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Field Exam for Economic Demography

Please answer all parts of all four questions, which will be weighted equally in the total grade. Cite the literature where appropriate. You have three hours.

1. Consider economic influences on marriage behavior and fertility.
   a) Briefly explain the concept of the gains to marriage, originally developed by Becker. Falling mortality in Third World countries led to rapid population growth in recent decades. Drawing on Becker's theory and class discussion, how might this have affected the division of the gain to marriage between males and females? (Think of the sex ratio in the marriage market.)
   b) Briefly explain in words the role of the value of female time in the economic theory of fertility; no equations or diagrams are necessary.
   c) Now consider the effect on both marriage behavior and fertility of a reduction in discrimination against women in the labor force, drawing on the relevant theories you have sketched above.

2. A policy maker is worried about projected population aging in the US, and its fiscal consequences. The policy maker consults experts. The first suggests that we raise the quota for legal immigrants, in order to reduce the pace and extent of population aging. The another argues that this would be a mistake, because increased immigration would reduce wages and therefore reduce tax revenues rather than increase them. The first one counters that wage rates are actually higher in local labor markets with higher proportions of immigrants.
   a) Could the economic consequences of population aging be avoided by switching the responsibility for supporting the elderly from the public sector to the family? Explain.
   b) Does the empirical literature suggest that increased immigration would have a substantial negative impact on wages of US native workers? Discuss this literature and any issues of research design that you think are relevant.
   c) Are there theoretical reasons to expect the impact of immigrant workers on native wages to be large or small? Discuss, including consideration of the static effect (holding capital constant), the dynamic impact (allowing capital to vary), and demand side effects. You may use diagrams or equations if you choose, but they are not required.

3. A strong positive association between health and socio-economic status has been observed within many countries, but the direction of causality underlying this association is disputed.
   a) Discuss the evidence of this association that is presented in the study by Banks et al that compares health outcomes in the US and UK.

b) Almond presents evidence that conditions in utero affect health outcomes in later life.
c) Smith argues, among other things, that the direction of causality over much of the life cycle goes from health to socio-economic outcomes.
d) Are these three studies consistent or inconsistent with one another? Can you draw any general policy recommendations from them?

4. There is lively interest in the field of behavioral economics in identifying human genetic variants, or "alleles" which affect propensities for risk taking and other traits which may alter survival chances and lifespans. In such genetic studies, it is important to measure how lifetable survivorship values $\ell_x(C)$ for carriers of an allele, labeled "C", differ from survivorships $\ell_x(W)$ for the whole cohort, labeled "W".

a) Table 1 shows lifetable survivorships ℓ_x and corresponding standard logits Y_x for a special Brass standard based on recent combined-sex German data. Suppose we have empirical data for two ages for the whole cohort in a study population, namely $\ell_{55}(W) = 0.886$ and $\ell_{80}(W) = 0.621$. Find the Brass relational logit parameters α and β which give the best fit to these two lifetable observations.

b) Most genetic studies only have period data and do not directly provide values for $\ell_x(C)$. However, suppose that researchers have used proportions of carriers observed in the two age groups $x = 55$ and $y = 80$ to estimate an odds ratio

$$\frac{\ell_y(C)}{1 - \ell_y(C)} \Big/ \frac{\ell_x(C)}{1 - \ell_x(C)} = 0.2120$$

Can you estimate a value of Brass's β parameter for carriers ("C") from this ratio? If yes, please do so. If not, please explain very briefly why not.

c) Can you estimate a value of Brass's α parameter for carriers from the ratio in Part (b)? If yes, please do so. If not, please explain very briefly why not.

d) Suppose now that survival to age 55 for carriers differs little from that for the whole cohort and that only older ages are affected by the particular genetic propensities for risk under study. How much would the probability of surviving to age 100 for carriers differ from the probability for the whole cohort?

Table 1: Brass Standard Based on 2008 German Period Lifetable

x	ℓ_x	Y_x	x	ℓ_x	Y_x
1	**0.99657**	**2.835880**	**80**	**0.61078**	**0.225296**
10	**0.99537**	**2.685279**	**85**	**0.43590**	**-0.128909**
20	**0.99343**	**2.509325**	**90**	**0.23170**	**-0.599368**
50	**0.96364**	**1.638624**	**95**	**0.07020**	**-1.291811**
55	**0.93917**	**1.368457**	**100**	**0.01001**	**-2.297055**
60	**0.91538**	**1.190584**	**101**	**0.00605**	**-2.550814**
67	**0.85382**	**0.882441**	**102**	**0.00351**	**-2.824312**
70	**0.81844**	**0.752907**	**103**	**0.00196**	**-3.116424**

A Selection of Useful Formulas

Growth Rate: $R = (1/T)\log(K(T)/K(0))$

Exponential Growth: $K(t+n) = K(t)e^{Rt}$

Survival from hazards: $l_{x+n} = l(x)e^{-h_x\ n}$

Gompertz Model: $h(x) = \alpha e^{\beta x}$; $l_x = \exp\big((-\alpha/\beta)(e^{\beta x} - 1)\big)$

Period Lifetable: ${}_nq_x = \dfrac{(n)({}_nM_x)}{1 + (n - {}_na_x)({}_nM_x)}$

Age Specific Death Rate: ${}_nM_x = {}_nD_x \,/\, {}_nK_x$

First Age Factor: ${}_1a_0 = 0.07 + 1.7({}_1M_0)$.

Second Age Factor: ${}_4a_1 = 1.5$

Survivorship: $l_{x+n} = l_x(1 - {}_nq_x) = l_x - {}_nd_x$

Person-Years Lived: ${}_nL_x = (n)(l_{x+n}) + ({}_na_x)({}_nd_x)$

Lifetable death rate: ${}_nm_x = {}_nd_x/{}_nL_x$

Expectation of Life: $e_x = T_x/l_x$

Brass's Logit System: $l_x = \dfrac{1}{1 + \exp(-2\alpha - 2\beta Y_x)}$

Leslie Matrix Top Row: $\dfrac{{}_nL_0}{2l_0}\left({}_nF_x + {}_nF_{x+n}\dfrac{{}_nL_{x+n}}{{}_nL_x}\right) f_{fab}$

Leslie Matrix Subdiagonal: $\dfrac{{}_nL_{x+n}}{{}_nL_x}$

Lotka's Equation: $1 = \sum (1/2)\left({}_nF_{x\,n}L_x + {}_nF_{x+n\,n}L_{x+n}\right)(f_{fab}/l_0)e^{-r(x+n)}$

Stable Age Pyramid : ${}_nK_x^{stable} = B({}_nL_x)\, e^{-rx}$

Lotka's Parameter: $r \approx \log(NRR)/\mu$