

**Department of Economics
University of California, Berkeley**

Field Examination in Economic Demography

21 August 2009

Please answer all parts of all questions. The four questions count equally, and all parts count equally except as indicated in Question 4. Cite the literature where appropriate.

This is a closed-book examination. Please start your answer to each of the four questions on a new page. For the question on demographic methods, show your work and label your answers clearly. Answers with decimals should be given with six figures beyond the decimal point. Useful formulas are included at the end of the examination. A list of readings covered on the Field Exam is provided at the end of the exam.

1. In a developing country with limited demographic data on a national level, one local district has been monitored by a demographic program including periodic household enumerations and vital registration extending over several decades. A 1988 enumeration indicated a total population of 25,772 in the district. A 2003 enumeration indicated 33,258, including 1,244 under the age of 1 year.

a) What was the growth rate R for this district between 1988 and 2003?

b) There were 128 infant deaths recorded in the district in 2003. Calculate the value of the period life table probability of dying ${}_1q_0$. Government statistics assert that a proportion $\ell_5 = 0.85$ of all children survive to the age of 5. If yearly probabilities of dying were constant between the ages of 1 and 5, how low would this yearly probability have to be for the government's claim to be true?

c) The population of the district is composed primarily of two ethnic groups, with very different levels of fertility and migration. Group A has been declining in the district at a rate of $R = -0.020$ per year since 2003, due both to comparatively low fertility and to migration out of the district, mainly to a relatively distant provincial capital. Group B has very high fertility and little migration out of the district, and its numbers in the district have been increasing at the dramatic rate of $R = +0.040$ since 2003. The sizes of the

two groups were about equal in 2003. If the growth rates of the two groups persist until 2010, what total population would you predict in 2010 in the district? What proportion of this total would consist in members of Group B?

d) Taking into account the differing growth of the two groups, what growth rate would you estimate for the whole population between 2003 and 2010? How does this rate compare with the less sophisticated rate assumed in Part “a”?

e) In a thought experiment, we imagine the growth rates for the two ethnic groups persisting forever into the future. In this imaginary setting, what would be the shortest doubling time for the district population that would ever occur?

A Selection of Useful Formulas

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

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

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

$$\text{Gompertz Model: } h(x) = \alpha e^{\beta x}; l_x = \exp\left(\frac{-\alpha}{\beta}(e^{\beta x} - 1)\right)$$

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

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

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

$$\text{Second Age Factor: } {}_4a_1 = 1.5$$

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

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

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

$$\text{Expectation of Life: } e_x = T_x / l_x$$

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

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

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

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

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

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

2. (25) This question concerns sex bias in familial behavior:
- a) (8) Becker's economic theory of fertility does not distinguish between male and female children. Discuss how you might introduce male and female children into his Quantity-Quality theory. You do not need to write down a mathematical model, but you should discuss any issues that arise and possible implications of your two-sex analysis for sex biased fertility, sex biased investments per child, and the effects on these of income.
 - b) (8) We know from many studies that in some cultures, there is a sex bias in fertility. Does this sex bias carry over to a bias in investment in the human capital of male and female children? Describe an empirical analysis you could do to investigate this question.
 - c) (9) Drawing on the theory of marriage, discuss the later consequences for female well being and other outcomes, including female labor force participation, of male-biased sex selection and investment.

3. (25) In a recent article, Borjas claims that analysis of the effects of immigration on the wages of domestic workers is best carried out at the national level rather than at the level of local labor markets. Explain the basis for this claim, and sketch his strategy for the national analysis. What is Card's view about whether analysis of local labor markets is helpful in this regard, and what evidence does he present in support of his view?

4. (25) Below are listed three papers on different aspects of the relation of population change to economic development (Acemoglu and Johnson, Bloom et al, and Miller). Each attempts to draw causal conclusions from empirical analysis. Explain the problems of endogeneity that arise in each of these three analyses, and the identification strategy employed in each case. Which of the three papers did you find most and least convincing, and why?

Daron Acemoglu and Simon Johnson (2007) "Disease and Development: the Effect of Life Expectancy on Economic Growth", *Journal of Political Economy*, (December) volume 115, pp. 925-985.

David E. Bloom, David Canning, Günther Fink, and Jocelyn E. Finlay (2007) "Fertility, Female Labor Force Participation, and the Demographic Dividend" working paper (September).

Grant Miller (2007) "Contraception as Development? New Evidence from Family Planning in Colombia," (May) working paper.

For your reference, here is a list of readings covered by the field exam:

Background

(*)-Ron Lee (2003) "The Demographic Transition: Three Centuries of Fundamental Change" *Journal of Economic Perspectives* v.17 n.4 Fall 2003 pp.167-190

Economics of Marriage and Divorce

(**)Becker Gary, Elizabeth Landes, and Robert Michael (1977) "An Economic Analysis of Marital Instability" *Journal of Political Economics* 85(6): 1141-1187

(*)Lundberg, Shelly and Robert Pollack (2007) "The American Family and Family Economics" *Journal o Economic Perspectives* v.21 n.2 Spring pp.3-26

(#)Stevenson Betsey, Justin Wolfers (2007) "Marriage and Divorce: Changes and their Driving Forces" *Journal of Economic Perspectives* v.21 n.2 Spring pp.27-52

(#)Angrist Josh (2002) "How do Sex Ratios Affect Marriage and Labor Markets? Evidence from America's Second Generation" *Quarterly Journal of Economics*. Vol. 117 No.3 (Aug 2002) pp.997-1038

(#)#Grossbard, Shoshana and Catalina Amuedo-Dorantes (2007) "Cohort-level sex ratio effects on women's labor force participation" *Review of Economics of the Household*, v.5 n.3 (September), pp.249-278. (May need to get hardcopy from me; not sure.) []

#DAN ARIELY, GUENTER J. HITSCH, ALI HORTACSU (2008) "Matching and Sorting in Online Dating" Working Paper. (**bSpace**) []

#ALOYSIUS SIOW and CHASS.UTORONTO.CA (2008) "How Does the Marriage Market Clear? An Empirical Framework" *Canadian Journal of Economics*, Vol. 41, Issue 4, pp. 1121-1155, November/novembre 2008 []

#NGUYEN VI CAO, EMMANUEL FRAGNIERE, JACQUES-ANTOINE GAUTHIER, MARLÈNE SAPIN, ERIC WIDMER (2008) "Optimizing the Marriage Market Through the Reallocation of Partners: An Application of the Linear Assignment Model", Working Paper. (**bSpace**) []

Economics of Fertility

**Gary S. Becker (1992) "Fertility and the Economy," *Journal of Population Economics* v.5 n.3 (August) pp.185-201.

Martha Bailey (2006) "More Power to the Pill: The impact of contraceptive freedom on women's life cycle labor supply" *Quarterly Journal of Economics*

Adsera, Alicia. 2004. "Changing Fertility Rates in Developed Countries: The Impact of Labor Market Institutions." *Journal of Population Economics*.

- [AreChildrenNormal.pdf](#)
- [TertiltEcHistOfUSFert.pdf](#) (Kelvin)
- [BillariFertAndPensions.pdf](#)
- [\(FLFP by age of young child.pdf](#) probably less interesting than others)
- [HowParentsAllocateTime.pdf](#) (Alma)
- [MorettiDemandForSons.pdf](#) (Emily)
- [\(OsterHepBAndMaleSexRatio.pdf](#) – retraction of an earlier argument made by Emily Oster on causes of sex ratio imbalance in China)

#Angrist, Josh (2002) "How Do Sex Ratios Affect Marriage and Labor Markets? Evidence from America's Second Generation", *Quarterly Journal of Economics*, Vol. 117, No. 3. (Aug., 2002), pp. 997-1038. [Monica]

#DAN ARIELY, GUENTER J. HITSCH, ALI HORTACSU (2008) "Matching and Sorting in Online Dating" Working Paper. (**bSpace**) [Aaron]

#NGUYEN VI CAO, EMMANUEL FRAGNIERE, JACQUES-ANTOINE GAUTHIER, MARLÈNE SAPIN, ERIC WIDMER (2008) "Optimizing the Marriage Market Through the Reallocation of Partners: An Application of the Linear Assignment Model", Working Paper. (**bSpace**) [Kirsten]

George Akerlof, Janet Yellen, and Michael Katz, "An Analysis of Out-of-Wedlock Childbearing in the United States," *Quarterly Journal of Economics*, May 1996, 111(2): 277-317

*Claudia Goldin (2006) "The 'Quiet Revolution' That Transformed Women's Employment, Education, and Family," *American Economic Review, Papers and Proceedings*, (Ely Lecture), 96 (May), pp. 1-21. (read **lightly**).

Causal Analysis in Economic Demography

**Robert Moffit (2005) "The Analysis of Causal Relationships in Population Research", *Demography* (Feb 2005), pp.91-108. (Read this article carefully)

These next two on causality and natural experiments are optional. No need even to skim unless you want to.

Rosenzweig, Mark and Ken Wolpin (2000) "Natural 'Natural Experiments' in Economics" *Journal of Economic Literature* 38:827-74.

Andus Deaton (2009) "INSTRUMENTS OF DEVELOPMENT: RANDOMIZATION IN THE TROPICS, AND THE SEARCH FOR THE ELUSIVE KEYS TO ECONOMIC DEVELOPMENT" NBER WP 14690

This next one you should skim to get the basic idea.

Report: Kasey Buckles and Daniel M. Hungerman “SEASON OF BIRTH AND LATER OUTCOMES: OLD QUESTIONS, NEW ANSWERS” NBER Working Paper 14573

Arline Geronimus and Sanders Korenman (1992) “The Socioeconomic Consequences of Teen Childbearing Reconsidered,” *Quarterly Journal of Economics* CVII: pp.1187-1214.

Joe Hotz, S. McElroy and S. Sanders (1996) “The Costs and Consequences of Teenage Childbearing for Mothers”, in *Kids Having Kids: Economic Costs and Social Consequences of Teen Pregnancy* (Urban Institute Press).

Gertler P and J Molynueax (2000) “The Allocation and Impact of Planning Program Inputs in Indonesia,” in Cyrus Chu and Ronald Lee, eds., *Population and Economic Change in East Asia, Population Development Review* 2000, Vol. 26 (Sup) pp. 61-88.

Health and Mortality

*James Smith (2005) “Unraveling the SES-Health Connection”, *Population and Development Review*, Special Issue (February).

*Robert Fogel (2004) “Why the Twentieth Century Was So Remarkable”, Chapter 2 of Robert Fogel, *The Escape from Hunger and Premature Death, 1700-2100* (Cambridge University Press, Cambridge England), pp.20-42.

* “THE SES HEALTH GRADIENT ON BOTH SIDES OF THE ATLANTIC” James Banks, Michael Marmot, Zoe Oldfield, James P. Smith. NBER Working Paper 12674.

* “HEALTHY, WEALTHY, AND WISE: SOCIOECONOMIC STATUS, POOR HEALTH IN CHILDHOOD, AND HUMAN CAPITAL DEVELOPMENT” Janet Currie, NBER Working Paper 13987.

“A Dynamic Model of Birth Weight” by Emilia Del Bono, John Ermisch, And Marco Francesconi, IZA Discussion Paper No. 3704 (September 2008).

“Being Born Under Adverse Economic Conditions Leads to a Higher Cardiovascular Mortality Rate Later in Life: Evidence Based on Individuals Born at Different Stages of the Business Cycle” Gerard J. van den Berg, Gabriele Doblhammer-Reiter, Kaare Christensen (IZA Discussion Paper No. 3635 August 2008).

Douglas Almond (2006) “Is the 1918 Influenza Pandemic Over? Long-term Effects of In Utero Influenza Exposure in the Post-1940 U.S. Population” *Journal of Political Economy*, 114 (August 2006), 672-712.

Age Composition, Family Life Cycle, and Intergenerational Transfers

* A.V. Chayanov, *The Theory of Peasant Economy*, Daniel Thorner et al translators, (University of Wisconsin Press, 1986; originally 1925); pp. 53-60 and bottom 76-81.

* Ronald Lee and Karen Kramer (2002) "Children's Economic Roles in the Context of the Maya Family Life Cycle: Cain, Caldwell, and Chayanov Revisited," *Population and Development Review*, 28 (3):475-499 (September 2002). (.)

** Gary S. Becker and Kevin M. Murphy (1988), "The Family and the State," Supplement to Chapter 11 in *A Treatise on the Family* (Enlarged Edition), Harvard University Press, reprinted from Gary S. Becker and Kevin M. Murphy (1988), *Journal of Law and Economics*, April, pp. 1-18. (Read carefully.)

* Ronald Lee. (2003) "Demographic Change, Welfare, and Intergenerational Transfers: A Global Overview," *Genus* v.LIX, no. 3-4 (July-December), p.43-70.

The following two articles are optional; not required even to skim.

Donald Cox, "Motives for Private Income Transfers," *Journal of Political Economy*, June 1987, 95: 508-546.

Yean-Ju Lee, William L. Parish, and Robert J. Willis, "Sons, Daughters, and Intergenerational Support in Taiwan," *American Journal of Sociology*, January 1994, 1010-1041.

*Ron Lee "Some notes on modeling the interface of demography and macro-economics", on bSpace as PopEconMath. 5 pages.

*Paul Samuelson (1958) "An Exact Consumption-Loan Model of Interest With or Without the Social Contrivance of Money," *Journal of Political Economy* v.66 n.6 pp.467-482.

*Ronald Lee (1994) "The Formal Demography of Population Aging, Transfers, and the Economic Life Cycle," in Linda Martin and Samuel Preston, eds., *The Demography of Aging* (National Academy Press).

*David Cutler, James Poterba, Louise Sheiner, and Lawrence Summers (1990) "An Aging Society: Opportunity or Challenge?" *Brookings Papers on Economic Activity* v.1, pp.1-56 and 71-73.

Immigration

*George Borjas (2003) “The Labor Demand Curve is Downward Sloping: Reexamining the Impact of Immigration on the Labor Market”, *Quarterly Journal of Economics* (November), pp.1335-74.

*David Card (2009) “IMMIGRATION AND INEQUALITY”, Eli Lecture to American Economic Association, Jan 2009, and NBER Working Paper 14683, at <http://www.nber.org/papers/w14683>

*David Card “Is the New Immigration Really So Bad?” *Economic Journal* 115 (November 2005). bSpace (There is some overlap with his Eli Lecture).

Population and Economic Development (with introductions to many of the readings)

*National Research Council Working Group on Population and Economic Development (1986) *Population and Economic growth Development: Policy* <http://search.nap.edu/nap-cgi/de2007.cgi?term=population+growth+and+economic+development&GO.x=0&GO.y=0>

*Allen C. Kelley, Robert M. Schmidt (2005) “Evolution of recent economic-demographic modeling: A synthesis” *Journal of Population Economics* 18:275–300

*Daron Acemoglu and Simon Johnson (2007) “Disease and Development: the Effect of Life Expectancy on Economic Growth”, *Journal of Political Economy*, (December) volume 115, pp. 925-985.

*David E. Bloom, David Canning, Günther Fink, and Jocelyn E. Finlay (2007) “Fertility, Female Labor Force Participation, and the Demographic Dividend” working paper (September).

*Grant Miller (forthcoming) “Contraception as Development? New Evidence from Family Planning in Colombia,” *Economic Journal*.

D. Human capital

*Ronald Lee and Andrew Mason (in press) “Fertility, Human Capital, and Economic Growth over the Demographic Transition” *European Journal of Population*. (on bSpace).

Biology and Economic Demography

**Cox, Donald (2007) “Biological Basics and the Economics of the Family” *Journal of Economic Perspectives* v.21 n.2 Spring pp.91-108.

*“Improvements and Future Challenges in the Field of Genetically Sensitive Sample Designs”, Frank M. Spinath November 2008. (GenesAndEconomics on bSpace)

*“Individual differences in allocation of funds in the dictator game associated with length of the arginine vasopressin 1a receptor RS3 promoter region and correlation between RS3 length and hippocampal mRNA” A. Knafo†, S. Israel†, A. Darvasi‡, R. Bachner-Melman†, F. Uzefovsky†, L. Cohen§, E. Feldman†, E. Lerer¶, E. Laiba**, Y. Raz††, L. Nemanov‡‡, I. Gritsenko‡‡, C. Dina§§, G. Agam,***, B. Dean†††, G. Bornstein† and R. P. Ebstein* in *Genes, Brain and Behavior* (2008) 7: 266–275 (GeneticsAndBehavior_2007 on bSpace).

*Ronald Lee "Rethinking the Evolutionary Theory of Aging: Transfers, not Births, Shape Senescence in Social Species," *Proceedings of the National Academy of Sciences* v.100, n.16 (August 5, 2003), pp.9637-9642. (LeePNAS03 in bSpace).