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Life and Growth

Charles I. Jones*

During the twentieth century, life expectancy in the United States rose from less than 50 years to 77 years, while average incomes rose by about a factor of 7. Which change was more valuable? William Nordhaus famously posed this question to his friends and colleagues about a decade ago: which would you rather have, the health care system in 2000 but the average income in 1900, or the reverse? Based on this informal survey and on a range of other evidence, Nordhaus argued that the two changes were about equally important. The rise in longevity in the twentieth century was just as valuable as the more standard measure of economic growth.¹ Motivated in part by this observation, a number of my recent research papers explore the interplay between the value of life and economic growth.

The Value of Life and the Rise in Health Spending

Health spending was about 5 percent of GDP in the United States in 1960 and has risen to more than 17 percent in recent years. Importantly, this increase is not just a U.S. phenomenon: health spending as a share of GDP is rising in every OECD country for which there is data over this time period.² While part of the increase in the United States is surely due to particular institutional features of the U.S. economy, the fact that the health share is rising across a broad range of countries suggests that deeper economic forces may be at work.

My research with Robert Hall on this topic observes that standard utility

functions — of the kind that economists use to study asset pricing, the labor-leisure tradeoff, and macroeconomic fluctuations — already contain a key ingredient that can deliver this type of “income effect” in health spending. In essence, consumption runs into strong diminishing returns during any given time period. These diminishing returns cause the value of life to rise disproportionately as we get richer, so that economic growth naturally tilts spending toward preserving life. Put more coarsely, as we get richer, which is more valuable: an additional flat-screen TV, another smart phone, or additional days of life to enjoy our already high standard of living?³

Quantitative analysis of this mechanism suggests that these effects can be substantial. For example, our baseline model indicates that it could be efficient to spend as much as 33 percent of GDP on healthcare by 2050, and even more in later years, assuming that economic growth continues. While this particular number is subject to a range of uncertainty, the more general point is that it could be economically efficient for society to spend ever-larger amounts of our GDP on life preservation as incomes continue to grow. This obviously introduces important questions about the nature of the financing of health expenditures at such high levels.⁴ Still, the point remains: it may well be that much of the rise in health spending is a byproduct of economic growth — as we get richer, life is increasingly one of the most valuable goods we can purchase.

Life and Growth

If economic growth produces an income effect that tilts an economy’s spending toward health care, a natural question arises: can this structural change in turn have feedback effects on the nature of economic growth itself?

After all, some new technologies save lives — new vaccines, new surgical techniques, anti-lock brakes, and pollution scrubbers. Other technologies threaten lives — pollution, nuclear accidents, global warming, the rapid global transmission of disease, and bioengineered viruses. When technological change involves life and death as well as just higher consumption, how is our understanding of economic growth affected? Can the diminishing returns to consumption affect the direction of technological change itself?⁵

To begin, consider what might be called a “Russian roulette” model of economic growth. Suppose the overwhelming majority of new ideas are beneficial and lead to growth in consumption. However, there is a small chance that a new idea will be dangerous and cause substantial loss of life. Do discovery and economic growth continue forever in such a framework, or should society eventually decide that consumption is high enough and stop playing the game of Russian roulette?

The answer to this question hinges on the extent of diminishing returns to consumption, just as in the research on health spending. In particular, for standard preferences, it turns out that the diminishing returns are strong enough that growth is affected. In the simple Russian roulette example, once the decision maker is sufficiently rich, it can be optimal to stop research all together. The risks of a disaster may outweigh the possible gain in consumption as life gets increasingly valuable.

Of course, there are many technologies whose main purpose is explicitly to save lives. What if researchers can invent cures for cancer and safer transportation? In this case, one can show that the research process itself is affected. As society (endogenously) gets richer, the direction of technological change is affected.

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The returns to inventing life-saving ideas rises relative to the return to inventing new consumption goods and research shifts toward saving lives.

Evidence from R and D spending and patenting suggests that this kind of shift has been observed during the last 40 years. On the R and D side, the empirical measures are far from perfect. For example, not everything that an economist or business person would consider to be R and D is counted as such in the data, and the classification of R and D according to whether the goal is to save lives versus to provide new consumption or investment goods is imperfect. What we can say is that the fraction of R and D that is health-related rose from around 7 percent in 1960 to more than 25 percent in 2006 in the United States. A similar increase is also observed for OECD countries. On the patent side, Jeff Clemens documents that the fraction of patenting devoted to medical equipment and pharmaceuticals rose from 4 percent in 1963 to more than 13 percent in 1999. By these measures, it appears that technological change itself is shifting toward life-saving technologies.⁶

If indeed this shift in the direction of technological change is occurring, it has important implications for (non-health) consumption growth. In particular, the model suggests that such shifts may cause the optimal rate of consumption growth to slow, relative to the feasible rate that could be achieved if research efforts were balanced. Depending on modeling details, it could be that consumption growth is reduced by between 20 and 60 percent. Alternatively, it could be—as the Russian roulette example suggested—that it is optimal for consumption growth to slow all the way to zero. Future research is needed to better distinguish these cases.

Beyond GDP

Life expectancy at birth varies substantially across countries. For example, in 2007 it stood at 82.5 years in Japan, 80.8 years in France, 77.8 years in the United States, 72.6 years in China, and

just 51.0 years in South Africa. Such differences surely have a substantial impact on standards of living. However, they are captured only imperfectly, if at all, in conventional measures such as GDP per person. The third project related to life and growth that I discuss here examines a broader measure of economic welfare that incorporates differences in life expectancy.⁷

It has long been appreciated that GDP is an imperfect welfare measure. In the 1970s, Nordhaus and James Tobin made progress in constructing a “Measure of Economic Welfare” that included leisure, household work, and urban disamenities. The United Nations Human Development Index adds together GDP per person, literacy rates, and life expectancy to create an index number. More recently, economists including Amartya Sen, Joseph Stiglitz, Gary Becker, Tomas Philippon, Rodrigo Soares, and Marc Fleurbaey have made progress on this question.⁸

In my research on this topic with Peter Klenow, we seek to combine data on consumption, leisure, life expectancy, and inequality to produce a broader welfare measure for a large number of countries. We use conventional utility functions from economics to tell us how to convert leisure, life expectancy, and inequality into consumption-equivalent values that can be added together. This exercise leads to three main findings.

First, our welfare measure and GDP per person turn out to be highly correlated. The correlation coefficient is 0.95. Not surprisingly, perhaps, countries that are successful according to GDP tend to be successful on other dimensions as well, and vice versa.

However, it would be a mistake to conclude that this means that comparisons based on GDP are adequate. Our second finding is that the differences for particular countries are often large, and systematically so. For example, many Western European countries have higher life expectancy, more leisure, and lower inequality than the United States, and these differences are quantitatively important. For France and Germany, for

example, we find that each of these differences add more than 10 percentage points to their welfare measure. Whereas GDP per person in France and Germany in 2007 was about three fourths of the U.S. level, this gap is essentially eliminated when the broader measure of welfare is considered. Western Europe as a whole moves from 76.4 percent of the United States in terms of GDP per person all the way up to 95.3 percent in our consumption-equivalent welfare measure.

Our third finding is that the opposite happens when one looks at developing countries. Relative to the United States and Western Europe, these countries tend to have lower life expectancy, higher inequality, and sometimes less leisure. China, for example, loses ground when compared to the United States on each of these dimensions: its GDP per person in 2007 was 12.6 percent of that of the United States, but its welfare is only 5.0 percent of ours. Other examples are also enlightening. The AIDS epidemic is partly responsible for South Africa’s low life expectancy of 51 years, and this effect alone is enormous: South Africa falls from 17 percent of the United States in terms of GDP to just 2.4 percent in terms of welfare.

Conclusion

As researchers seek to understand the economic role played by considerations of life and death, new insights have emerged. The careful consideration of life-and-death issues can help us to understand the tremendous rise in health spending in the United States and the OECD, the changing nature of economic growth over time, and differences in economic welfare across countries.

¹ W.D. Nordhaus, “The Health of Nations: The Contribution of Improved Health to Living Standards” NBER Working Paper No. 8818, February 2002, and in *Measuring the Gains from Medical Research: An Economic Approach*, Kevin M. Murphy and

Robert Topel, eds. (Chicago: University of Chicago Press, 2003).

². See Table 124 in “Health United States 2011”, published by the National Center for Health Statistics, Hyattsville, Maryland, 2012.

³. For example, this is true with additively separable preferences where flow utility is logarithmic or for similar preferences in which marginal utility falls even faster (such as CRRA preferences with a risk aversion parameter bigger than one). See R. E. Hall and C. I. Jones, “The Value

of Life and the Rise in Health Spending” NBER Working Paper No. 10737, September 2004, and *Quarterly Journal of Economics*, February 2007, Vol. 122 (1), pp. 39–72.

⁴. For example, see K. Baicker and J.S. Skinner, “Health Care Spending Growth and the Future of U.S. Tax Rates” NBER Working Paper No. 16772, September 2011.

⁵. See C. I. Jones, “Life and Growth”, NBER Working Paper No. 17094, revised April 2013.

⁶. J. P. Clemens, “The Effect of U.S. Health Insurance Expansions on Medical Innovation,” U.C. San Diego working paper, January 2013.

⁷. See C. I. Jones and P. J. Klenow, “Beyond GDP: Welfare across Countries and Time,” NBER Working Paper No. 16352, September 2010, revision in progress.

⁸. See the working paper cited in the preceding note for a more detailed discussion of these contributions.

NBER Profile: Mario Crucini

Mario Crucini is a Research Associate in the NBER’s Program on International Finance and Macroeconomics. He is also a Professor of Economics at Vanderbilt University and Director of the Center for International Price Research there.

Crucini received his M.A. and Ph.D. in Economics from the University of Rochester and an Honors B.A. in Economics from the University of Western Ontario in Canada. He has held faculty appointments at the Wharton School, University of Pennsylvania; the Ohio State University; the Stern School of Business, New York University; and the Melbourne Business School.

Crucini’s research focuses on international business cycle transmission, micro-

economic and macroeconomic aspects of international price determination, and the role of commercial policy during the Great Depression. He serves as co-editor of the *Canadian Journal of Economics* and Associate Editor of the *Journal of Monetary Economics*. He is also President of the International Economics and Finance Society.

Crucini lives in Brentwood, Tennessee with his wife, Jill, and their twin boys, Gabriel and Christopher. The family enjoys travelling the world together, meeting new friends, and learning first-hand about history, culture, and language. Fall break, though, is always spent at a relaxing cabin in the Smoky Mountains!

