

Examining Variance in World Life Spans Since 1960

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Abstract

Variance in life span represents a fundamental inequality in well-being, and like shorter average life span, it is also an economic cost. Previous research has explored the trends in average life expectancy worldwide and economists have estimated their contribution to human well-being. Trends in the variance are less well understood because mortality data are either scarce or virtually nonexistent for developing countries. Statistical demographers and epidemiologists are now engaged in many efforts to improve mortality measurement in developing countries. In this paper, I report preliminary results from a new study of historical trends in the variance in the age at death that merely examines what we currently know about mortality in developing countries.

Introduction

The past 50 years have brought an enormous amount of global convergence in life expectancy, or average life span. To be sure, the ravage of HIV-AIDS particularly in sub-Saharan Africa has contributed to much lingering between-country health inequality worldwide (Goesling and Firebaugh, 2004), but the overall postwar trend has been toward mortality convergence. During a time when life expectancy has grown very rapidly in industrialized countries, at a rate of about 0.2 years of life for every additional calendar

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year of passing time (White, 2002), life expectancy in developing countries has grown even faster. The gap in average life span between the richest and poorest nations has declined from about 35 years in 1950 to 23 years today (Wilson, 2001).

Longer life is a good like any other, and a vast literature examines the economic valuation of life, as reviewed by Viscusi (1993). Recently, Becker, Philipson and Soares (2005) reveal much global convergence since 1960 in the sum total of human well-being, as measured by the value of life plus the value of income per capita. This result contrast dramatically with the continuing disparities in income per capita (Barro, 1991), which are not well understood. This result is particularly puzzling to an economist since life span and income are complementary and so ought to rise together (Hall and Jones, 2007).

Trends in the variance in life span, as opposed to the average, will also affect total well-being because they speak directly to a very fundamental inequality that is costly. Among industrialized countries, variance fell rapidly prior to 1960 but has remained roughly stable since (Edwards and Tuljapurkar, 2005). There are relatively large differences between high-variance countries like the U.S. and France, where a standard deviation in adult life span is about 15 years, and low-variance countries like Japan and Sweden, where it is about 12 years. These results are qualitatively consistent with those of Wilmoth and Horiuchi (1999), who examine other measures of variability and reveal little evidence of compression toward an upper limit on life span. Edwards (2007) shows that the economic costs of life-span uncertainty are quite large. Standard modeling techniques suggest that Americans would be willing to trade away about a half a year in average life to obtain one less year in standard deviation.

While we have good data on life-span variance in industrialized countries, little is known about variance in developing countries other than it is surely larger, owing to the nature of the demographic transition.¹ Data tend to be sparse because those countries lack the resources of rich countries to monitor vital statistics. In practice, demographers typically estimate average life span, or life expectancy at birth, for developing countries based on estimates of a few key statistics like infant mortality, extrapolations, and model life tables like those originally developed by Coale and Demeny (1966).

The very estimates of average life expectancy in developing countries that

¹Infectious disease, a prevalent cause of death in the modern developing world as well as in the developed world prior to the epidemiological transition, produces high variance in adult death. Infant mortality rates also remain high, which produces high unconditional variance.

are cited and used by economists and demographers derive from these model life tables, yet no single source actually reports the historical model life tables in full. The World Development Indicators of the World Bank (2006) contains only selected summary measures, e.g., life expectancy and infant mortality. The United Nations Population Division (2004) maintains and distributes complete model life tables for a wide cross section of countries, but only beginning in 1990.

The reason for these omissions is undoubtedly because estimates of higher moments of life span beyond the mean will be even noisier than the very crude estimates derived from model life tables. But to get a ballpark estimate of trends in life-span variance, and thus of trends in within-country health inequality, we need better coverage of these albeit incomplete historical data. To be sure, other investigations currently underway to better understand mortality in developing countries through new modeling techniques and new data collection (Murray et al., 2003; Hill and Choi, 2004) will in time provide a better solution to this problem. In this paper, I report progress and preliminary results from a new study that seeks to infer what we know about historical trends in the variance in the age at death based on the limited data we currently have available.

Project Design

The goal is to investigate trends over time in life-span variance among a broad panel of developing and industrialized countries and reassess the implications for convergence in overall well-being. Another goal is to examine trends in within versus between-country inequality in life span. I require life tables for as wide a cross section of countries as can be obtained, ideally spanning the period from 1960 to 2000.

The United Nations Population Division (2004) provides complete life tables for most countries since 1990. To obtain historical coverage, I first collect extant life tables from the Human Mortality Database (2007), the Human Life-Table Database (2007), and the collection of UN life tables used by Murray et al. (2003).

For those countries missing from this list, a group that consists primarily of African countries, I infer model life tables for historical periods based on reported statistics. That is, I infer rather than build historical life tables from source data using appropriate modeling techniques, since historical vital statistics tend to be sparse. I begin by examining historical life expectancy in these countries as reported by the United Nations Population

Division (2004). Then I identify the modeling technique for each country as reported by the UN in the *World Population Prospects Analytical Report*. Finally, I match the appropriate model life table to the reported life expectancy for each country in each year.

Points of Interest

With this new database, I aim to examine the country and region-specific trends in variance in the age at death since 1960. Ultimately these new estimates will contribute to a reevaluation of the results of Becker, Philipson and Soares (2005) that account for the costliness of the variance.

Additionally, I will construct and examine the global distribution of life span by combining country-specific life tables weighted by population. I plan to decompose trends in world inequality into within and between-country components.

References

- Barro, Robert J. 1991. "Economic Growth in a Cross Section of Countries." *Quarterly Journal of Economics* 106(2):407–443.
- Becker, Gary S., Tomas J. Philipson and Rodrigo R. Soares. 2005. "The Quantity and Quality of Life and the Evolution of World Inequality." *American Economic Review* 95(1):277–291.
- Coale, Ansley J. and Paul Demeny. 1966. *Regional Model Life Tables and Stable Populations*. New York: Academic Press.
- Edwards, Ryan D. 2007. "The Cost of Uncertain Life Span." Unpublished manuscript, August.
- Edwards, Ryan D. and Shripad Tuljapurkar. 2005. "Inequality in Life Spans and a New Perspective on Mortality Convergence Across Industrialized Countries." *Population and Development Review* 31(4):645–675.
- Goesling, Brian and Glenn Firebaugh. 2004. "The Trend in Between-Nation Health Inequality." *Population and Development Review* 30(1):131–146.
- Hall, Robert E. and Charles I. Jones. 2007. "The Value of Life and the Rise in Health Spending." *Quarterly Journal of Economics* 122(1):39–72.
- Hill, Kenneth and Yoonjoung Choi. 2004. "The Adult Mortality in Developing Countries Project: Substantive Findings." Paper prepared for Adult Mortality in Developing Countries Workshop.

- Human Life-Table Database. 2007. Max Planck Institute for Demographic Research (Germany), University of California, Berkeley (USA), and Institut national d'études démographiques (France). Available at www.lifetable.de.
- Human Mortality Database. 2007. University of California, Berkeley (USA) and Max Planck Institute for Demographic Research (Germany). Available at www.mortality.org.
- Murray, C. J. L., B. D. Ferguson, A. D. Lopez, M. Guillot, J. A. Salomon and O. Ahmad. 2003. "Modified Logit Life Table System: Principles, Empirical Validation, and Application." *Population Studies* 57(2):165–182.
- United Nations Population Division. 2004. *World Population Prospects*. CD-Rom.
- Viscusi, W. Kip. 1993. "The Value of Risks to Life and Health." *Journal of Economic Literature* 31(4):1912–1946.
- White, Kevin M. 2002. "Longevity Advances in High-Income Countries." *Population and Development Review* 28(1):59–76.
- Wilmoth, John R. and Shiro Horiuchi. 1999. "Rectangularization Revisited: Variability of Age at Death within Human Populations." *Demography* 36(4):475–495.
- Wilson, Chris. 2001. "On the Scale of Global Demographic Convergence 1950–2000." *Population and Development Review* 27(1):155–171.
- World Bank. 2006. *World Development Indicators (WDI) Database*. World Development Indicators (WDI) Database. Available at www.worldbank.org.