

La Salud como Capital Humano

Parte 2

Capital Humano: Teoría y
Evidencia Empírica
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Inversión en R&D y Población

I will neglect them to concentrate on another issue: the role of population in affecting the incentives to spend on medical R&D. To generate this analysis, consider a pharmaceutical company that can spend R to produce a medical innovation also, I , in the form of pills that raise the probability of surviving particular ages A . Once innovated, the cost of producing each pill equals c . The demand for these pills is given by

$$D(I) = N(I, A)p^{-\varepsilon}, \quad (31)$$

where p is the market price of a pill, and ε is the elasticity of demand for these pills.

To determine the market price, I assume that the innovator is given a patent that provides effective monopoly power in the market for I for T years. After T years pass, generics enter and push the market price of each pill to c , its cost of production. So the innovator earns monopoly profits for T years and zero profits after that. Since profits on the pills related to I equal $\Pi = pD - cD$, given eq. (31), profits are maximized when price equals

$$p^* = (\varepsilon/\varepsilon - 1)c \quad (32)$$

Then the present value of discounted profits equal

$$W = [N(I, A)(\varepsilon/\varepsilon - 1)^{-\varepsilon}(c^{1-\varepsilon}/\varepsilon - 1)] \sum_1^T (1/1 + r)^j. \quad (33)$$

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Clearly, the wealth from selling the pills is greater the lower is c , the smaller is ε , the bigger is T , and the larger is N . For the innovation to be worth the investment, it is necessary that

$$W = [N(I, A) (\varepsilon/\varepsilon - 1)^{-\varepsilon} (c^{1-\varepsilon}/\varepsilon - 1)] \sum_1^T (1/1 + r)^j > R. \quad (34)$$

This is more likely to hold the longer is the effective patent life (T), the lower the elasticity of demand for the pill that is created, and the lower the cost of producing each pill.

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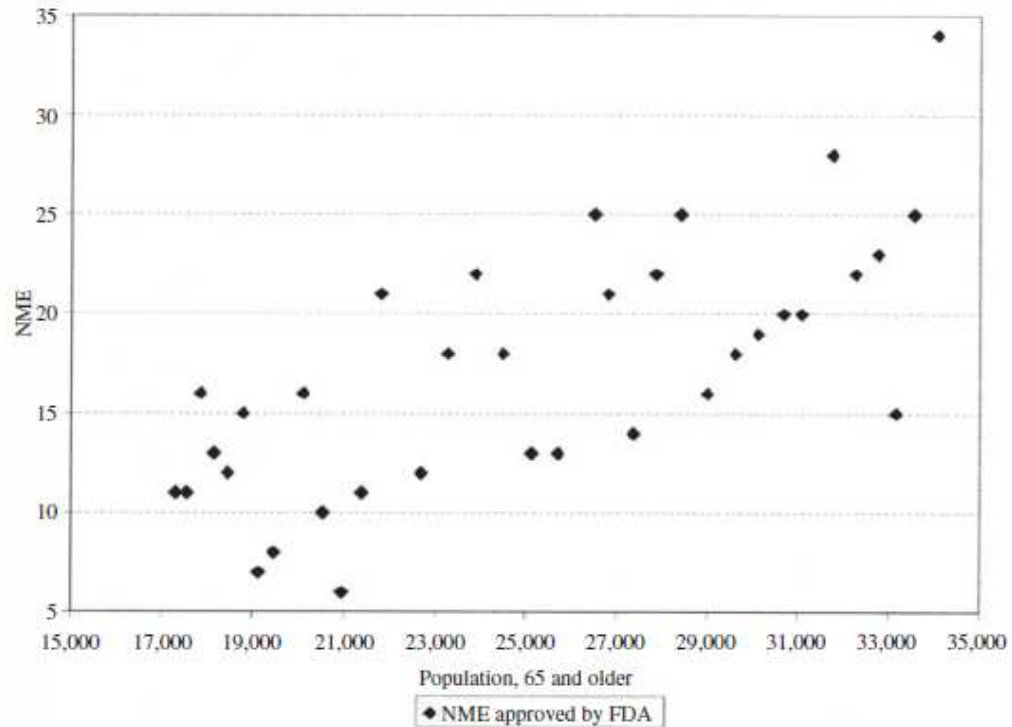


Fig. 2. New Molecular Entities approved by FDA and US Population of 65 and older, 1962–1997

Source: Cerda, 2003.

Table 3 Estimated value of loss from a potential avian flu epidemic

	US Estimate	World Estimate
Number of deaths from the flu 1918–19 divided by population at that time	$2.80\% \times 1.8\text{bn} = 50\text{m}$	$2.80\% \times 1.8\text{bn} = 50\text{m}$
Estimate of possible deaths from avian flu	$300\text{m} \times 2.8\% = 8.4\text{m}$	$6\text{ bn} \times 2.8\% = 168\text{m}$
Ratio of US GDP <i>per capita</i> over World GDP <i>per capita</i>		$\$8,800 / \$40,100 = 0.22$
Estimate of value of loss from a potential avian flu epidemic	$\$3\text{m} \times 8.4\text{ m} = \25 tr	$\$3\text{m} \times 168\text{m} \times 0.22 = \110tr

Source: Gary S. Becker Calculations.

El Valor de Mejoras que afectan la Salud y la Longevidad

- Murphy y Topel (2005) desarrollan un modelo económico para valorar mejoras que afectan la salud y la expectativa de vida de las personas, basado la predisposición a pagar de las personas.
- El marco teórico les permite estimar las ganancias de reducciones en la tasa de mortalidad y la tasa de mortalidad asociada con ciertas enfermedades.

Expectativa de vida al nacer y a los 50 Estados Unidos - 1900-2000

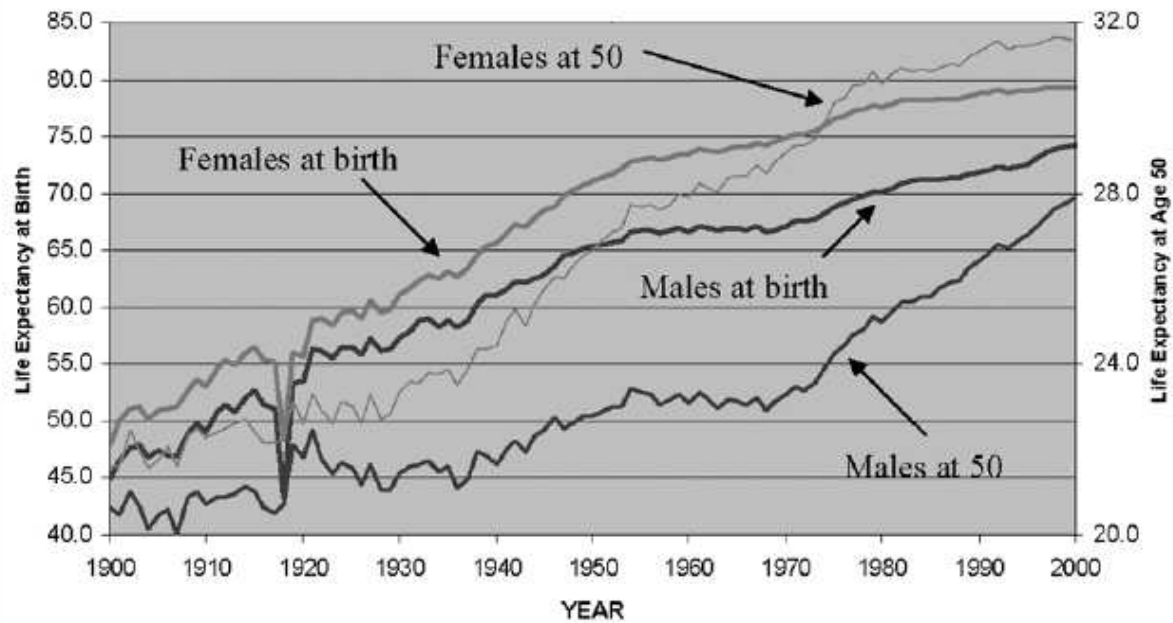


FIG. 1.—Life expectancy at birth and age 50, United States, 1900–2000

Source: Murphy, Kevin M. and Robert H. Topel. 2006. "The Value of Health and Longevity," *Journal of Political Economy*, vol. 114(5), págs. 871-904, October.

TABLE 1
ADDITIONAL LIFE-YEARS DUE TO REDUCED MORTALITY FROM SELECTED CAUSES, BY
DECADE, 1950–2000

Disease	1950–60	1960–70	1970–80	1980–90	1990–2000	Total
Men						
Infant mortality	.54	.36	.75	.23	.20	2.07
Heart disease	.16	.38	1.05	1.26	.88	3.73
Cancer	-.19	-.17	-.08	.02	.43	.01
Stroke	.10	.15	.41	.24	.08	.98
Accidents	.18	-.15	.37	.41	.17	.98
Other	.54	-.19	.41	-.31	.85	1.30
Total	1.33	.37	2.92	1.85	2.60	9.07
Women						
Infant mortality	.40	.35	.59	.22	.13	1.68
Heart disease	.59	.72	.87	.90	.46	3.54
Cancer	.20	.07	-.01	-.11	.17	.31
Stroke	.20	.33	.63	.38	.06	1.59
Accidents	.10	-.04	.17	.13	.01	.36
Other	.77	.19	.69	-.25	-.04	1.36
Total	2.25	1.61	2.94	1.25	.79	8.85

SOURCE.—Authors' calculations from Centers for Disease Control, Vital Statistics, Special Reports, various years.

NOTE.—Figures are additional expected life-years calculated from cross-sectional age-specific mortality rates in each year. Entries for each cause of death are contributions to additional expected life-years over the decade due to changes in mortality rates from that cause.

Source: Murphy, Kevin M. and Robert H. Topel. 2006. "The Value of Health and Longevity," *Journal of Political Economy*, vol. 114(5), págs. 871-904, October.

Marco económico para valorar mejoras que afectan la salud y la longevidad

Función de Utilidad

$$\int_a^{\infty} H(t)u(c(t), l(t))\tilde{S}(t, a)e^{-\rho(t-a)}dt, \quad (1)$$

Restricción presupuestaria

$$A(a) + \int_a^{\infty} [y(t) - c(t)]\tilde{S}(t, a)e^{-r(t-a)}dt = 0, \quad (4)$$

Marco económico para valorar mejoras que afectan la salud y la longevidad

The individual chooses $c(t)$ and $l(t)$ to maximize (1) subject to (4):

$$U(a) = \int_a^{\infty} \{H(t)u(c(t), l(t))e^{-\rho(t-a)} + \mu[y(t) - c(t)]e^{-r(t-a)}\} \tilde{S}(t, a) dt + \mu A(a). \quad (5)$$

Optimization yields the necessary conditions:⁶

$$\begin{aligned} H(t)u'_c(c(t), l(t)) &= \mu e^{-(r-\rho)(t-a)}, \\ H(t)u'_l(c(t), l(t)) &= w(t)\mu e^{-(r-\rho)(t-a)}. \end{aligned} \quad (6)$$

Marco económico para valorar mejoras que afectan la salud y la longevidad

The value of life at a is the marginal rate of substitution between $\lambda(a)$ and assets, $A(a)$:

$$\begin{aligned} V_\lambda(a) &\equiv -\frac{\partial U(a)/\partial \lambda(a)}{\partial U(a)/\partial A(a)} \\ &= \frac{1}{\mu} \int_a^\infty \{H(t)u(c(t), l(t))e^{-\rho(t-a)} + \mu[y(t) - c(t)]e^{-r(t-a)}\} \tilde{S}(t) dt. \end{aligned}$$

From (6), the value of life at age a is

$$V_\lambda(a) = \int_a^\infty v(t) e^{-r(t-a)} \tilde{S}(t, a) dt, \quad (7)$$

where

$$v(t) = \frac{u(c(t), l(t))}{u'_c} - c(t) + y(t) \quad (8)$$

Marco económico para valorar mejoras que afectan la salud y la longevidad

Willingness to Pay for Improvements in Health

Consider some factor, α , that can affect both type H and type G health. We can think of α as the state of “medical knowledge”—techniques, medicines, and so on—though it can equally represent environmental improvements, improved nutrition, or access to medical care. The value of a medical advance follows from displacement of (5):

$$\begin{aligned} V_\alpha(a) &\equiv \frac{U'_\alpha(a)}{\mu} \\ &= \int_a^\infty v(t)S(t, a)\Gamma_\alpha(t, a)dt + \int_a^\infty \frac{H'_\alpha(t)}{H(t)} \frac{u(c(t), l(t))}{u_c} S(t, a)dt. \end{aligned} \quad (11)$$

Marco económico para valorar mejoras que afectan la salud y la longevidad

$$V_{\lambda}(a) = \int_a^{\infty} [y^F(t) + c^F(t)\Phi(z(t))]S(t, a)dt \quad (14)$$

and

$$\begin{aligned} V_{\alpha}(a) &= \int_a^{\infty} [y^F(t) + c^F(t)\Phi(z(t))]S(t, a)\Gamma_{\alpha}(t, a)dt \\ &+ \int_a^{\infty} \frac{H'_{\alpha}(t)}{H(t)} c^F(t)[1 + \Phi(z(t))]S(t, a)dt. \end{aligned} \quad (15)$$

Marco económico para valorar mejoras que afectan la salud y la longevidad

- Willingness to pay for health rises with wealth, so growth is a boon to health-related investments. This is especially important when willingness to pay is income elastic, as suggested by (16). Then richer societies are likely to invest proportionally more.¹¹
- The value of a life-year includes the value of nonmarket time. Common attempts to value life-years on the basis of income or consumption expenditures alone neglect much of what people value, especially when health improvements are concentrated at older ages, as has occurred in recent decades.¹²
- With wealth constant, health improvements are more valuable when surplus, Φ , is large. This occurs when the demand for *current* consumption is inelastic, so consumption expenditures at different ages are poor substitutes: $\sigma(z)$ is small. Then loss of a year of life cannot be offset by simply reallocating consumption to other years. We exploit this notion in the next section, gauging Φ from evidence on intertemporal substitution in consumption.
- The value of progress against a disease is greatest when the current age, a , is close to, but before, the typical age of onset of the disease.

Complementariedad entre las mejoras en salud

past advances raise the value of further improvements. To formalize the point, assume two diseases, A and B , that affect only mortality. By the nature of competing risks, $\lambda(t) = \lambda^A(t) + \lambda^B(t)$, where $\lambda^j(t)$ is the death rate from disease j . Let $d\alpha$ ($d\beta$) be an advance that reduces mortality from A (B), so $\lambda_\alpha^A < 0$. Differentiation of (15) yields¹³

$$V_{\alpha\beta}(a) \equiv \frac{\partial V_\alpha(a)}{\partial \beta} = \int_a^\infty [y^F(t) + \Phi(z)c^F(t)]S(t, a)\Gamma_\alpha(t, a)\Gamma_\beta(t, a)dt > 0. \quad (17)$$

Valor social de las mejoras en salud

$$W_{\alpha}(\tau) = \int_{a=0}^{\infty} N(a, \tau) V_{\alpha}(a) da + N^f(\tau) V_{\alpha}(0). \quad (18)$$

Here $N(a, \tau)$ is the population of age a at date τ and $N^f(\tau)$ is the present value of future births. These enter the calculation because medical advances that improve health will also apply to future generations, for whom value is measured at birth. When combined with (15), (18) yields two additional implications:

- The current social value of a health advance is proportional to the size of the current and future populations to which it applies.
- Aggregate willingness to pay for progress against a disease will be highest when the age distribution of the population is concentrated near, but before, the typical age of onset of the disease. For example, the aging of the baby-boom generation has raised the social value of medical advances against age-related ailments.

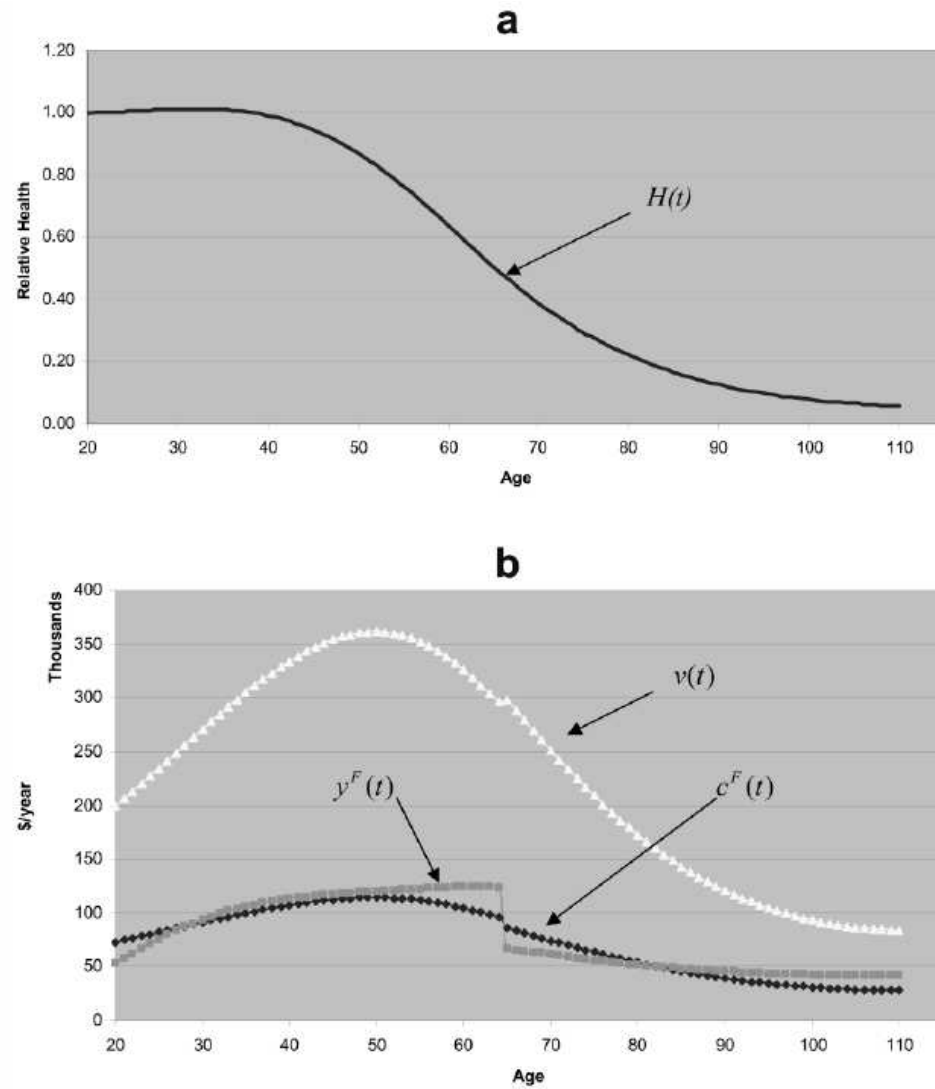


FIG. 2.—*a*, Implied shape of $H(t)$ consistent with consumption data. *b*, Life cycle profiles of full income, full consumption, and the value of a life-year.

Source: Murphy, Kevin M. and Robert H. Topel. 2006. "The Value of Health and Longevity," *Journal of Political Economy*, vol. 114(5), págs. 871-904, October.

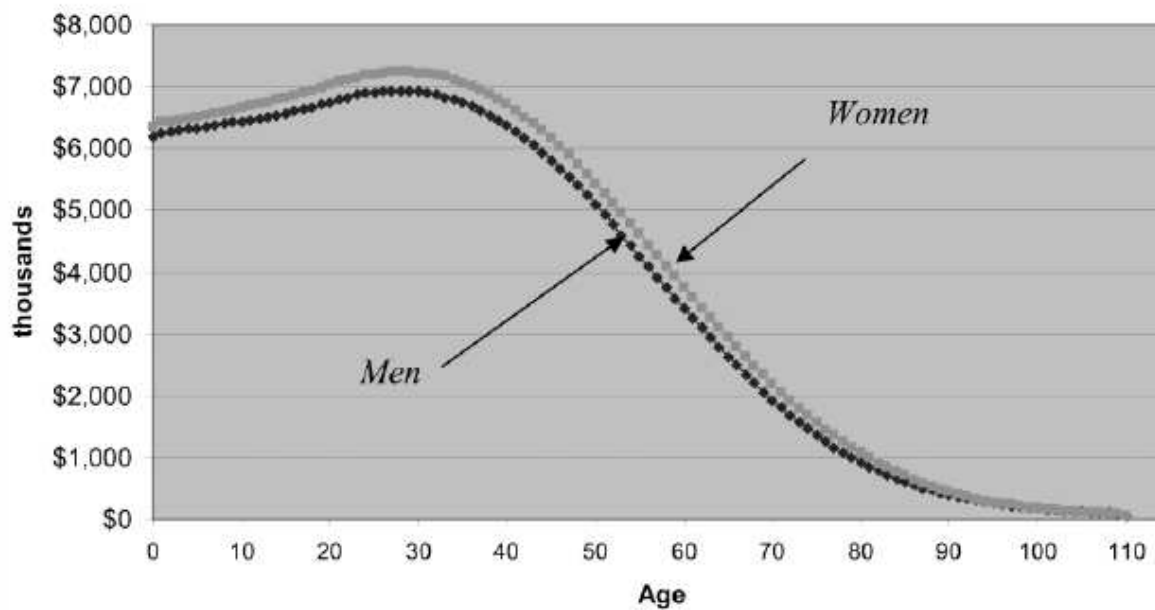
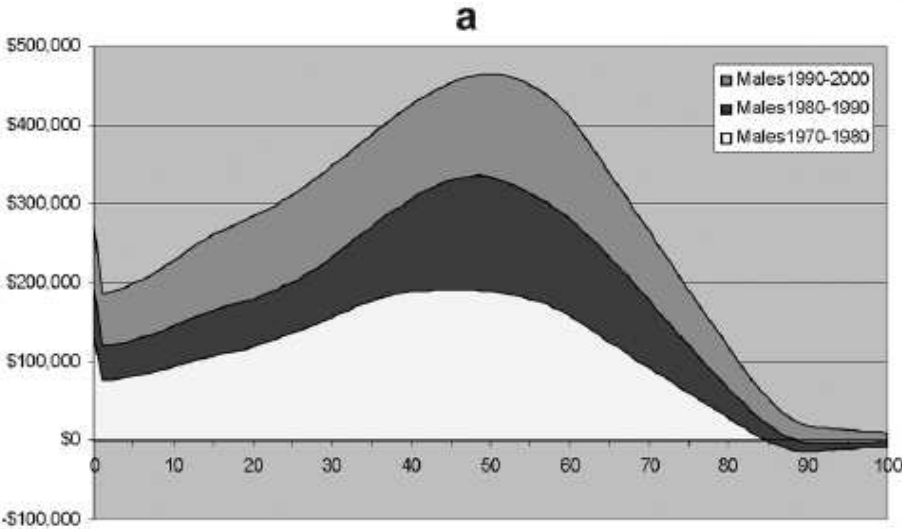


FIG. 3.—Value of remaining life (\$6.3 million value of a statistical life)

Source: Murphy, Kevin M. and Robert H. Topel. 2006. "The Value of Health and Longevity," *Journal of Political Economy*, vol. 114(5), págs. 871-904, October.

Ganancias de Aumento en la Longevidad para los Hombres Estados Unidos - 1970-2000



Source: Murphy, Kevin M. and Robert H. Topel. 2006. "The Value of Health and Longevity," Journal of Political Economy, vol. 114(5), págs. 871-904, October.

Ganancias de Aumento en la Longevidad para las Mujeres Estados Unidos - 1970-2000

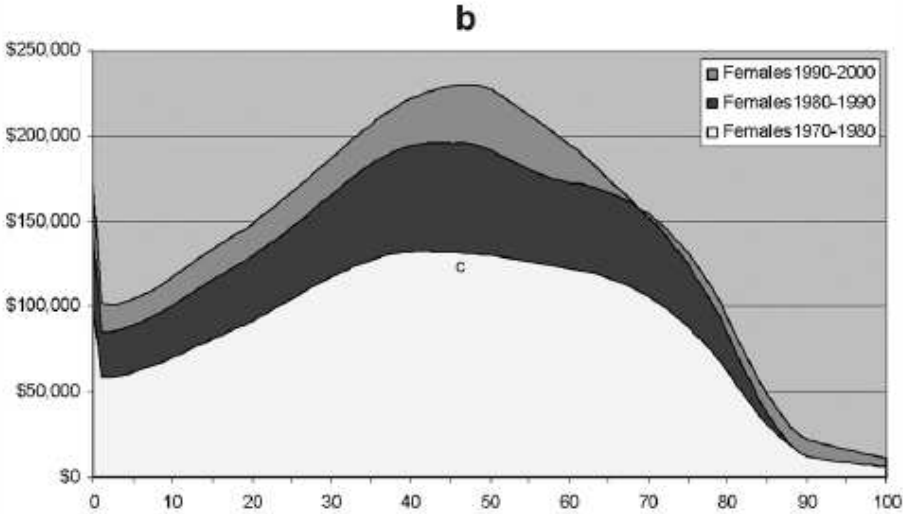


FIG. 6.—Gains from increased longevity, 1970–2000: *a*, males; *b*, females

Source: Murphy, Kevin M. and Robert H. Topel. 2006. "The Value of Health and Longevity," *Journal of Political Economy*, vol. 114(5), págs. 871-904, October.

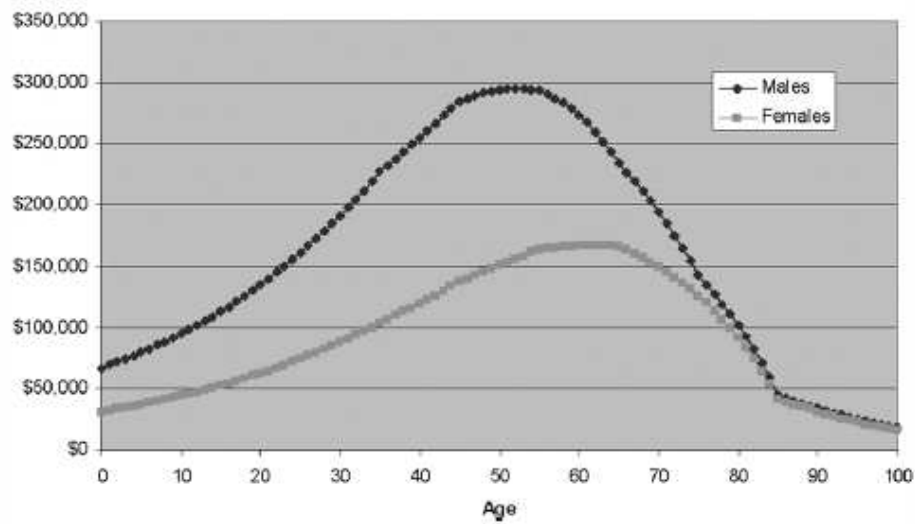


FIG. 7.—Gains from reductions in heart disease, 1970–2000

Source: Murphy, Kevin M. and Robert H. Topel. 2006. "The Value of Health and Longevity," *Journal of Political Economy*, vol. 114(5), págs. 871-904, October.

Ganancias Económicas de Reducciones en la Mortalidad Estados Unidos – 1970-2000

	Aggregate Gains (billions of \$2004)			
	1970-80	1980-90	1990-2000	1970-2000
Males	26,699	15,471	19,153	61,323
Females	20,515	9,067	4,440	34,022
Total	47,214	24,588	23,593	95,345

Source: Murphy, Kevin M. and Robert H. Topel. 2006. "The Value of Health and Longevity," Journal of Political Economy, vol. 114(5), págs. 871-904, October.

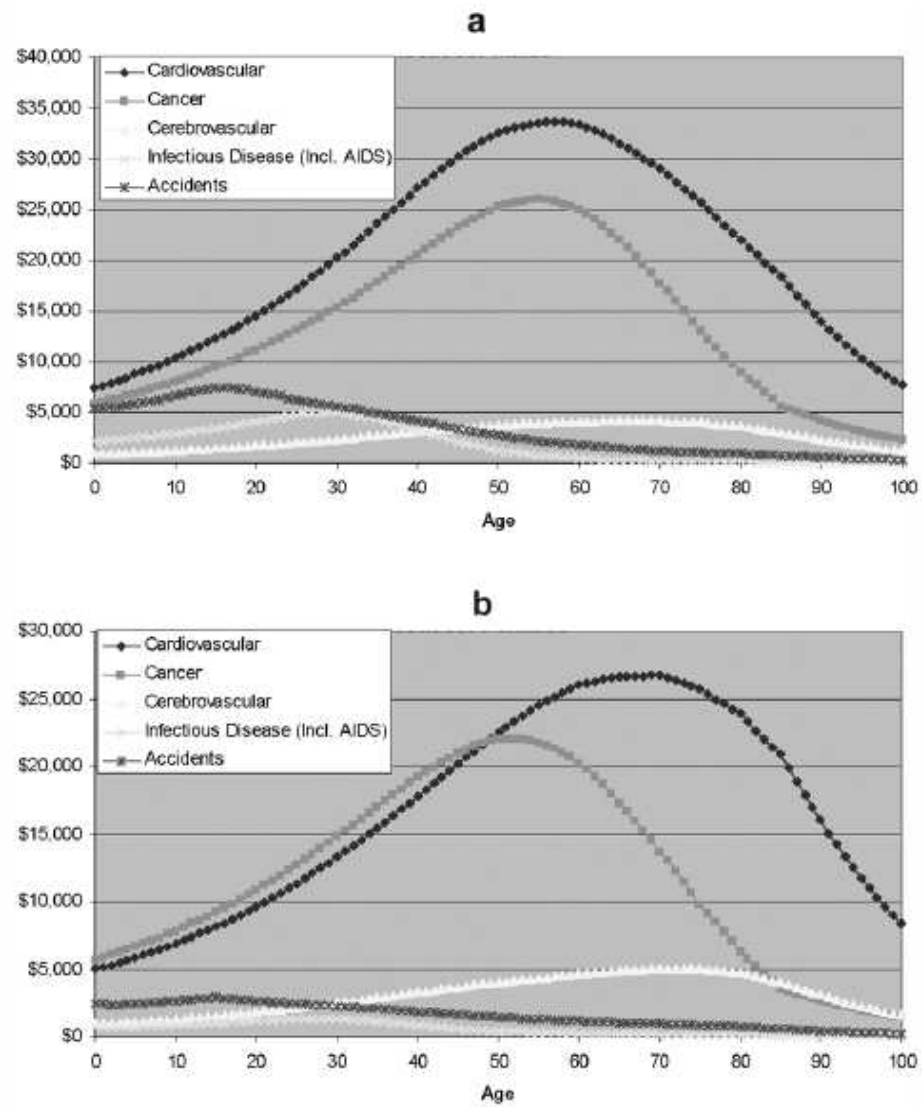


FIG. 8.—Prospective value of a 10 percent reduction in mortality from selected diseases: *a*, males; *b*, females.

- La valuación de mejoras en la salud basadas en la predisposición a pagar de las personas arrojan valores enormes.
- Las reducciones en la mortalidad desde 1970 al año 2000 tuvieron un valor económico cercano a los \$3.2 billones por año para la población americana del año 2000.
- De acuerdo a sus estimaciones el valor de una reducción (modesta) de un 1% en la mortalidad debido al cáncer estaría en el orden de lo U\$S500 mil millones.
- Estos valores altos pueden ser contrarestados por los costos de desarrollar e implementar las mejoras en salud.

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*, vol. 95(1), págs. 277.

Idea principal y resultados

- Incorporar a las comparaciones cross-country de bienestar la cantidad (longevidad) versus la calidad (ingreso anual) de la vida.
- Debido a que los países más ricos tuvieron menores ganancias en longevidad en relación a los países más pobres, la desigualdad mundial no aumento tanto como se argumenta generalmente e inclusive podría estar disminuyendo.

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*, vol. 95(1), págs. 277.

Consider the indirect utility function $V(Y, S)$ of an individual with survival function S and lifetime income Y :

$$V(Y, S) = \max \int_0^{\infty} \exp(-\rho t) S(t) u(c(t)) dt \quad (1)$$

subject to

$$Y = \int_0^{\infty} \exp(-rt) S(t) y(t) dt = \int_0^{\infty} \exp(-rt) S(t) c(t) dt \quad (2)$$

where $S(t)$ is the probability of survival to age t , $y(t)$ is income at t , $c(t)$ consumption at t , and $r = \rho$ is the assumed interest rate. This budget constraint assumes full annuity insurance, or the existence of a complete contingent claims market.

Now consider a given country at two points in time, with lifetime income and survival functions denoted by Y and S , and Y' and S' respectively. We are interested in the infra-marginal income $W(S, S')$ that would give a person in this country the same utility level observed in the first period, but with the mortality rates observed in the second:

$$V(Y' + W(S, S'), S) = V(Y', S') \quad (3)$$

More precisely, to calibrate the model for commonly available national income and mortality statistics for a given country and year, we consider a *hypothetical life-cycle individual* (HLCI) who receives the country's income per capita in all years of life and faces throughout life the country's cross-sectional survival function. Under the maintained assumptions, this implies that optimal consumption equals the constant income; $c(t) = c = y$, so that the indirect utility function can be expressed in terms of the yearly income y as in:

$$V(y, S) = u(y)A(S) \quad (4)$$

where $A(S) = \int_0^{\infty} \exp(-rt)S(t)dt$ is the value of an annuity based on the survival function S . If $w(S, S')$ is the yearly – as opposed to lifetime – income that measures the gain in longevity in a manner similar to before, w satisfies

$$u(y'+w(S, S'))A(S) = u(y')A(S') \quad (3')$$

with the corresponding annual “full-income” growth rate $g = [y'+w(S, S')]/y-1$. The value of longevity gains measured in yearly income is related to the value measured in life-time income according to $W(S, S') = A(S)w(S, S')$. The usual critiques of GDP as a measure of “full-income” that it does not incorporate value of leisure, household production, and non-market goods – also apply to our methodology. In fact, we attempt to fill in one of these gaps, as it relates to home-produced or non-market health.

Table 1
Evolution of Cross-Country Inequality in Income and Life Expectancy
1960-2000

	Income per Capita			Life Expectancy		
	1960	1990	2000	1960	1990	2000
Coefficient of Variation	1.23	1.25	1.17	0.26	0.12	0.14
Std. Dev. of Logs	1.02	1.03	0.96	0.25	0.13	0.15
Gini Coefficient	0.51	0.52	0.49	0.13	0.07	0.07
Regression to the Mean over Previous Date		-0.01 (0.86)	-0.07 (0.00)		-0.61 (0.00)	0.04 (0.31)

p-values in parenthesis

Note: Income per capita is GDP per capita in 1996 international prices, adjusted for terms of trade (Penn World Tables 6.1). Life expectancy is life expectancy at birth (World Development Indicators, World Bank). Inequality measures weighted by country population (abstracting from within country inequality). Sample includes 96 countries, comprising more than 82% of the world population. Regression to the mean is the coefficient of a regression of the change in the variable over the period on its initial level (natural logs used in the income regressions; weighted regressions).

Table 2 presents the results for the value of longevity gains and the growth rate of “full-income,” together with income and life expectancy statistics, using the value of the parameters derived in the previous section. The value of longevity gains is presented in two forms: yearly income (w), and total discounted lifetime value (W). Results are presented for the regions of the world according to the World Bank classification, and for the groups of poorest and richest countries in 1960 (population-weighted averages).

Table 2
Value of Life Expectancy Gains by Region of the World and Groups of Countries
1960-2000

	1960		2000		Value of life Exp. Gains in Annual Income	Lifetime Present Value of Life Exp. Gains	Yearly Growth Rate of Full Income
	Life Exp.	GDP per Capita	Life Exp.	GDP per Capita			
Europe & Central Asia	68	6,810	76	18,281	1,809	51,706	2.7%
East Asia & Pacific	42	1,317	71	5,866	2,600	60,957	4.8%
Latin Am. & the Carib.	56	3,459	70	7,161	1,365	36,935	2.3%
Middle East & N. Africa	48	1,935	69	5,525	1,817	46,076	3.4%
North America	70	12,380	77	32,880	2,804	81,993	2.7%
South Asia	44	892	63	2,346	635	15,504	3.1%
Sub-Saharan Africa	41	1,470	46	1,573	72	1,612	0.3%
Poorest 50% countries in 1960	41	896	64	3,092	1,456	33,673	4.1%
Richest 50% countries in 1960	65	7,195	74	18,162	2,076	58,957	2.6%
World	49	2,983	67	7,236	1,627	40,626	2.8%

Note: Income per capita is GDP per capita in 1996 international prices, adjusted for terms of trade (Penn World Tables 6.1). Life expectancy is life expectancy at birth (World Development Indicators, World Bank). Regional averages weighted by country population. Sample includes 96 countries, comprising more than 82% of the world population. Value of life expectancy gains based on the authors' calculations.

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, vol. 95(1), págs. 277.

This indicates that, unlike income changes, longevity changes since 1960 reduced the disparity in welfare across countries. Table 3 explores this point further by repeating the same income dispersion measures presented in Table 1, and by additionally calculating the same statistics for “full-income” in 1990 and 2000 (taking 1960 as the base period). As the Table shows, by any statistic, the inclusion of life expectancy in the measure of “full-income” generates significant reductions in inequality between 1960 and 1990, and also a significant increase in the rate of reduction in inequality between 1960 and 2000. The coefficient on $\ln(\text{income in } 1960)$ in the “full-income” regression to the mean equations is negative and statistically significant. Higher income in 1960 is consistently associated with lower growth in “full-income” in the thirty-year period between 1960 and 1990 and in the forty-year period between 1960 and 2000.

Table 3
Evolution of Cross-Country Inequality in Full Income
1960-2000

	Income per Capita			Full Income	
	1960	1990	2000	1990	2000
Coefficient of Variation	1.23	1.25	1.17	1.17	1.05
Std. Dev. of Logs	1.02	1.03	0.96	0.98	0.95
Gini Coefficient	0.51	0.52	0.49	0.49	0.46
Regression to the Mean over 1960		-0.01 (0.86)	-0.13 (0.01)	-0.1 (0.02)	-0.26 (0.00)

p-values in parenthesis

Note: Income per capita is GDP per capita in 1996 international prices, adjusted for terms of trade (Penn World Tables 6.1). Full income calculate by the authors with 1960 as base year, incorporating gains in life expectancy at birth (World Development Indicators, World Bank). Inequality measures weighted by country population (abstracting from within country inequality). Sample includes 96 countries, comprising more than 82% of the world population. Regression to the mean is the coefficient of a regression of the change in the natural log of income over the period on its initial level (weighted regressions).

These results would be even stronger if we accounted for expenditures on health and R&D, because part of the gains in life expectancy is driven by these expenditures. Since most of these expenditures are undertaken by the developed world, the share of truly exogenous reductions in mortality is certainly higher for the less-developed countries. Therefore, convergence in welfare would be higher if the endogenous part of longevity gains were netted out.

Now consider cause specific changes in mortality. Let there be K competing independent causes of mortality, inducing the overall survival function $S = \prod_{k=1}^K S^k$, where S^k denotes the survival function of cause k . Define the counterfactual survival function $S'_k = S'^k \prod_{i \neq k} S^i$. Similarly to the case of age-specific mortality changes, this expression gives the survival function that would be observed if only changes in mortality from cause of death k had taken place.

In order to further understand the differential impact of mortality by different causes and age groups on the evolution of cross-country inequalities in health, we apply the decomposition strategy described in the previous section to the regression to the mean in life expectancy. As mentioned before, regression to the mean in life expectancy can be decomposed into regression to the mean in changes in life expectancy attributable to each cause of death and age group. The coefficient of regression to the mean in this restricted sample is equal to -0.55 (statistically significant at any standard significance level). We run 56 regressions of age and cause-specific changes in life expectancy (13 causes of death, 3 age groups, plus all ages and all causes of death together) on the initial life expectancy level (each one giving one of the $\beta_{k,a}$ coefficients from the previous section). We then calculate the contribution of the specific age group and cause of death 16 to the overall regression to the mean in life expectancy ($\beta_{k,a} / \beta$). The results are presented in Table 5.

In this respect, we concentrate the analysis on the regression to the mean in life expectancy. The approach outlined above gives a direct decomposition of the overall regression to the mean in life expectancy into the regression to the mean attributable to each cause and age. By definition, the regression to the mean coefficient is given by a linear regression of ΔL on a constant plus L^{65} . Define $X^{65} = [1 \ L^{65}]$, a matrix containing a column of ones, and a column with the life expectancy at birth for the different countries in 1965. The convergence coefficient is given by $\beta = (X^{65'}X^{65})^{-1}X^{65'}\Delta L$. By substituting ΔL from expression (7), we can write

$$\beta = (X^{65'}X^{65})^{-1}X^{65'} \left[\sum_{a=\{0,20,50\}} \sum_{k=1}^{13} \Delta L_{k,a} + \Delta L_H \right]$$

This expression gives a natural decomposition for the convergence coefficient:

$$\beta = \sum_{a=\{0,20,50\}} \sum_{k=1}^{13} \beta_{k,a} + \beta_H \quad (8)$$

where $\beta_{k,a}$ is the vector of coefficients of the OLS regression of $\Delta L_{k,a}$ on X^{65} .

In words, the coefficient of the regression of changes in life expectancy on initial life expectancy levels can be decomposed into coefficients of regressions of cause and age-specific changes in life expectancy on initial life expectancy levels, plus a residual term (β_H). That is, regression to the mean in life expectancy is decomposed into regression to the mean attributable to the thirteen underlying causes of death and three age groups, plus a residual term. This allows us to evaluate the role of different causes of death in generating the observed reduction in life expectancy inequality, and also to analyze in what ages this reduction in inequality was concentrated.

Table 5

Contribution of Age and Cause Specific Mortality Changes to Regression to the Mean in Life Expectancy - 1965-1995

Cause of death \ Age group	0-20	20-50	Above 50	All Ages
R01: Infectious	3.7%*	3%*	1.0%	7.8%*
R02: Neoplasms	-0.7%*	-0.7%	-0.4%	-1.8%
R03: Endocrine, metabolic and blood diseases, nutritional deficiencies	1.3%*	1.6%*	-0.5%	2.4%
R04: Mental Disorders	-0.1%*	0.2%	0.2%	0.3%
R05: Nervous system and senses organs	0%	-0.2%	-11.4%*	-11.5%*
R06: Heart and circulatory	-0.8%*	-2%*	-20%*	-22.7%*
R07: Respiratory and digestive	77.8%*	3%*	-0.5%	80.7%*
R08: Urinary and genital	0.3%*	-0.4%*	-1.3%*	-1.3%*
R09: Abortion and obstetric causes	0.1%*	1.1%*	0%*	1.2%*
R10: Skin and musculoskeletal	0.1%*	0.1%*	0.3%*	0.5%*
R11: Congenital anomalies and perinatal period conditions	10.5%*	-0.1%*	0%*	10.4%*
R12: Ill-defined	8.5%*	4.1%*	20.4%*	33.7%*
R13: Accidents, suicides and homicides	-0.7%	-1.2%	-1.6%*	-3.4%*
All causes	109.6%*	8.9%*	-23.7%*	100%*

Note: Calculations based on coefficients from (population weighted) regressions of the changes in life expectancy attributable to each specific cause of death and age group on the life expectancy at birth in 1965. * denotes statistical significance at 5% of the coefficients in these regressions. Decomposition of the life expectancy changes based on the authors' calculations using World Health Organization Data (49 countries).

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Table 4
Decomposition of Life Expectancy Gains by Cause of Death and Age Group
Regions of the World, 1965-1995

	Europe & Cent. Asia	E. Asia & Pacific	Latin Am. & the Carib.	Middle East & N. Africa	North America	Whole Sample
Total	8.6	5.4	10.2	18	5.8	7.1
<i>By Cause of Death:</i>						
R09: Abortion and obstetric causes	0.1	0	0.1	0.1	0	0
R10: Skin and musculoskeletal	0	0	0	0.1	0	0
R11: Congenital anomalies and perinatal period conditions	0.7	1	1.1	2.6	1	1
R12: Ill-defined	1.2	0.5	2.8	2.9	0	0.9
R13: Accidents, suicides and homicides	0.5	0.3	-0.1	0.4	0.4	0.3
<i>By Age Group:</i>						
Between 0 and 19	2.5	2.2	5.9	16.2	1.5	3
Between 20 and 49	1.2	0.4	1.4	0.8	0.6	0.7
50 and above	4.6	2.7	2.3	0.5	3.5	3.1

Note: Decomposition of life expectancy calculated by the authors based on age and cause specific mortality data from the World Health Organization. Regional averages weighted by country population. Sample includes 49 countries. The total life expectancy change for East Asia & Pacific is so different from the one presented in Table 2 because the sample used here excludes some of the main beneficiaries of the life expectancy gains in the region, such as China, Indonesia, Korea, and Thailand.

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Table 4 (Continued)
Decomposition of Life Expectancy Gains by Cause of Death and Age Group
Regions of the World, 1965-1995

Change in Life Expectancy	Europe & Cent. Asia	E. Asia & Pacific	Latin Am. & the Carib.	Middle East & N. Africa	North America	Whole Sample
Total	8.6	5.4	10.2	18	5.8	7.1
By Cause of Death:						
R01: Infectious	0.8	0.4	1.1	-0.1	0	0.4
R02: Neoplasms	0.2	0.1	0.1	0	0.1	0.1
R03: Endocrine, metabolic and blood diseases, nutritional Deficiencies	0.3	0	0	0.4	-0.2	0
R04: Mental Disorders	0	0	0	0	0	0
R05: Nervous system and senses organs	2.3	1.4	0.9	0.1	1.2	1.4
R06: Heart and circulatory	-0.2	0	-0.4	-1.6	2.3	0.4
R07: Respiratory and digestive	1.3	1.1	3.5	12.1	0.5	1.6
R08: Urinary and genital	0.2	0.2	0.1	0	0.1	0.1

Note: Decomposition of life expectancy calculated by the authors based on age and cause specific mortality data from the World Health Organization. Regional averages weighted by country population. Sample includes 49 countries. The total life expectancy change for East Asia & Pacific is so different from the one presented in Table 2 because the sample used here excludes some of the main beneficiaries of the life expectancy gains in the region, such as China, Indonesia, Korea, and Thailand.