2876607	0.7123393	2.585199	0.0000000	0.0000000
3	0.4943891	0.1567056	0.3766632	0.3169681	0.6830319	2.427255	0.1801271	0.0890529
4	0.3376835	0.1130954	0.4022801	0.3349152	0.6650848	2.321617	0.4417776	0.1491810
5	0.2245882	0.0778436	0.4192659	0.3466059	0.6533941	2.238925	0.7077949	0.1589624
6	0.1467446	0.0520106	0.4307673	0.3544291	0.6455709	2.161373	0.9405289	0.1380175
7	0.0947340	0.0340773	0.4386006	0.3597150	0.6402850	2.073494	1.1279077	0.1068513
8	0.0606568	0.0220360	0.4439266	0.3632896	0.6367104	1.957489	1.2709528	0.0770919
9	0.0386208	0.0141236	0.4475285	0.3656983	0.6343017	1.789093	1.3761398	0.0531476
10	0.0244972	0.0089981	0.4499474	0.3673119	0.6326881	1.532303	1.4513443	0.0355539
11	0.0154991	0.0057097	0.4515599	0.3683858	0.6316142	1.131614	1.5039407	0.0233097
12	0.0097895	0.0097895	2.0000000	1.0000000	0.0000000	0.500000	1.5400772	0.0150765

Table 1: Sensitivity Perturbations

0.3741554	0.1560649	0.0344634	0.0049345
0.4787263	0.1996833	0.0440955	0.0063136
2.4286661	1.0130279	0.2237048	0.0320303
15.3512859	6.4031296	1.4139889	0.2024572

Table 2: Elasticity Perturbations

0.2399484	0.0000000	0.0000000	0.1342068
0.1342067	0.0654763	0.0000000	0.0000000
0.0000000	0.1342065	0.0894979	0.0000000
0.0000000	0.0000000	0.1342063	0.0682503

Perturbation Matrices

Perturbs elements within a matrix population model and measures the response (sensitivity or elasticity) of the per-capita population growth rate at equilibrium ( ), or, with a user-supplied function, any other demographic statistic.

Perturbation Analysis of transition types

Calculates the summed sensitivities or elasticities for various transition types within a matrix population model (MPM), including stasis, retrogression, progression, fecundity, and clonality.

Sensitivities or elasticities are calculated by perturbing elements of the MPM and measuring the response of the per-capita population growth rate at equilibrium ( ), or, with a user-supplied function, any other demographic statistic.

- stasis The sensitivity or elasticity of lambda to stasis.
- retrogression The sensitivity or elasticity of lambda to retrogression.
- progression The sensitivity or elasticity of lambda to progression.
- fecundity The sensitivity or elasticity of lambda to sexual fecundity.
- clonality The sensitivity or elasticity of lambda to clonality.

Measure	Sensitivity	Elasticity
Stasis	1.0000007	0.4631730
Retrogression	NA	NA
Progression	2.9057432	0.4026194
Fecundity	0.0049345	0.1342068
Clonality	NA	NA

Perturbation analysis of vital rates

Perturbs lower-level vital rates within a matrix population model and measures the response (sensitivity or elasticity) of the per-capita population growth rate at equilibrium ( ), or, with a usersupplied function, any other demographic statistic. These decompositions assume that all transition rates are products of a stage-specific survival term (column sums of matU) and a lower level vital rate that is conditional on survival (growth, shrinkage, stasis, dormancy, or reproduction). Reproductive vital rates that are not conditional on survival (i.e., within a stage class from which there is no survival) are also allowed.

- survival sensitivity or elasticity of demog_stat to survival
- growth sensitivity or elasticity of demog_stat to growth
- shrinkage sensitivity or elasticity of demog_stat to shrinkage
- fecundity sensitivity or elasticity of demog_stat to sexual fecundity
- clonality sensitivity or elasticity of demog_stat to clonality

Measure	Sensitivity	Elasticity
Survival	1.8922055	0.9999992
Growth	1.0406220	0.2500416
Shrinkage	0.0000000	0.0000000
Fecundity	0.0016331	0.1342068
Clonality	0.0000000	0.0000000

Table 3: Survival independent rates - Survival

0.6958263	NA	NA	NA
0.3041737	0.7122376	NA	NA
NA	0.2877624	0.8082501	NA
NA	NA	0.1917499	NA

Table 4: Survival independent rates - Reproductive

NA	NA	NA	80.67898
NA	NA	NA	NA
NA	NA	NA	NA
NA	NA	NA	NA

Plot life cycle

look R can do this for you

Age of reproductive maturity

X1	X2
Prob of reaching mat	0.0218669
Age at Mat	6.8211804

Vital Rates

Corresponding to separate demographic processes

Derive mean vital rates corresponding to separate demographic processes from a matrix population model. Specifically, this function decomposes vital rates of survival, progression, retrogression, sexual reproduction and clonal reproduction, with various options for weighting and grouping stages of the life cycle.

surv	retr	prog	fec	clo
0.5434124	0	0.2612287	26.7005	0

Mean vital rates

X1	X2
Rate of Survival	0.5434124
Rate of Growth	0.2612287
Rate of shrinkage	NA
Rate of stasis	0.7387713

Survival independent rates

Stage specific vital rates

Stage	Survival	Growth	Stasis	Reproduction
1	0.9048003	0.3041737	0.6958263	NA
2	0.4519657	0.2877624	0.7122376	NA
3	0.4859363	0.1917499	0.8082501	NA
4	0.3309474	NA	NA	80.67898

Misc

Demetrius' entropy, Keyfitz's entropy, generation time, net reproduction, Time to stable stage

Note: method for net reproductive value (R0) from a matrix population model. The net reproduction value (R0) is the mean number of recruits produced during the mean life expectancy of an individual. Note: Can also specify "start" for method but if offspring only arise in stage start, the two methods give the same result.

Note: method for generation time specified as R0, the time required for a population to increase by a factor of R0 (the net reproductive rate; Caswell (2001), section 5.3.5). Other options: the average parent-offspring age difference (Bienvenu & Legendre (2015)), or the expected age at reproduction for a cohort (Coale (1972), p. 18-19).

X1	X2
Demetrius' Entropy	2.1100118
Keyfitz's Entropy	0.5920757
Generation Time	7.3827459
Net Reproduction	0.8726632
Time to Stable Stage Dist	9.0000000