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BULLETIN ON AGING AND HEALTH

How Behavioral Changes Have Affected U.S. Population Health Since 1960

In the continual drive to improve the health of the U.S. population, attention often centers on medical innovation, such as new prescription drugs or surgical techniques. Yet changes in behavioral risk factors also have the potential to improve — or worsen — health outcomes.

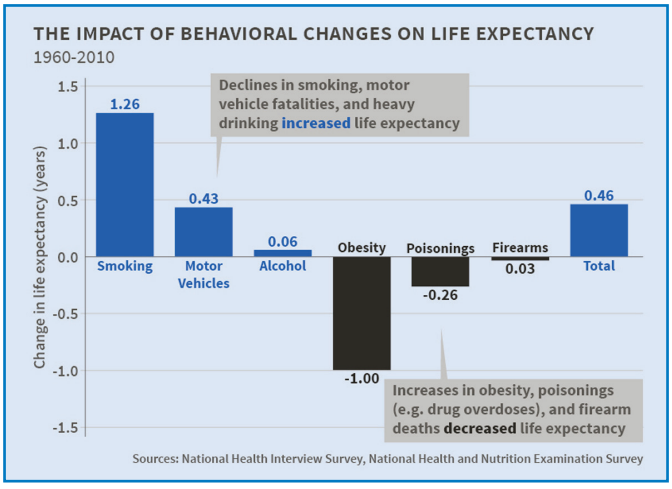
According to one recent study, more than 4 in 10 deaths in the U.S. in the year 2000 were accounted for by six behavioral risk factors, including smoking, obesity, and alcohol consumption. These factors also affect the quality of life.

There have been significant shifts in behavioral risk factors over the past few decades, with smoking rates declining sharply while obesity rates have risen dramatically. On net, how have changes in adverse behavioral risk factors over time contributed to U.S. health trends?

This is the subject of a new working paper by NBER researchers **Susan Stewart** and **David Cutler**, "**The Contribution of Behavior Change and Public Health to Improved U.S. Population Health**" (NBER Working Paper No. **20631**). The authors examine the effect of changes from 1960 to 2010 in six major behavioral factors — obesity, smoking, heavy alcohol use, and unsafe use of motor vehicles, firearms, and poisonous substances — on mortality and health-related quality of life.

For their analysis of the first three factors, the authors begin by assembling historical data on body mass index (BMI), smoking behavior, and alcohol use in the U.S. population over time from the National Health Interview Survey and the National Health and Nutrition Examination Survey. They then estimate models relating each of these risk factors to subsequent all-cause mortality and to an overall index of health. Finally, the authors combine the historical data and their model results to estimate the life expectancy change and quality of life change that occurred between 1960 and 2010 as a result of changes in the prevalence of each of the risk factors.

For the other health behaviors, the authors must adopt a different approach due to the lack of historical data on behaviors such as unsafe driving or firearm storage practices. In this case, they simply measure the changes over time in deaths from motor vehicle accidents, firearm use, and poisoning. In order to distinguish the change in mortality due to behavioral change from that due to improving medical care (for example, advances in trauma care that improve survival from a motor vehicle accident, gunshot wound, or accidental poisoning), the authors make the assumption that one-quarter of mortality improvements are due to medical care, following estimates in the literature.



The figure shows the estimated change in life expectancy attributable to changes in each of the six health behaviors between 1960 and 2010. Overall, life expectancy increased by 6.9 years during this period. The large decline in smoking over this period (a decrease in current smokers from over 40 percent of

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the population to less than 20 percent) is estimated to have added 1.26 years to life expectancy. The prevalence of heavy drinking also fell, from about 11 to 9 percent of the population. Due to the smaller change in this behavior and the weaker link between heavy drinking and mortality, however, this added only 0.06 years to life expectancy.

The decline in motor vehicle fatalities is estimated to have added an additional 0.43 years to life expectancy. However, the significance of changes in driving behavior is greater than this figure might imply. Total motor vehicle fatalities fell by nearly 50 percent during a period when miles driven per capita rose sharply; the authors predict that fatalities would have risen by over 200 percent if deaths per mile driven had remained constant. This points to the success of public health interventions such as airbag requirements, safer roads, and stricter enforcement of seat belt and motorcycle helmet laws.

Not all changes in health behavior have led to increases in life expectancy. The share of the population that is obese or morbidly obese rose from 14 percent in 1960 to 36 percent in 2010. The increase in obesity is estimated to have reduced life expectancy by 1.00 years. For poisonous substance use, a decrease in infant and child poisoning was overwhelmed by an increase in accidental drug overdoses, particularly those involving prescription opioid medications. Overall, changes in poisonings during this period reduced life expectancy by 0.26 years. Firearm homicides rose and fell several times during this half-century; on net, a small increase in gun-related homicides and suicides reduced life expectancy by 0.03 years.

Incorporating the effects of behavioral changes on quality of life as well as mortality and translating the health gains into a dollar value, the authors find that the gains associated with declines in smoking, motor vehicle fatalities, and heavy drinking are essentially offset by the losses arising from rising obesity and misuse of firearms and poisonous substances. Valued in dollar terms, there is a near zero net gain in health from public health and behavioral changes over the past fifty years. However, the analysis includes a mix of some risk factors that have been aggressively addressed through public health and behavioral changes over a long period (smoking, unsafe driving), and others that are in the earlier stages of being addressed and have proven challenging (obesity, prescription drug addiction).

In sum, improvements in smoking and motor vehicle fatalities have added nearly two years to life expectancy over the past half-century. But much of these gains are offset by health declines due to rising obesity and accidental drug overdose. The authors conclude "our study demonstrates the enormous benefits of public health and behavioral change in improving population health, underscoring the importance of continued advances in these areas of research and practice."

This work was supported by National Institute on Aging research grant P01 AG31098.

Why is Infant Mortality Higher in the U.S. Than in Europe?

The U.S. infant mortality rate (IMR) compares unfavorably to that of other developed countries, ranking 51st in the world in 2013. In the U.S., there are nearly 7 infant deaths during the first year of life per 1000 live births, roughly twice the rate in Scandinavian countries. The U.S. IMR is similar to that of Croatia, despite a three-fold difference in GDP per capita.

What explains the U.S.'s relatively high IMR? This is the subject of a new NBER working paper by researchers **Alice Chen**, **Emily Oster**, and **Heidi Williams**, "**Why is Infant Mortality Higher in the U.S. Than in Europe?**" (NBER Working Paper No. **20525**).

There are numerous theories as to why the IMR is higher in the U.S. than in other countries. There may be reporting differences for infants born near the threshold of viability, with the U.S. more likely to count them as live births while other countries are more likely to count them as miscarriages or stillbirths. Babies in the U.S. also may have lower birth weight or a lower gestational age at birth, predisposing them to worse outcomes. Finally, U.S. babies may experience a higher neonatal mortality rate (deaths within the first month of life) or higher post-neonatal mortality rate (deaths in months one through twelve) than do babies of similar birth weight and gestational age in other countries.

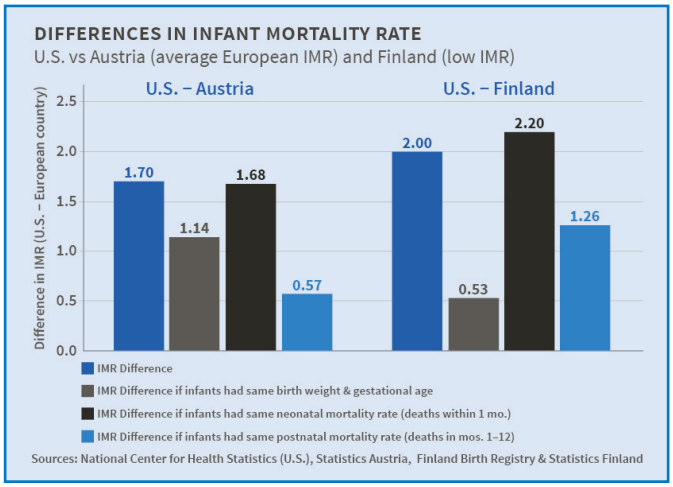
To quantify the importance of these potential sources of the U.S. IMR disadvantage, the authors combine natality micro-data from the U.S. with similar data from Finland and Austria. These countries provide a useful comparison because Finland has one of the lowest IMRs in the world and Austria has an IMR similar to much of continental Europe.

To address the reporting difference issue, the authors limit their sample to infants born after 22 weeks of gestation with birth weight over 500 grams, since births are required to be reported above these thresholds. They also limit the analysis to singleton births, as access to reproductive technologies has increased the frequency of multiple births, which have higher mortality rates. Making these restrictions reduces the U.S. IMR disadvantage by about 40 percent, but a substantial disadvantage remains — in this sample, the U.S. IMR is 4.65 per 1000, versus 2.94 in Austria and 2.64 in Finland.

How much of the remaining U.S. IMR disadvantage can be explained by the other three factors? To explore this, the authors conduct a counterfactual exercise, as reported in the figure. The first column shows the IMR difference for singleton births after 22 weeks and above 500 grams — 1.70 for the U.S. versus Austria and 2.00 for the U.S. versus Finland. The next column reports what the IMR difference would be if the U.S. infants had the same birth weight and gestational age distribution as babies born in Austria or Finland but the relationship between birth conditions and mortality remained what it is in the U.S. currently. Under this scenario, the U.S.-Finland IMR difference would decline by 75 percent, to 0.53 deaths per 1000 live births, due to the higher birth

weight and later gestational age of Finnish infants. By contrast, the U.S.–Austria IMR difference would decline by 30 percent, to 1.14, because birth conditions in Austria are only modestly better than those in the U.S.

The remaining two columns show what the IMR difference would be if U.S. infants had the same birth conditions as they do currently but experienced the neonatal or post-neonatal mortality rate of Austrian or Finnish infants. Conditional on birth conditions, the neonatal mortality rate in the U.S. is similar to that in Austria and actually lower than that in Finland, so making this change does not reduce the IMR difference. However, the post-neonatal mortality rate is much lower in Austria than the U.S., so the U.S.–Austria IMR difference would fall by two-thirds, to 0.57, if the U.S. had Austria's postneontal mortality rate. Applying Finland's mortality rate, the U.S.–Finland IMR difference would fall by one-third, to 1.26. In short, worse conditions at birth and a higher post-neonatal mortality rate are both important contributors to the U.S.'s higher IMR.



Finally, the authors explore how the U.S. IMR disadvantage varies by racial and education group. They find that the U.S.'s higher post-neonatal mortality rate is driven almost entirely by excess mortality among individuals of lower socioeconomic status. As the authors note, "infants born to white, college-educated, married women in the U.S. have mortality rates that are essentially indistinguishable from a similar advantaged demographic in Austria and Finland."

The authors conclude, "these new facts suggest that a sole focus on improving health at birth (for example, through expanding access to prenatal care) will be incomplete, and that policies that target less advantaged groups in the post-neonatal period may be a productive avenue for reducing infant mortality in the U.S." As an example of a potential policy lever, they point to home nurse visiting programs, which have been shown to reduce post-neonatal mortality rates in randomized trials.

The authors acknowledge financial support from the Neubauer Family (Oster), National Institute on Aging grant T32-AG000186 to the NBER (Williams), and National Science Foundation grant 1151497 (Williams).

How Health Evolves After Retirement: The Role of Education

If there is nothing certain in life besides death and taxes, as Benjamin Franklin once wrote, the decline of health at older ages might be considered a close third. Yet quantifying how quickly health declines with age and exploring how this varies by education and racial group is not a simple task.

Researchers **Florian Heiss**, **Steven Venti**, and **David Wise** take on these questions in their recent paper "**The Persistence and Heterogeneity of Health Among Older Americans**" (NBER Working Paper No. **20306**).

The authors begin by pointing out that a simple tabulation of average health by age will yield a misleading picture of how health evolves with age for a typical individual. The reason is that two things happen as people age. First, as expected, health declines. Second, people in better health are more likely to survive from one age to the next. The latter effect, on its own, leads to improvements in average health over time; ignoring this effect thus leads to an understatement of the age-related decline in health.

The authors illustrate this point using data from the Health and Retirement Study (HRS), a longitudinal survey of individuals age 50 and up that began in 1992 and includes rich data on health. They first construct a health index based on responses to 27 questions about functional limitations, health conditions, and medical care usage. For each survey wave, each individual is assigned a health index percentile, where the value reflects the person's position relative to the health of all persons in the HRS in all survey years.

Over the period 1994 to 2010, married individuals in the original HRS cohort (ages 53 to 63 in 1994) experience an average decline in the health index of 16 percentage points. However, this includes a roughly 7-point increase in the index due to greater survival among those who were in better health in 1994. Removing this effect reveals a "true" age-related decline in health over the 16-year period of 23 percentage points.

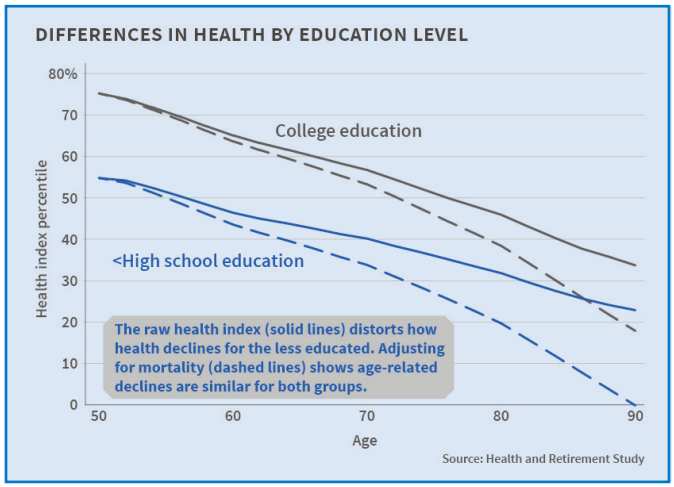
Ignoring the effect of survival can distort conclusions about how health declines with age across education and racial groups as well. To show this, the authors produce simulations based on a joint model of health and mortality. As seen in the figure, at age 50, the average health index value for individuals with a college education is 20 percentage points higher than for those with less than a high school education. The gap appears to narrow to less than 10 points by age 90 (as seen in the convergence of the two solid lines), suggesting that health declines relatively more slowly with age for the less educated.

However, after adjusting for the fact that healthier individuals are more likely to survive to older ages, the gap is more or less constant from age 50 on (as seen in the dashed lines). Thus, age-related declines

in health are roughly similar across education groups. A similar finding holds with respect to race — the Black–White gap in health appears to narrow from 8 to 5 points between ages 50 and 90, but after adjusting for differential survival, the health of Blacks actually declines more rapidly with age than the health of Whites.

The differential levels of health by education group that can be seen in the figure also have important consequences for survival. The authors find that the less educated have substantially higher mortality and that this is primarily due their poorer health — in fact, worse health can explain about four-fifths of the relationship between education and mortality for women, and about two-thirds of the relationship for men.

How does the effect of race compare to that of education? Ignoring education, there are large differences in health across racial groups, with a 12-point gap in the health index between non-Hispanic Whites and non-White Hispanics for women at age 50 and a 7-point gap for men. However, after accounting for differences in education across racial groups, these gaps shrink dramatically.



Overall, the study's results emphasize the existence of substantial health differences by level of education, the persistence of these differences between ages 50 and 90, and the consequences of these differences for mortality. Much of the difference in age-health profiles by racial-ethnic groups is accounted for by differences in education.

One practical implication of the study's findings relates to the private annuity market. The authors show that the value of an annuity is more than twice as high for someone in the top decile of health with a college education as compared to the value for an individual in the lowest health decile with less than a high school education. As people of the same age and gender face the same premium, "this suggests the scope for adverse selection is enormous."

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NBER Profile: *Erzo F.P. Luttmer*

Erzo Luttmer is a Professor of Economics at Dartmouth College. He is also a Research Associate with the NBER's programs in Aging, Political Economy, and Public Economics.

Luttmer is the Co-Editor of the *Journal of Public Economics,* an Associate Editor of the *Quarterly Journal of Economics,* and a member of the editorial board of the *American Economic Journal: Economic Policy*. He is a research fellow of IZA, the Institute for the Study of Labor, and a fellow of Netspar, the Network for Studies on Pensions, Aging, and Retirement.

Professor Luttmer previously held academic appointments at the John F. Kennedy School of Government at Harvard University and the Irving B. Harris School of Public Policy Studies at the University of Chicago. Prior to this, he was a member of the Young Professional program at the World Bank.

Luttmer earned a Ph.D. in Economics from Harvard University, a masters in Econometrics from Erasmus University Rotterdam in the Netherlands, and a degree in electrical engineering from Delft University of Technology in the Netherlands.

Dr. Luttmer's research seeks to understand what drives the demand for redistribution and social insurance and how the implementation of redistribution and social insurance programs can be improved. Many of his papers highlight the important role of social effects in economic behavior. Much of his more recent research explores the role of cognitive limitations on demand for and design of social insurance programs. In 2014, his research on health and the value of consumption was awarded the European Economics Association's Hicks-Tinbergen award.

Luttmer lives with his wife, Ellen Meara, and two children in Hanover, NH. In his free time, he enjoys playing piano, skiing (downhill and cross country), nordic skating, and hiking.

Abstracts of Selected Recent NBER Working Papers

WP 20359

Michael Geruso, Thomas McGuire
Tradeoffs in the Design of Health Plan Payment Systems: Fit, Power, and Balance

In many markets, including the new U.S. Exchanges, health plans are paid by risk-adjusted capitation, in some markets combined with reinsurance and other payment features. This paper proposes three metrics for grading these complex payment systems: fit, power, and balance, each of which addresses a distinct market failure in health insurance. We implement these metrics in a study of Exchange payment systems with data similar to that used to develop the Exchange risk adjustment scheme and describe the tradeoffs among the metrics. We find that a simple reinsurance system scores better on fit, power and balance than the risk adjustment formula in use in the Exchanges.

WP 20400

Janet Currie, Ishita Rajani
Within-Mother Estimates of the Effects of WIC on Birth Outcomes in New York City

There is a large literature suggesting that "WIC works" to improve birth outcomes. However, methodological limitations related to selection into the WIC program have left room for doubt about this conclusion. This paper uses birth records from New York City to address the limitations of the previous literature. We estimate models with mother fixed effects to control for fixed characteristics of mothers and we directly investigate the way that time-varying characteristics of mothers affect selection into the WIC program. We find that WIC is associated with reductions in low birth weight, even among full term infants, and with reductions in the probability that a child is "small for dates." These improvements are associated with a reduction in the probability that the mother gained too little weight during pregnancy. Improvements tend to be largest for first born children. We also find that women on WIC are more likely to be diagnosed with chronic conditions, and receive more intensive medical services, a finding that may reflect improved access to medical care.

WP 20462

Jonathan Gruber, Robin McKnight
Controlling Health Care Costs Through Limited Network Insurance Plans: Evidence from Massachusetts State Employees

Recent years have seen enormous growth in limited network plans that restrict patient choice of provider, particularly through state exchanges under the ACA. Opposition to such plans is based on concerns that restrictions on provider choice will harm patient care. We explore this issue in the context of the Massachusetts GIC, the insurance plan for state employees, which recently introduced a major financial incentive to choose limited network plans for one group of enrollees and not another. We use a quasi-experimental analysis based on the universe of claims data over a three-year period for GIC enrollees. We find that enrollees are very price sensitive in their decision to enroll in limited network plans, with the state's three month "premium holiday" for limited network plans leading 10% of eligible employees to switch to such plans. We find that those who switched spent considerably less on medical care; spending fell by almost 40% for the marginal complier. This reflects both reductions in quantity of services used and prices paid per service. But spending on primary care actually rose for switchers; the reduction in spending came entirely from spending on specialists and on hospital care, including emergency rooms. We find that distance traveled falls for primary care and rises for tertiary care, although there is no evidence of a decrease in the quality of hospitals used by patients. The basic results hold even for the sickest patients, suggesting that limited network plans are saving money by directing care towards primary care and away from downstream spending. We find such savings only for those whose primary care physicians are included in limited network plans, however, suggesting that networks that are particularly restrictive on primary care access may fare less well than those that impose only stronger downstream restrictions.

WP 20470

Marika Cabral, Michael Geruso, Neale Mahoney
Does Privatized Health Insurance Benefit Patients or Producers? Evidence from Medicare Advantage

The debate over privatizing Medicare stems from a fundamental disagreement about whether privatization would primarily generate consumer surplus for individuals or producer surplus for insurance companies and health care providers. This paper investigates this question by studying an existing form of privatized Medicare called Medicare Advantage (MA). Using difference-in-differences variation brought about by payment floors established by the 2000 Benefits Improvement and Protection Act, we find that for each dollar in increased capitation payments, MA insurers reduced premiums to individuals by 45 cents and increased the actuarial value of benefits by 8 cents. Using administrative data on the near-universe of Medicare beneficiaries, we show that advantageous selection into MA cannot explain this incomplete pass-through. Instead, our evidence suggests that insurer market power is an important determinant of the division of surplus, with premium pass-through rates of 13% in the least competitive markets and 74% in the markets with the most competition.

WP 20499

Ann Bartel, Carri Chan, Song-Hee (Hailey) Kim
Should Hospitals Keep their Patients Longer? The Role of Inpatient and Outpatient Care in Reducing Readmissions?

Twenty percent of Medicare patients are readmitted to the hospital within 30 days of discharge, resulting in substantial costs to the U.S. government. As part of the 2010 Affordable Care Act, the Hospital Readmissions Reduction Program financially penalizes hospi-

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tals with higher than expected readmissions. Utilizing data on the over 6.6 million Medicare patients treated between 2008 and 2011, we estimate the reductions in readmission and mortality rates of an inpatient intervention (keeping patients in the hospital for an extra day) versus providing outpatient interventions. We find that for heart failure patients, the inpatient and outpatient interventions have practically identical impact on reducing readmissions. For heart attack and pneumonia patients, keeping patients for one more day can potentially save 5 to 6 times as many lives over outpatient programs. Moreover, we find that even if the outpatient programs were cost-free, incurring the additional costs of an extra day may be a more cost-effective option to save lives. While some outpatient programs can be very effective at reducing hospital readmissions, we find that inpatient interventions can be just as, if not more, effective.

WP 20534

Jason Fletcher, Leora Horwitz, Elizabeth Bradley

Estimating the Value Added of Attending Physicians on Patient Outcomes

Despite increasing calls for value-based payments, existing methodologies for determining physicians' "value added" to patient health outcomes have important limitations. We incorporate methods from the value added literature in education research into a health care setting to present the first value added estimates of health care providers in the literature. Like teacher value added measures that calculate student test score gains, we estimate physician value added based on changes in health status during the course of a hospitalization. We then tie our measures of physician value added to patient outcomes, including length of hospital stay, total charges, health status at discharge, and readmission. The estimated value added varied substantially across physicians and was highly stable for individual physicians. Patients of physicians in the 75th versus 25th percentile of value added had, on average, shorter length of stay (4.76 vs 5.08 days), lower total costs ($17,811 vs $19,822) and higher discharge health status (8% of a standard deviation). Our findings provide evidence to support a new method of determining physician value added in the context of inpatient care that could have wide applicability across health care setting and in estimating value added of other health care providers (nurses, staff, etc).

WP 20537

Hefei Wen, Jason Hockenberry, Janet Cummings

The Effect of Substance Use Disorder Treatment Use on Crime: Evidence from Public Insurance Expansions and Health Insurance Parity Mandates

We examine the effect of increasing the substance use disorder (SUD) treatment rate on reducing violent and property crime rates, based on county-level panels of SUD treatment and crime data between 2001 and 2008 across the United States. To address the potential endogeneity of the SUD treatment rate with respect to crime rate, we exploit the exogenous variation in the SUD treatment rate induced by two state-level policies, namely insurance expansions under the Health Insurance Flexibility and Accountability (HIFA) waivers and parity mandates for SUD treatment. Once we address the endogeneity issue, we are able to demonstrate an economically meaningful reduction in the rates of robbery, aggravated assault and larceny theft attributable to an increased SUD treatment rate. A back-of-the-envelope calculation shows that a 10 percent relative increase in the SUD treatment rate at an average cost of $1.6 billion yields a crime reduction benefit of $2.5 billion to $4.8 billion. Our findings suggest that expanding insurance coverage and benefits for SUD treatment is an effective policy lever to improve treatment use, and the improved SUD treatment use can effectively and cost-effectively promote public safety through crime reduction.

WP 20546

Alan Gustman, Thomas Steinmeier, Nahid Tabatabai

Distributional Effects of Means Testing Social Security: An Exploratory Analysis

This paper examines the distributional implications of introducing additional means testing of Social Security benefits where proceeds are used to help balance Social Security's finances. Benefits of the top quarter of households ranked according to the relevant measure of means are reduced using a modified version of the Social Security Windfall Elimination Provision (WEP). The replacement rate in the first bracket of the benefit formula, determining the Primary Insurance Amount (PIA), would be reduced from 90 percent to 40 percent of Average Indexed Monthly Earnings (AIME). Four measures of means are considered: total wealth; an annualized measure of AIME; the wealth value of pensions; and a measure of average indexed lifetime W2 earnings. The empirical analysis is based on data from the Health and Retirement Study. These means tests would reduce total lifetime household benefits by 7 to 9 percentage points. We find that the basis for means testing Social Security makes a substantial difference as to which households have their benefits reduced, and that different means tests may have different effects on the benefits of families in similar circumstance. We also find that the measure of means used to evaluate the effects of a means test makes a considerable difference as to how one would view the effects of the means test on the distribution of benefits.

NBER

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