THE EFFECT OF INCOME ON ELDERLY MORTALITY: EVIDENCE FROM THE OLD AGE ASSISTANCE PROGRAM IN THE UNITED STATES*

Andreea Balan-Cohen

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Abstract. How much have government programs improved the well-being of the most vulnerable elderly? To analyze this question, I examine the impact of Old Age Assistance (OAA) —the first significant U.S. welfare program for the elderly—on the mortality of older Americans from 1930-1955. I construct two new data sets: a database of OAA benefits and rules, and a database of mortality by age, race, gender, and cause of death. To control for the joint determination of income and mortality, I use a simulated instrumental variables approach that relies on exogenous changes in OAA legislation at the state and year level. I find a substantial reduction in mortality for many vulnerable elderly groups, especially poor males. Mortality decreased mainly because of declines in risky behavior, infectious diseases (after the introduction of antibiotics) and suicides. Household survey analyses reveal changes in consumption consistent with these patterns. Overall, OAA income transfers were highly effective in preventing deaths among the elderly poor by increasing their access to health care and altering their behavior.

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Introduction

What is the effect of welfare programs aimed at the elderly on their health and well-being? In particular, how much have government income support programs done for the poorest and most vulnerable groups? Given the increasing share of elderly in the world population, policies for ensuring good health at older ages are vital. However, how much can a burst of income received rather late in life change the level of recipients' health? I show that the answer is dramatically large, if the initial stock of health is low, and if the additional income substantial.

I focus on the first large-scale elderly welfare program in the United States – the Old Age Assistance Program (OAA). Unlike today's Social Security Program, OAA was specifically targeted at the poor. Moreover, the size of the program was large, even by current standards. Nationwide, more than 23 percent of the elderly in the United States (2.8 million people) were receiving OAA payments at its peak in 1950, and recipiency rates in certain states were even higher, reaching almost 50 percent of the elderly population. Furthermore, the program existed before any other elderly programs that may have targeted other groups (such as the middle class).

Despite the size of the OAA program, its impact on elderly welfare remains largely unexplored. Friedberg (1999) and Costa (1999) show that the change in OAA between 1940 and 1950 resulted in higher retirement rates among 65-75 year old men, and more independent living arrangements among widowed women. These findings, although important on their own, and suggestive of improved elderly well-being, are nevertheless limited from the point of view of welfare evaluation. They do not provide information on the change in elderly welfare resulting from the introduction of OAA, nor on shorter-run yearly variation in such changes. Also, since their focus is on specific sub-groups of elderly, these papers do not shed light on the average effect of OAA, nor allow comparisons between various recipient groups. By contrast, I focus on elderly health and welfare more directly, and shed light on all of these issues.

For these purposes, I have constructed a new dataset that allows me to estimate the impact of OAA income on elderly mortality between 1930 and 1955. Quantifying the impact of income on health is a difficult task, and the sign and size of this effect remain largely unsettled (Cutler et al. 2006, Herd et al. 2007, and Smith 1999). Causality can run from income to health, as well as from health to income, with many complex factors possibly determining both. Due the complexity of issues involved, the goal of this paper is not to assess the importance of income on mortality relative to other factors. Rather, I provide credibly identified estimates of the magnitude of the causal impact of income on elderly health. From this point of view, this paper is similar in spirit to Case (2001) and Evans and Snyder (2002). However, I take this analysis further, by showing how the impact of income is heterogeneous among different population sub-groups, as well as at different income levels, and how this finding can be used to reconcile the contradictory findings of the impact of income on health in the literature.

I use two main econometric strategies in this paper: a differences-in-differences approach, and simulated instrumental variables. I use a panel of states to estimate the impact of income on mortality, thereby controlling for time, state, and age-invariant factors, as well as a rich set of state-level covariates. Since income and mortality are both functions of individual behavior, endogeneity problems remain. To address this issue, I develop an instrumental variable procedure that isolates a source of variation in OAA income—OAA state legislation policy—that is exogenous to mortality. I create a measure of 'simulated' OAA income per elderly person, and use it as an instrument for the actual OAA income in each state and time period.

The OLS coefficient is statistically significant, but rather small, suggesting that between 1930-1955, OAA decreased elderly mortality by 3 percent. Using simulated instruments to correct for income endogeneity, however, reveals that the actual impact of OAA was much larger (20 percent decline). Furthermore, falsification tests reveal that OAA had no impact on the mortality of the 45-64 year olds, who were not eligible for OAA.

The aggregate effect of OAA on mortality masks substantial heterogeneity across different subgroups. To begin with, OAA had a strong protective impact on male elderly mortality, but no significant impact on female deaths at older ages. Using data from mental hospitals admissions (which acted as de facto nursing homes during this time period), I argue that the most likely explanation for this difference was the shift in male living arrangements away from crowded housing conditions (poorhouses). Furthermore, OAA had a strong impact on elderly mortality in non-southern states, but not in southern ones. Since neither black nor white mortality in southern states was affected by the OAA program, I argue that the most probable explanation was the low level of OAA funding in this region, rather than discrimination.

To provide further light on the mechanisms through which the OAA income transfers decreased elderly mortality, I also disaggregate results by the underlying cause of death. I classify mortality into three main groups: mortality from treatable illnesses (represented by infectious diseases), mortality from behavioral causes (tobacco and drinking related) and cardiovascular disease, and mortality from chronic conditions (non-smoking related cancers). Using the natural experiment provided by the introduction of antibiotics in 1944, I show that the OAA income decreased infectious disease mortality by facilitating access to medical technology. I also show that the OAA program had a strong impact on behavioral mortality, especially for men, and at high levels of transfers. This is consistent with a nonlinear effect of income on health operating through changes in the consumption of risky goods, and I confirm this finding using Gallup and consumption survey data.

The paper is organized as follows. Section 1 provides a brief background on the OAA program, including evolution, rules, and recipient characteristics. Section 2 describes the new constructed data sets, and section 3 provides the econometric framework. In section 4, I analyze the effect of OAA on overall mortality, and in section 5, I disaggregate the results by gender, race, and geographic region. In section 6, I examine the channels through which the impact of

OAA on mortality occurred, and section 7 discusses how the results relate to other findings in the literature. Section 8 concludes.

1. Background on the Old Age Assistance Program (OAA)

1.1 Historical Background

On paper, 27 states had old age programs before the passage of the Social Security Act in 1935. In practice, however, most of these programs were optional, since the responsibility for their operation resided with county authorities, making them highly dependent on volatile local funds. Even when operational, these programs had high citizenship and residency restrictions, and more often than not refused to take on new pensioners or cut the benefits of existing ones. As a result, recipiency rates were close to zero almost everywhere, and benefits levels were low.[1]

In 1935, old age pension programs started expanding in earnest. The Social Security Act included provisions for two main programs targeted at the elderly, OAA and Old Age Insurance (OASI). OASI later developed into the current Social Security Program, and was federally administered. OAA, on the other hand, was need-based and intended to be temporary, until OASI would be fully rolled out. Despite its present-day size and importance, until 1950 OASI was the smaller of the two programs; in 1947, for instance, 97 percent of the combined OAA and OASI payments went to OAA.

The provisions of the Social Security Act made OAA programs mandatory (state-wide), and greatly reduced age, citizenship and residency requirements. The OAA program expanded until 1950 when the provisions for OASI were greatly liberalized. It then declined gradually until 1955, and subsequently declined rapidly post 1960. Whereas in 1950, at the peak of the OAA program, 22 percent of the total elderly population were receiving benefits, this number declined to 14 percent in 1960, and to less than 7 percent by 1974. Since after 1955 OASI was much

[1] In 1931 there were only 76,349 recipients in all of the United States, of which 47,000 lived in New York state, 11,000 in

larger in size compared with OAA, and since my identification strategy relies on differences in old age income both across states and time, I restrict my attention to the 1930-1955 time period.

1.2 Size and Variation of the OAA Program

Figure I shows the large expansion of the OAA program after the passage of the Social Security Act, and panels A and B of Figure II reveal that increases in both benefits and the number of recipients contributed to this expansion. OAA benefits during this time period were large; average benefits per recipient represented, on average, 11 percent of personal after-tax income, and about 20 percent of elderly per capita income.[2] For the poor OAA recipients, the additional income from OAA benefits constituted a large increase in overall income; in 1944, for instance, OAA benefits were on average 3.5 larger than recipients' income.[3]

At the inception of the OAA program, the majority of recipients had not benefited from other types of aid, either directly or as members of relief households for at least two years prior to 1936 (Geddes and Leisy, p.3). The impact of OAA on mortality therefore is not likely to be the spurious impact of the cumulative effect of relief.[4] Moreover, during the time period under study, the majority of OAA recipients did not receive relief other than OAA. In 1936 and 1937, only about 25 percent of OAA recipients received other forms of assistance, and this other form of assistance was usually another OAA grant (usually for a spouse). The only exception was the joint receipt of OAA and OASI beginning in 1950s. Since OASI had low coverage and included richer recipients compared to OAA, the overlap between the two programs was initially small.

Massachusetts, and 9,800 in California.

[2]The magnitude of elderly incomes prior to 1950, especially among the poor, is subject to debate due to the lack of adequate data (Weaver 1987, Danzinger et al.1988, Gratton 1996, Lee 2000). Internal analyses of the Social Security Board reveal that elderly income per capita was $600 in 1936 (Gratton 1996). In the 1935-1936 Survey of Consumer Purchases (discussed in section 6), where the poorest elderly are excluded, average income per capita among the elderly was about $800.

[3] Author's calculations based on data from Bureau of Public Assistance (1944), Table 30. Survey data on OAA recipients' incomes from other years is not available. To corroborate this, during the time period studied OAA benefits represented on average 75 percent of the income cut-offs for qualifying for OAA, hence a relative ratio of benefits-to-income of about 3:1 seems plausible.

[4] Fishback et al. (2005) show that the New Deal Relief had a significant negative impact on non-infant (city-level) mortality between 1929-1940.

When the provisions of OASI were liberalized in 1950, however, the number of new OASI beneficiaries receiving minimum benefits—and hence in need of assistance—increased. As a result, the percentage of OAA recipients receiving (some) OASI benefits increased from less than 2 percent in 1944 to 13 percent in 1952 (White 1953). I therefore include in my estimations controls for the level of OASI benefits per elderly person in each state and year.

The evolution of the OAA program depicted in Figures I and II, however, masks enormous variation across states and time. In 1937, for instance, benefits varied from \$61 in Mississippi to \$380 in California, and recipiency rates from 4 percent in Maine to 50 percent in Oklahoma. There was also a large variation within states; for example, between 1940 and 1950, recipiency rates tripled in Alabama and decreased by more than one-half in Delaware.

1.3. OAA Program Rules

In order to qualify for federal funds for OAA, states had to meet certain criteria—by 1940 the age for eligible elderly could not be higher than 65, and residence and citizenship requirements could not exceed 5 years. Within these broadly defined limits, however, program rules were allowed to vary by state. Persons were eligible for aid if their resources were below specified limits for assets, real estate and income, but these limits varied substantially between states and over time. The Federal Government provided states with funding up to a specified limit, according to a common matching formula. This matching schedule was based on states' own contributions: the greater the states' spending per recipient, the lower the federal contribution became at the margin. Thus, the ultimate decision regarding the level of OAA benefits and number of recipients rested with the states themselves, since federal reimbursement was a step function based solely on the amounts that states paid to individual recipients.

States' responsiveness to the federal matching schedule was higher along the intensive (benefits) margin compared to the extensive (recipients) margin, largely due to political factors

(Balan-Cohen and Ban 2007).[5] Despite these differences, both OAA benefits and recipiency rates were very sensitive to own and cross-prices, as well as to the federal contribution to OAA.[6] In turn, these prices were a function of the federal matching schedule, state income and revenue per capita, and the fraction of elderly in the population. I therefore control for a rich set of state-level covariates in my analysis to ensure that OAA payments, rather than state characteristics, are the driving factor behind the changes in elderly mortality.

2. Data

I have constructed a new dataset on mortality, OAA spending at the state level, and a rich set of state-level covariates. Summary statistics are presented in Table I.

*Mortality Data***.** The mortality data between 1927-1955 were collected by hand from Vital Statistics Reports. Appendix A describes the mortality data in greater detail, and discusses data reporting across time, causes of deaths, and regions. The 1934-1955 data are aggregated by state-year-age groups, and cover 48 continental states, as well as five age groups—two for the non-elderly (45-54 and 55-64) and three for the elderly (65-74, 75-84, 85-94). Although I focus on elderly mortality, I also provide estimations of the impact of OAA on the non-elderly, as a specification check. For the 1937-1955 time period, the available data are further disaggregated by race and gender.

Welfare Programs Data. The OAA data set that I constructed covers 1930-1955, and contains yearly information on average state benefits and number of recipients, as well as on the distribution of payments, sources of funds (state versus federal government), and eligibility rules. In addition to the OAA data, I have also collected data on Aid to the Blind (AB) and Aid to Dependent Children (ADC)—the other two main types of public assistance programs (in addition

[5] The responsiveness to the federal subsidy along either the extensive or the intensive margin was also much larger for OAA compared to the other non-elderly programs set up under the Social Security Act, Aid to Dependent Children and Aid to the Blind (Balan-Cohen and Ban 2007)

[6] Baicker (2005) finds a strong responsiveness of AFDC to own and cross prices for the 1948-1963 time period, but

to OAA) established under the Social Security Act. I use ADC and AB data in falsification tests to show that state welfare programs not aimed at the elderly had no impact on elderly mortality. Further details on the OAA, AB, and ADC data are provided in Appendices B1 and B2.

Other Controls. I also collected data on state level factors that influenced the evolution of OAA during this time period or that could have affected mortality (see Appendix B2). These include net personal income (from IRS tax returns), demographic characteristics (the percentages of the total population 65 years and older, black, urban, white, foreign born, or divorced), availability of health resources (total number of hospitals and state expenditures on health), measures of state revenue and expenditures, measures of education (percentage of the population with high school degree or higher, and percentage of the population that is illiterate), measures of religiosity (percentage of the population that is Catholic), as well as measures of employment (percentage of people employed in manufacturing, total wages in manufacturing, percentage of people employed, and the percentage of the labor force in agriculture).

3. Econometric Specification

3.1 OLS Estimation

To assess the impact of OAA on elderly mortality, as well as the channels through which this impact occurs, I estimate regressions of the following form:

$$ln(mortality\ rate)_{sta} = \alpha + \beta * OAA_{st} + X_{st}\theta + S_s + T_t + A_a + S_s * A_a + A_a * T_t + R_r * T_t + \varepsilon_{sta}$$

where *a, s, t,* and *r* index age groups, states, years, and nine census regions respectively, and X is a vector of state-level covariates. *Mortality rate* is the cell mean number of deaths for a given mortality cause, divided by the cell mean population. The dependent variable is the log of the mortality rate.[7] *OAA per elderly person* is defined as the product of the OAA average benefit per

the magnitude is similar along the extensive and intensive margins.

[7] A level specification would constrain the outcome to grow by an equal amount in each cell, which is inappropriate given the large variation in benefits, population and recipiency across states. For suicide mortality, where some cells have zero deaths, the

recipient, multiplied by the recipiency rate (the number of recipients divided by the population 65 years and older). To avoid mechanical correlation between the dependent variable and the OAA measure—stemming from the fact that they both contain elderly population in their denominators—I divide OAA by the 1930 (rather than current) population 65+. This modified OAA measure is expressed in US$ 1982 real terms, and is corrected for differences in the cost of living across states (using Lindert and Williamson 1980).

The unit of observation is the *state-age-year* cell. I include *state, year* and *age* fixed effects, as well as *age*year* and *state*age* interactions in all specifications. Since the source of variation in my estimation is at the *state*year* level, I cannot include *state*year* interactions to control for differential time patterns by state. However, I do include *region*year* interactions in all specifications. The coefficient β is therefore estimated from changes in mortality in a given state and age group over time, as compared to other states in its census region. As a specification check, I also include controls for state and age group specific trends in some estimations.

Individual level OAA and mortality data are not available, so I am constrained to use grouped data estimators, which are less efficient than individual level ones.[8] Regressions are weighted by the square root of population in each cell.[9] I use robust standard errors, corrected for clustering on state and age group. Finally, I omit Louisiana 1946-1952 from the estimation.[10]

3.2 Instrumental Variables Estimation

The OLS estimates can document the relationship between OAA and mortality, but do not

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dependent variable is log ((suicides+1)/population).

[8] Another concern is that the OAA data is not available separately by age group, which could result in measurement error and attenuation bias. Social Security publications reveal that this is not a very big concern; the distribution of OAA was slightly more skewed towards the 65-74 age group, but not by a lot. In 1944 for instance, 55 percent of OAA recipients were in the 65-74 age group, compared to 45 percent in the 75 plus age group.

[9] The weighted regressions are the appropriate way to gauge the impact of OAA faced by the average (nationally representative) person. It also reduces the variability in estimates caused by small state-age group-year cells since the weights are inversely proportional to the variance of each observation.

[10] Due to the populist policies of the governors Jimmy Davis and Earl Long, OAA data for this time period is unreliable. On paper, benefits were almost double than those in the most generous states (for instance California). In practice, however, benefits were much smaller and were often manipulated for political reasons. For instance, Governor Long cut the benefits for blacks in June, at the height of the cotton harvest season (Quadagno 1988).

establish a causal relationship. Although the covariates and fixed effects control for determinants of mortality and correlates of OAA, the OLS results could still be biased due to the endogeneity of income, as both mortality and OAA benefits are functions of individual resources. Since recipients had few resources besides OAA, the absolute levels of these resources are unlikely to be a major concern. However, unobserved *differential* shocks to the incomes of OAA recipients that varied within states and age groups during this time period, would bias OLS coefficients towards zero. The resulting bias could be large, since relative rather than absolute income differences would be the source of the problem.[11]

To address the endogeneity issue, I develop an instrumental variable procedure that isolates a source of variation in OAA income—OAA state legislation policy—that is exogenous to mortality. Essentially, I create a measure of 'simulated' OAA income per elderly person, and use it as an instrument for the actual OAA income (see Appendix C). First, I use the available state OAA legislation to determine eligibility rules in each state and year. Using a national sample of the elderly, I then determine, based on state legislation only, how many elderly in this sample would be eligible for OAA and the amount of OAA benefits they would receive in each state and year. Since I use the same national sample of elderly in each simulation, the resulting OAA instrument is independent of state characteristics, and is a function of state rules only.

OAA state legislation during this period was driven by administrative, bureaucratic and political considerations of a nature unrelated to OAA recipients' resources.[12] Since no published payment schedules existed for OAA, changes in laws were most often driven by bureaucratic

[11] The OLS coefficient in this case would be most likely underestimated since such income shocks would probably be associated with higher relief spending, as well as higher mortality rates. There is a large literature suggesting an independent impact of income inequality on health and mortality. See for instance Kawachi et al. (1999) and Deaton and Lubotsky (2002) for different views on this issue.

[12] Note that the exogeneity condition for the instrument only needs to hold *conditional* on the fixed effects, interactions and covariates. Unconditional exogeneity would not be a valid assumption; for instance, richer states had slightly more generous OAA legislation, though not always.

attempts to clarify the complex aspects of determining need and resources.[13] Political factors also played a large role. OAA payments were more liberal during gubernatorial election years and when the party affiliation of the governor was Democrat, as well as in states with larger fractions of elderly, and lower fractions of blacks (Balan-Cohen and Ban 2007). The OAA legislation reflected certain of these effects (the electoral year increases) but not others (racial discrimination in southern states). Since uniform treatment of recipients was a condition for OAA federal funding, on paper southern states could not discriminate against specific groups; such discrimination was more likely to occur in the actual administration of laws.[14] Furthermore, in non-southern states, legislation was driven by ideological and political battles over the relative roles of OAA and OASI, rather than by recipients' economic circumstances. As a result, changes in OAA legislation often occurred prior to political elections and were reversed afterwards.[15]

The simulated OAA measure is not just exogenous, but also relevant and strong in most specifications; the raw correlation between the actual and simulated measures is 0.7. In some specifications, first stage F tests reveal enough power to estimate the coefficient unbiasedly, but only borderline power regarding test size (Stock and Yogo 2005). To address this issue, I also performed estimations robust to the presence of weaker instruments. I construct confidence intervals for β using the Conditional Likelihood Ratio (CLR) test proposed by Moreira (2003).[16] For point estimation, I use Fuller's (1977) estimator with parameter equal to 1.[17]

[13]Benefits and eligibility were determined on an individual basis, by visiting social workers, on the basis of OAA legislation. In order to ensure uniform standards of assistance, a change in some part of OAA laws more often than not necessitated further changes and clarifications during the next OAA legislature session. See for instance Linford (1949) for an account of legislative changes in Massachusetts.

[14] In southern states local administrators were basically granted full autonomy in determining need. For instance, they could assign OAA recipients to non-local parishes for the purpose of receiving aid, and thus manipulate OAA distribution according local labor needs (Quadagno 1988).

[15] The title of a New York Times article from October 1939 on the OAA political game played by the governor O'Daniel in Texas is revealing "Old Folks Never Did Get Total [OAA Benefits] O'Daniel Set [for them] and Protests Mount as Average [OAA Benefit] Shrinks".

[16] The two-sided CLR test has been shown to have certain optimal properties in terms of its power within a broad class of two sided IV procedures (Andrews, Moreira and Stock 2006), and to retain its properties even in the presence of weak instruments. Estimations using the weak instrument (and autocorrelation and clustering) robust procedure proposed by Hansen and Chernozhukov (2005) yielded similar results and are not reported here.

[17] The Stata algorithm reports the CLR-based confidence interval along with the limited information maximum likelihood

4. The Effect of OAA Income On Elderly Mortality

From 1900 and until 1930, recorded mortality among people aged 65 years and older in the United States fluctuated around a relatively constant trend, of about 9,500 deaths per 100,000 people (Figure III). During the early years of the OAA program (and prior to the passage of the Social Security Act), elderly mortality first declined slightly (to about 9,000 deaths per people) but then rose back to close to its pre-1930 level. By 1955, however, elderly mortality had declined to 26 percent of its 1936 level. Did the expansion of the OAA program between 1936 and 1955 play a causal role in this decline?

The comparison of trends in elderly and non-elderly mortality in states with high (above the median) and low levels of OAA benefits per elderly person provides suggestive evidence. Panel A of Figure IV reveals that elderly mortality declined after 1936 in both groups of states, but did so at a faster rate in states with high OAA levels, especially after 1940 when the OAA program was fully established—by 1939 all states had OAA programs. Furthermore, panel B shows that near-elderly mortality trends do not show this pattern.[18]

Table II shows this more formally. The first column presents the results from estimating equation (1) for people 65 years and older by OLS. The vector of state level controls includes correlates of mortality suggested by the literature—demographic composition, health resources availability, education, employment, manufacturing and agricultural conditions—as well as proxies for elderly political power and income.[19] Of these variables, the only significant

(LIML) estimate of β. Although the LIML estimator has better properties compared to 2SLS, it can nevertheless be biased in the presence of weak instruments due to its lack of finite moments. The Fuller estimator with parameter 1 is essentially a LIML estimator, modified to have finite moments. Hahn et al. (2004) and Andrews et al. (2006,2007) showed that this estimator performs reasonably well, even in the presence of weak instruments.

[18]Mortality among 45-64 years old declined continuously between 1930 and 1955, and it did so at roughly the same rate in both high and low OAA states. The level of mortality was higher in low OAA states, which, on average, were poorer than high OAA states.

[19] The proxies for elderly political power and wealth are the percentage of the population 65 + (proxying for greater mobilization for OAA) and the percentage of housing that was owner occupied (since the resources of elderly people often took the form of housing during this period). Specifications with alternate proxies for health (number of doctors per capita) and education (the percentage of population with high school degree or higher) yielded similar results. Specifications including the percentage of the

correlates of mortality after controlling for income are the number of hospitals per square mile and the fraction of the population that is black. Mortality was higher in states with greater medical needs (where hospitals were endogenously located) and in poorer and possibly discriminatory states (with large shares of black population). Since for any given level of federal subsidies richer states can afford to pay higher benefits, and given that mortality is correlated with income as well, I also control for average after-tax personal income. This measure is also a proxy for states' fiscal capabilities since states that are better at collecting income taxes are usually better at collecting taxes in general.[20] As the results in column 1 suggest, however, state income did not have a separate effect on mortality other than through its influence on OAA. Both OAA and OASI were negatively associated with mortality, but the effect of OAA was larger. The estimate of β implies that OAA decreased mortality by 3.2 percent relative to the level that would have prevailed in the absence of the OAA program.[21]

As discussed in section 3, the endogeneity of income could bias the estimate of β towards zero. To address this issue, I next estimate equation (1) by instrumental variables, using simulated OAA income as an instrument for actual benefits per elderly person. Column 2 of Table II presents the results. The estimate for β is statistically significant and negative, and much larger than the OLS estimate, implying a decline in elderly mortality of 19.7 percent relative to the level that would have prevailed in the absence of OAA.[22]

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population that is urban (to reflect the urban mortality penalty (Cutler and Miller 2005)), the ratio of divorces per new marriages, and the percentage of the population that is catholic (to proxy for private charitable expenditures) were also similar.

[20] States fiscal capabilities were also determinants of states' spending on welfare (Altmeyer 1945). Estimations controlling for states' total revenue per capita, however, yielded essentially the same results.

[21] This is the nationwide sum of the state-by-state declines in yearly deaths following the introduction of OAA, calculated relative to the level that would have prevailed in the program's absence. The effect at the mean level of OAA per elderly person is $1-e^{-0.009*5.99}=5\%$.

[22] In interpreting and calibrating the size of the estimate it's important to keep in mind the much higher likelihood of dying among OAA beneficiaries compared to the rest of the elderly population. In 1936, relief recipients who were 65+ were 3-8 times more likely to suffer from conditions such as tuberculosis, digestive and respiratory diseases, and much less likely to receive either physician or hospital care compared to richer elderly (White 1940, tables 9 and 10). This suggests that mortality changes among OAA recipients would substantially affect overall elderly mortality even in states where the number of OAA recipients was low. For instance, if we assume, conservatively, that OAA recipients were three times as likely to die compared to non-OAA recipients, that they constituted 30% of the overall elderly population, and that all mortality declines from the OAA program

Since state legislation during this time period (conditional on state and year fixed effects) was driven by bureaucratic and political factors unrelated to elderly mortality, the instruments are exogenous. The Hansen J over-identification test confirms this.[23] However, the first stage F statistic reveals that although instruments are strong enough to provide unbiased estimation, they are borderline weak regarding test size (the first stage results are presented in column 3).[24] Estimations robust to the presence of weaker instruments confirm this; the point estimate of β using Fuller's estimator is essentially identical to the IV estimate (column 4), and is contained in the 95 percent confidence interval based on the CLR test (column 5). We are therefore confident that the estimated effect of OAA on mortality is not a mere artifact of invalid instruments.

Although the instrumental variable approach is valid, the slight decline in aggregate elderly mortality before the introduction of OAA raises the possibility that β is simply capturing a continuation of earlier downward trends. To address this issue, in column 1 of Table III, I restrict my attention to the post-1936 time period, and include in the estimation state and age specific mortality trends for the 1926 to 1935 time period.[25] The results, however, are essentially unchanged—the estimated mortality decline is now 19.2 percent rather than 19.7 percent. Columns 2-4 present some further specification checks. In column 2, I extend the analysis to include the 1931-1933 period by combining all persons aged 65+ in a single age group; in column 3, I check the sensitivity of results to using OAA data prior to the passage of the Social Security Act; and in column 4, I address the concern that OASI rather than OAA is driving the results by restricting the estimation to the 1934-1950 time period, when the OASI program was

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were concentrated among recipients, then a decline in mortality among OAA recipients of about 30% would be sufficient to cause a 20% decline in overall mortality as suggested by the IV estimation.

[23] The statistic is 1.94 and we cannot reject the null hypothesis of exogeneity of instruments (p-value is 0.17).

[24] The F statistic is 20.18, which is much larger than the 13.9 critical value required for unbiased point estimation, but only slightly larger compared to the critical value of 19.38 required for correct test size (Stock and Yogo 2005).

[25] I use the data between 1926 and 1935 to run linear regressions of log mortality on year, and construct trend rate predictions for each state and elderly age group for the time period 1936-1955.

small.[26] In all of these specifications, however, the coefficient on β is essentially unchanged.

Although the analysis so far reveals a strong protective impact of OAA on elderly mortality, it is worthwhile to consider two placebo tests in order to confirm its causal nature. In column 5 of Table III, I show that OAA had no effect on the mortality of people 45 to 64 years old, who were ineligible for OAA. Furthermore, income from the other two welfare programs, set up together with OAA under the Social Security Act and subject to similar state administration and matching rate structures, but not targeted at the elderly—Aid to the Blind (AB), and Aid to Dependent Children (ADC)— had no impact on mortality at older ages (columns 6-7). Together, these placebo tests provide further confirmation that our estimates of β capture the causal effect of the OAA income transfer on elderly mortality.

5. Who were the beneficiaries of OAA?

The stated goal of the OAA program was to provide a safety net for the destitute elderly. The question that naturally arises, therefore, is whether this goal was reached in practice. Did mortality among poorer elderly fall more compared to that of the better-off aged individuals? Since the mortality data is not available separately by income levels, I cannot answer this question directly. I can, however, provide insights into this issue by analyzing the impact of OAA on suicides, and disaggregating the results by gender and race.

5.1 The Effect of OAA on Suicides

In rational suicide models, death occurs when the remaining lifetime utility falls below a certain threshold; suicides are thus predicted to be higher among older and poorer people, and to increase with perceived lifetime income decreases. Although not all suicides are rational, existing research has documented these predictions in a variety of settings (Hammermesh and

[26] In column 3, I set the values of OAA benefits to be zero in the years and states without federally approved OAA plans. The rationale behind this latter robustness check is that the OAA data prior to 1936 might be noisier since prior to federal approval OAA data was not collected in a systematic manner.

Soss 1974, Fishback et al. 2005, Cutler et al. 2001, Ruhm 2000). Analyzing the effect of OAA on suicides, therefore, can provide us with valuable insights regarding elderly welfare.

The aggregate trends in elderly and non-elderly suicide mortality between 1930 and 1955 suggest a negative correlation between suicides and OAA (Figure VI). Prior to 1936, suicide levels in all age groups follow a similar trend; after 1936, however, the elderly trend shifts down, while the others continue to track each other closely. Table IV analyzes the relationship between OAA and suicide mortality more formally. The set of state level covariates is the same as in the estimations in the previous section, and the results are qualitatively similar to those for overall mortality, but larger in magnitude. Estimation by OLS and by instrumental variables reveals a statistically significant negative effect of OAA on suicides in both cases, but the IV estimate (-0.087) is larger than the OLS one (-0.019) because it corrects for income endogeneity (columns 1 and 2).[27] Estimations robust to the presence of weaker instruments confirm that the IV estimate of β is –0.087 (column 4), and that it is statistically significant at 5 percent (column 5). The magnitude of the IV coefficient implies a 26 percent decline in suicides relative to the level that would have prevailed in the absence of OAA.

5.2. Effect Of OAA On Elderly Mortality: Results By Gender

Although the suicide results are suggestive of large improvements in elderly welfare in the lower tail of the elderly income distribution, the fact that suicides are a very small share of overall mortality (0.5 percent) leaves unsettled the issue of whether the OAA program had, on average, a stronger impact on the more vulnerable elderly. To shed more light on this issue, I disaggregate the effect of OAA on mortality by demographic groups.[28]

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[27] Since suicides are rare count events, a nonlinear specification such as Poisson might be a more appropriate estimation technique compared to OLS. Estimating equation 1 using a Poisson fixed effect estimator (Cameron and Trivedi 1998) yields results very similar to OLS, however.

[28] Due to the lack of data at this finer level of analysis for the time period before 1937, the estimations in this section cover the 1937-1955 period only. Since the federal subsidization of the OAA program began in 1936, however, this is unlikely to be a major concern.

Table V shows the results disaggregated by gender. The contrast between the effect of OAA on male and female mortality is striking: while OAA reduced male mortality by 30 percent (coefficient –0.1), the impact on female mortality was insignificantly different from zero. The gender composition of OAA beneficiaries is unlikely to explain this differential mortality impact, since the number of female OAA recipients was slightly higher than that of male beneficiaries.[29] The most likely explanation for the different effect of OAA on male and female mortality lies in the nature of the transition that men and women undertook upon receiving OAA.

Compared to men, women without independent means of support were more likely to be cared for in the houses of friends and relatives when they reached old age (Bureau of Research and Statistics 1939). Since income was a large determinant of living arrangements prior to 1950, OAA income transfers between 1940 and 1950 resulted in a shift towards independent living among elderly women (Costa 1998). Elderly men unable to support themselves were less likely to be cared for by families, however, and more likely to be institutionalized. Partly as a heritage of old poor laws, women's destitution in general, and that at older ages in particular, was generally viewed more sympathetically by their families (Gratton and Haber 1994). In addition, the price of caring for older women was lowered by the governments' greater generosity towards women in the distribution of outdoor relief prior to the 1930s, and by the fact that women were perceived as relatively better able to help with household and child care duties (Gratton 1986).

As a result, in the late 1920s, men were twice as likely to be almshouse residents compared to women (Lerman, p.34), and 1.5 times more likely to be institutionalized in mental

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[29] The greater relative presence of men in the labor force at older ages resulted in a higher percentage of men among OASI beneficiaries, and, as OASI expanded, in a lower male OAA participation. Furthermore, as OAA grew in size, its demographic composition began to mirror more closely that of the elderly population at large, in which women were slightly more numerous due to longer life expectancies.

hospitals.[30] Living conditions in these institutions, however, were dire. As an Old Age Security staff report from January 1935 notes "insufficient and unfit food, filth, and unhealthful discomfort characterized most [these places]."[31] The advent of OAA—by providing needy elderly men with sufficient resources for better living—therefore had the potential to significantly improve their relative well being by enabling them to avoid institutionalization.[32]

Detailed state-level data on the number of elderly in almshouses during this time period is not available.[33] In order to shed some light on the impact of OAA on elderly men's likelihood of institutionalization, I have collected data on first admissions to state, municipal, and city mental hospitals, since during this time period these hospitals were increasingly becoming de facto nursing homes for the poor elderly (Lerman 1982).[34] Given that care in mental institutions was government-subsidized, the relatives of needy elderly (as well as local almshouse county officials) often resorted to commitment proceedings, even when the older persons displayed no mental health problems.[35]

The comparison of trends in admission rates in states with high (above the median) and low levels of OAA benefits provides suggestive evidence for the relative greater role played by

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[30] Author's calculations based on data described in text and Appendix B. The share of elderly living in almshouses was about 5% in the early 1930s (Gratton and Haber 1994, Vladeck 1980). The share of *poor* elderly who were institutionalized during this time period is unknown, but believed to be significantly higher.

[31] Moreover, as the same report continues, "even in the sanitary and physically suitable buildings, feebleminded, diseased, and defective inmates were customarily thrown in with the dependent aged."

[32] The elderly men could now live on their own, or pay to live in boarding houses. As Vladeck (1980) notes, the latter option had already been available for richer elderly during the early part of the century, and in the late 1930s, "demand [for this lodging option], fueled by OAA payments, grew steadily." (p.15)

[33] The last almshouse census was performed in 1923, and the sample sizes of institutionalized elderly in the 1930, 1940, and 1950 population censuses are too small (when disaggregated by state) to allow for a careful differences in differences analysis.

[34] By the first half of the 20th century, mental hospitals were increasingly replacing almshouses as de facto nursing homes for the needy elderly. The reason for this change was the fact that while almshouses had to be financed from local community funds, mental hospitals were increasingly benefiting from an influx of state-financed resources. As a result, local communities saw a golden opportunity to shift some of their financial responsibilities onto the states; by redefining senility in psychiatric terms, they were increasingly able to transfer the institutionalized elderly population from almshouses into mental hospitals (Grob 1983). Vladeck (1980) estimates that by 1930 there were at least as many elderly people in facilities for the mentally ill as there were in poorhouses and voluntary and charitable facilities combined.

[35] Lerman (1982) cites a study that estimates thatas many as two-thirds of the inmates of mental institutions in the early 1930s were simply "odd, peculiar, or simply immoral individuals" who had become "a social and financial burden for their families." "The reported behavior of [these people] included primarily nervous and depressive symptoms and a wide variety of fears, beliefs, perceptions [..] In these cases, the examiners […] failed to indicate any reason why the individual, for his own protection, or that of the community, had to be detained" (Lerman 1982, p.33.)

OAA in reducing institutionalization among elderly men (). Panel A reveals that although prior to 1937 institutionalization rates among elderly men in the high OAA states were larger, the trends were reversed after the advent of OAA. Furthermore, panel B shows that admission rate trends for elderly women do not show this pattern.[36] Table VI shows that the OAA program reduced institutionalization rates in mental hospitals by 40 percent for men, but had no statistically significant effect on female admission rates, nor on institutionalization rates for the 55-64 year old groups. Together, the results in tables VI and VII suggest that the OAA program played a larger role in reducing mortality among the more vulnerable group, namely poor elderly men—who had a higher risk of being institutionalized. A back of the envelope calculation suggests that changes in institutionalization rates induced by the OAA program accounted for slightly less than a half of the mortality decline among men.[37]

5.3. Results by Region

Disaggregating mortality results by region and race provides further evidence on the effect of the OAA program on its poor target population. Before 1946, the expansion of the OAA program was uneven across regions. During the early years of the program, the main recipients of OAA federal subsidies were northern and western states; OAA benefits in the south were initially low, and recipiency rates, especially in the cotton belt counties, even lower.[38] In 1946, however, a major change in the federal subsidization formula created incentives for states to admit a larger share of recipients, which, coupled with southern states' desire to attract a larger

[36]Admission rates among elderly females in both groups of states tracked each other closely prior to 1949 at least, but the rates were higher in lower OAA states, which, on average, were poorer than high OAA states. The decline in admission rates for men in high OAA states in the mid-1940s was most likely due to the large expansion of the OAA program in 1946 and 1948 (see section 5.3).

[37] Section 6 provides some further reasons for the male-female mortality differential by disaggregating results by cause of death.

[38] Since some northern and western states already had administrative and legislative infrastructure for OAA in place even before 1936, they were able to take advantage of federal subsidies faster. Furthermore, being richer on average, these states were also able to afford larger OAA programs. In addition, southern states were often unwilling to increase OAA programs for fear of subsidizing black farming families, and thus disrupting local cotton labor markets and tenant arrangements (Quadagno 1988).

share of federal funding, resulted in large expansions of OAA recipients in the south.[39] By contrast, northern and western states, who had fewer elderly on waiting rolls, and for whom increasing benefits was administratively cheaper and politically more attractive (Balan-Cohen and Ban 2007), responded to the federal subsidy by increasing benefits rather than recipients. As a result, the increase in recipients in the southern states was large (Figure VII).

The extent to which this translated into income increases for the poorest elderly in the South is unclear, however. Some authors have suggested that not all recipiency increases were real, and that even as recipiency rates increased, benefits were initially cut .[40] Elderly need was large in the south, however, and economic and political considerations were changing due to the increased mechanization of agriculture—which reduced the need for agricultural labor, and could have thus diminished states' resistance to expanding OAA. Indeed, Figure VIII indicates that benefits in the South did increase eventually, although the magnitude of the increase was much smaller compared to that in non-southern states. Since data on the size of benefits by race is not available, however, it is still possible that increased benefits and recipiency rates occurred mostly among white, rather than the poorer black, elderly.

In order to shed some light on this issue, I estimate the impact of OAA on elderly mortality by race and region. The results, presented in Table VII reveal that the OAA program had a large impact on mortality in non-southern states (17 percent decline for whites and 12 percent decline among blacks), but it had no effect on mortality in the south, either for whites or for blacks (panels A and B), even after the 1946 expansion (panel C). Since mortality among both blacks and whites was unaffected by the OAA income, discrimination is unlikely to be the

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[39]By this time southern politicians were increasingly aware that northern states received a disproportionate share of federal funding and that this situation led to a loss of political power (Quadagno 1988, p. 138)

[40] Some increases were simply accounting tricks, since states sometimes divided (formerly joint) OAA payments between husbands and wives (Quadagno 1988). Also, some states cut benefits somewhat; for instance Alabama increased the number of recipients by 40 percent, but reduced the average payment by $1.16(Quadagno 1988, p.141)

major factor driving the results, at least not directly.[41] The more likely explanation is that since southern states were constrained in expanding the OAA program by their lower levels of resources (Sterner 1943, Quadagno 1988), the size of benefits in the region was insufficient to generate big health improvements, for blacks and whites alike.

6. Mechanisms Leading to Lower Mortality

As the previous two sections show, OAA income decreased elderly mortality substantially between 1930 and 1955, and the effects were larger for the more vulnerable groups—provided that states were able to afford sufficient OAA payments, and provided that the initial levels of health among recipients were low.

Through what mechanisms did the OAA income decrease elderly mortality? Answering this question is a complex task. The literature suggests many channels through which income can affect mortality, including factors as diverse as education, nutritional improvements, sanitation, social status, psychological risk factors, and technological advances (Cutler et al. 2007). In the absence of detailed survey data, the independent contributions of these factors to the change in mortality cannot be identified. Instead, I provide evidence on the most plausible channels through which OAA reduced mortality by disaggregating results by cause of death.

I divide mortality into three groups: mortality from treatable diseases, deaths due behavioral causes, and chronic disease mortality. During this time period, medication existed mainly for infectious diseases (ID for short), and therefore mortality from these causes constitutes the treatable category in my analysis.[42] Mortality from behavioral causes refers to tobacco and alcohol related mortality, as well as cardiovascular deaths. Finally, I perform placebo tests using data on mortality from chronic conditions—non-smoking cancers—, since

[41] It is possible that southern states were unable to discriminate against blacks due to the fact that the federal government required uniformity in the distribution of assistance as a pre-requisite for the disbursement of funds. In order to not disrupt local labor markets, therefore, southern governments could have provided uniformly lower standards of OAA assistance.

these should be less responsive to changes in income compared to more acute conditions.

6.1. Treatable Diseases

Between 1900 and 1930, nutritional improvements and public health measures led to large declines in ID deaths (Preston 1996, Fogel 1994). Among the elderly, ID mortality fell 35 percent, from 1700 to 1100 deaths per 10,000 people.[43] The first medical advances for treating bacterial infections did not occur until the mid 1930s and 1940s, however; in 1935 sulfa drugs were discovered, followed by antibiotics in 1944.[44]

The discovery of sulfa drugs was greeted with a lot of enthusiasm, and was publicized heavily in newspapers and in medical journals. However, although these drugs were effective against certain types of infectious diseases (particularly pneumonia), they were ineffective against others, such as tuberculosis. Moreover, the publicity attending their discovery, coupled with the lack of pharmaceutical regulation during this period, led to overuse, the development of resistant strains, and frequent fatalities (McGrew 1985). In 1943, however, penicillin first became available, and beginning in 1944 other antibiotics also came into use. With the advent of antibiotics (and their combination with sulfa drugs), diseases that were once fatal became easily treatable. Antibiotics were not cheap, however; due to drug-specific patents and collusion in the drug industry, antibiotics prices stayed high throughout the 1940s and 1950s (Goozner 2004).

The introduction of these medical advances provides me with a natural experiment for analyzing the impact of OAA income on elderly mortality. Did OAA income enable the poor elderly, who were cash constrained, to take advantage of the newer and more expensive medical technologies? To answer this question, in Table VIII I examine the effect of OAA on ID

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[42] Prior to 1930s, for instance, drugs could be used to reduce symptoms, ease pain, or induce sleep, but they could not in general be used to cure diseases (Temin 1979, p.434).
[43] Author's calculation based on data from Cutler and Meara (2001).
[44] Although sulfonamides were first identified in 1908, they only came into prominence in 1935 when sulfanilamide was isolated and synthesized. Between 1935-1940, several members of the sulfonamide family were discovered. Antibiotics were discovered in 1940, but they were toxic for human use until the advent of streptomycin in 1944.

mortality, that is, on mortality from diseases that were responsive to antibiotics and sulfa drugs: tuberculosis, pneumonia and flu, syphilis, dysentery, and viral gastrointestinal diseases. Since a Quandt likelihood ratio test reveals that there is a break in the impact of OAA on elderly mortality in 1944, I perform estimations separately for 1930-1943 and 1944-1955.[45] Table VIII shows that the estimate of β is insignificantly different from zero prior to 1944, and strongly negative afterwards (OAA decreased ID elderly mortality by 37 percent between 1944-1955).

These results are consistent with the OAA income decreasing elderly mortality by facilitating access to the costlier, but potentially life-saving, antibiotics. Since crowding and sanitation play an important part in determining ID mortality, however (and in view of our discussion in section 5.2.) it is important to consider here the potential effect of housing conditions on mortality as well. To this view, Table VIII disaggregates the ID mortality results by gender. As columns 5-9 of show, the effect of OAA payments on ID mortality was twice as large for men (30 percent decline) compared to women (14 percent), and there were no spillover effects on the ID mortality of the non-elderly group (column 7). Together, these results are consistent with the results in section 5.2 that the OAA income shifted the living arrangements of the needy elderly men (more so than they did for women) away from crowded and unsanitary housing conditions in poorhouses, and towards independent living.

Since the effect of OAA on ID mortality was discontinuous in 1944 for both men and women, however, we can infer that access to antibiotics played an independent role as well (though potentially reinforcing that of living arrangements): in contrast with the ID mortality results, shows (and Quandt tests confirm) no breaks in the effect of OAA on mental hospital

[45] The Quandt likelihood ratio (QLR) test performs Chow tests on the coefficients at all possible break points in the data, and the highest of these F statistics represents the QLR statistic. If there is a discrete break in the data, the QLR test rejects with high probability; moreover, the value at which the constituent F statistic reaches the maximum is an estimate of the break point. The QLR statistic is 14.16 (much larger than the critical value of 2.43) and it is reached for the year 1944.

admissions during the entire time period.[46]

6.2. Behavioral and Cardiovascular Mortality

Health behaviors and income are closely associated; compared to poorer groups, rich people smoke less (Cutler and Glaeser 2006), seek medical care more actively (Case et al. 2005), are more likely to wear seatbelts (Lerner et al.2001; Shinar et al. 2001), and are less likely to engage in riskier sexual behavior (Oster 2007). Although the causal nature of this association is subject to some debate (Cutler et al. 2007), new experimental evidence suggests that income incentives can indeed induce behavioral changes, especially for smoking (Gine et al. 2008, Volpp 2008).

In order to assess the potential impact of OAA on elderly mortality through this channel, therefore, I parse out behavioral-related causes of death. I use published relative risks tables to determine the mortality causes among the elderly that have the highest fractions attributable to smoking, drinking, and reckless driving.[47] Since heart diseases also have a behavioral component—albeit a smaller one— I analyze the impact of OAA on cardiovascular mortality as well. The results, reported in Table IX, reveal that OAA decreased elderly cardiovascular and behavioral mortality by 23 and 33 percent respectively;[48] furthermore, placebo tests confirm that the OAA program had no impact on the mortality from these causes for the 45-64 year old group.

Although a direct analysis of the impact of the OAA program on elderly health behaviors between 1930 and 1955 is not possible due to data limitations, we can nevertheless provide some very suggestive evidence from survey data. Figure X uses cross-sectional Gallup data to calculate elderly smoking rates by income and OAA recipiency status, and shows that elderly smoking levels during this time period displayed a non-linear relationship with respect to income.[49]

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[47] These are: digestive cancer, lung cancer, and aortic aneurysm; alcoholism and cirrhosis of the liver; and auto accidents respectively. For sources on relative risks tables, see Mokhdad et al. (2000).

[48] Estimated separately, the effects on smoking, and respectively drinking-related mortality are 12 and 28 percent.

[49] Smoking rates were, on average, lowest for the wealthiest elderly, but the poorer elderly smoked less compared to those in an average income bracket. Note that since the Gallup data is only available for 1939, 1944, and 1952, inferences about trends in elderly smoking rates by income are limited, so I focus on analyzing levels instead.

Furthermore, consistent with the mortality results, the Gallup data reveals that although in 1939 OAA beneficiaries were more likely to smoke compared to non-recipients in any income groups, in later years, as the program expanded, the opposite was true. Finally, cross-sectional analyses using 1936 survey data also reveal a nonlinear effect of income on smoking behavior.[50] (Table X, columns (1)-(4))

The Gallup and consumption survey data both suggest a shifting of behavior away from current risk, and towards long life at sufficiently high levels of income. At low incomes, the consumption of risky goods initially increases with additional resources due to the income effect. However, since the value of life also increases with income, at sufficiently high resource levels the latter effect can dominate (Cutler and Glaeser 2006; Costa and Kahn 2004, Oster 2007).[51]

The income inflection points in Table X are low compared to the size of OAA payments between 1934-1955, which explains my finding a negative effect of OAA income on behavioral-related mortality.[52] To show this more formally, I disaggregate the effect of OAA on elderly

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[50]Since the survey does not contain information on alcohol measures, I focus on smoking only. The results for reckless driving (as proxied by fines) are qualitatively similar to those for smoking, but the standard errors are very large owing to small sample sizes. Note that since the elderly samples are smaller, I also perform estimations on the entire adult sample from the 1936 survey. As columns (3) and (4) of Table X show, the results for the elderly are qualitatively similar to those for the entire sample (which are strongly statistically significant).

[51] This might at first seem surprising for smoking given the time period under study. Although the Surgeon General's warning was issued in 1957, the evidence on the harmful effects of smoking on health had already been building throughout the 1930s-1950s (Stratton et al. 2001, Brandt 2007, Stanhope et al. 1964). For instance, it had been known since at least the 1920s that the ill effects of smoking ranged from throat irritation to discomfort, general malaise ("smoking hangover"), physiological malfunctioning, and a decline in mental and physical efficiency. (All these facts were hotly disputed by the tobacco industry, but the cigarette ad campaigns throughout the 1930s and 1940s contained an abundance of disclaimers (Stratton et al. 2001) that are clearly indicative of the fact that people were aware—albeit imperfectly— of the health consequences of smoking).

Furthermore, from the late 1930s onwards the effect of smoking on life expectancy, as well as on several serious diseases—bronchitis, emphysema, coronary heart disease, and lung cancer—was frequently discussed in scientific, as well as popular magazines, and even in some official public health publications. Stanhope et al. (1964) document over 18 articles on the connection between smoking and lung cancer between 1939 and 1955 alone. The years when the connection between smoking and the following health conditions were first discussed in scientific magazines are as follows: lung cancer in 1927 (and then again in the 1940s and in 1950); pulmonary conditions (like bronchitis and emphysema) in 1938; coronary disease in 1940 (and then again in 1945 and 1953); gastric disturbances in 1927; cancer of larynx in 1937; cancer of stomach in 1943 (Stanhope et al. 1964). Among popular magazines, *Reader's Digest* and *In Fact* periodically contained reports on the ill effects of health during the 1940s (Cunningham 1996, Seldes 1968), so much so that cigarette ads from this time period even found it necessary to try to refute the magazine exposes (see for instance the 1942 cigarette ad in Stratton et al. 2001, p.63). Finally, in 1940 the Department of Pensions and National Health even produced an official booklet detailing the many harmful effects of smoking, including shorter life span (Cunningham 1996). Under these circumstances, it is not surprising that richer people, who were more likely to have access to better information, smoked less than poorer ones. (see also Kenkel (2007) for the role of information in smoking from 1957onwards)

[52] Since the value of life effect depends on income, inflection points are going to differ by income groups. To ensure

mortality by income level categories. Table XI shows that OAA had no impact on mortality from smoking-related causes at income levels below the (survey estimated) income inflection point, and that it decreased mortality at higher income levels (columns 1-2). More generally, the effect of OAA on smoking, behavioral, and cardiovascular mortality was statistically insignificant in the two bottom OAA quartiles, and negative and large in the third quartile.[53]

Disaggregating the survey consumption results by gender reveals that although the relationship between income and smoking behavior for men mirrors the patterns in the overall population, for women the relationship is much weaker (Table X, columns 5-8).[54] These results are consistent with other findings in the literature that women's smoking is more related to emotional and psychological factors compared to men's, which makes it less responsive to price and income changes (Carpenter et al. 2005, Chaloupka et al. 1998).[55]

The behavioral mortality data results, disaggregated by gender, mirror the patterns in the survey data (Table IX, columns 5-6).[56] Since behavioral and cardiovascular diseases are important determinants of overall mortality, particularly for men (Case and Paxson 2005), these results provide another explanation for the differential effect of OAA on male and female mortality discussed in section 5.2. Figure IX shows that female elderly mortality trends were similar in both high and low OAA states, but male ones were not; consistent with the survey data patterns, male mortality was increasing in low OAA states, and decreasing in high OAA states.

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comparability with the OAA recipient group, I perform estimations similar to those in Table X on a restricted "poorer" sample of elderly people, with per capita incomes below $900. The estimated income corresponding to the inflection point is $1320. By comparison, the average OAA payment per recipient during this time period was $1850.

[53] In the topmost quartile, however, OAA had a slightly smaller effect on behavioral mortality, and a slight positive effect on cardiovascular mortality

[54] The female smoking participation elasticity (-0.16) is smaller compared to the male one (–0.25), and the number of cigarettes is linearly (rather than inversely U-shaped) related to income for women

[55] This was particularly likely to be the case in the 1930s and 1940s, with the advent of smoking advertising campaigns aimed specifically at women—especially richer ones who were more likely to break the social taboos regarding smoking in public (Amos and Haglund 2000).

[56] The OAA program had a strong protective impact on both behavioral and cardiovascular mortality for men—40, and 30 percent decline, respectively, relative to the level that would have prevailed in the absence of the OAA program. By contrast, the effect of OAA on female behavioral mortality was much smaller (10 percent decline), and that on cardiovascular mortality actually has the opposite sign.

7. Discussion

In the previous sections we have showed that the OAA program had a large impact on infectious, behavioral and cardiovascular mortality among the elderly, but not for the 45-64 year olds who were ineligible for OAA. Furthermore, the OAA program had no impact on elderly mortality from conditions that are less likely to be responsive to income, namely chronic diseases.[57] This provides further evidence that the effect on ID, behavioral and cardiovascular mortality (which are more acute conditions) is unlikely to be spurious. These results suggest three main mechanisms through which OAA income decreased elderly mortality: providing access to health care (antibiotics), shifting living arrangements away from crowded and unsanitary housing conditions in the poorhouses and mental hospitals, and reducing risky health behaviors.

The IV estimations reveal that the exogenous OAA income transfer decreased elderly mortality by 22 percent between 1930 and 1955. This effect is large; it translates into an increase in life expectancy at age 65 of about 2 years among OAA recipients.[58] In all specifications, the IV estimates are three to six times larger than the OLS ones. I have already discussed in section 3.2 how omitted variable bias could explain this difference. Another explanation is the fact that the IV estimates represent a local average treatment effect (Angrist et al.1996). Under the assumption that the effect of income on individuals is heterogeneous due to unobservable characteristics, the IV estimates provide the effect for the groups affected by the OAA policies. Since, as shown in this paper, the effect of OAA income was strongest for the most vulnerable groups, the larger IV estimates simply reflect the larger potential for mortality improvements

[57] Chronic diseases are non-smoking cancers. The IV coefficient (-0.03) is statistically insignificant; the CLR region is (-inf, .068]U[.939, +inf).
[58] The estimated effect is about 1 year in life expectancy increase at age 65 among the entire elderly population, or, roughly, over one third of the entire increase in life expectancy between 1930 and 1955 (calculations available from the author). The effect among OAA recipients is calculated based on the approximation in footnote 23.

among OAA recipients due to their lower initial health and resource levels.[59]

Although this paper finds a large negative impact of income on mortality (which is consistent with a large body of research documenting the protective effects of income on health), other studies in the literature reach a different conclusion, and it is important to understand why this is the case. In a series of recent papers, Ruhm (2000, 2006) argues that economic upturns are actually associated with increases in certain mortality causes, particularly from cardiovascular diseases. The effect of improved economic conditions on cardiovascular mortality in these studies was not due to income per se, however, but rather to the overwork, increased stress, and diminishing leisure time that accompanied the income increases (Ruhm 2006). Since OAA income payments were not associated with work requirements, these factors are unlikely to play a large part in my estimations.[60] Evans and Snyder (2004) use the changes in income from the Social Security Notch, and find a small positive impact of income on mortality. As shown in this paper, however, the impact of income on mortality is heterogeneous across income and vulnerability groups. Since the Notch provided a rather small change in income (4 percent) to a relatively better off elderly population, it is not surprising that mortality was not affected in beneficial ways by the income change.[61]

By contrast, the results in this paper are consistent in both sign and magnitude with those in Case (2001) and Fishback et al.(2005), who also focus on large income transfers to poor groups, namely elderly in South Africa and relief recipients during the Great Depression. My

[59] In a similar context (estimating the effect of New Deal relief on infant and adult mortality), Fishback et al. (2005) report IV estimates that are four to seven times larger than the OLS estimates. Lleras-Muney (2001) and Anderson (2006) report IV estimates of the effect of education and job promotion on mortality that are 3 times and 5 times as large as the OLS estimates.

[60] Friedberg (1998) showed that OAA income increased elderly retirement rates. The effect of retirement on health, however, is unclear (see Charles 2000, Dhaval et al. 2006, and Evans and Snyder 2004, for different views).

[61] In an independent analysis from this paper, Fishback and Stoian (2008, in progress) find no effect of OAA on elderly mortality rates in a panel of 75 cities between 1929 and 1940. This is not surprising given the fact that the size of the benefits and the number of recipients (and thus the size of OAA benefits per elderly person) was much smaller prior to 1940s, before the program started expanding in earnest; OAA benefits per person in 1940 were 50 percent lower than the average OAA benefits between 1940 and 1955. As Figure IV shows, I also find that the effect of OAA on mortality was most significant beginning in the early 1940s. Furthermore, as discussed in section 6, I also find that OAA had no effect on mortality in the bottom quartile of OAA.

estimates of the effect of income on health are slightly smaller than those found by Case for South African elderly and by Fishback et al.'s for infant mortality; however, they are of similar magnitude to the effect of New Deal relief on non-infant deaths from various causes.[62] Furthermore, relatively conservative assumptions on the relative size of OAA benefits in recipients' total incomes between 1934 and 1955 imply an income elasticity value for mortality of between –0.1 and –0.3. These magnitudes are very similar to those typically found in the literature (Deaton and Paxson, 2000).

8. Conclusion

This paper has shown that income from the OAA program had a large causal impact on elderly mortality. On the basis of the IV estimates, I calculate that the yearly cost per elderly life saved was about $77,716, well under the typical benchmark for the value of life of $100,000 per year.[63] Impressively, this compares favorably with programs such as Medicaid, which are targeted more directly at improving health (Currie and Gruber 1996). The estimates of the cost per life saved are also lower than those found by Fishback et al. (2005), which is consistent with the fact that OAA was more targeted in focus than the New Deal relief programs that they study.

These results suggest that income programs targeted at the elderly could provide a relatively cost-effective means of improving elderly health. Although the findings in this paper apply to low-income and vulnerable groups during the earlier half of the 20th century, the issues discussed are still very relevant to present policy concerns, because there are many elderly living at similar levels of poverty today. In developing countries, where most of the world's poorest elderly reside, and where government programs are still in their nascent stages, these results

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[62] Fishback et al. (2005) find no effect on cardiovascular mortality, however. Since New Deal spending had a large work relief component (and given the stress and turmoil associated with the Great Depression), it seems likely that factors like those proposed in Ruhm (2006) account for this effect.

[63] Note that our empirical specification can be rewritten as $D=C*e^{-\beta*OAA}$, where D is the number of deaths, and C represents the contribution of factors other than OAA to mortality. This implies that 1 marginal dollar of OAA spending will save $\beta*D_0$ number of life years, where D_0 represents the number of deaths at the inception of the OAA program. Since the units for the OAA

could be particularly useful. It is estimated that 75 percent of all elderly will live in developing countries by 2025 (Bloom and Canning 2003). Even in the United States, the government benefits that flow to the poorest elderly today (those receiving Supplemental Security Income – the successor to OAA) are comparable in magnitude to those of the original OAA recipients.[64]

Furthermore, the channels that I find have the greatest impact on mortality—increased access to medical care, housing conditions, and behavioral modifications—are still highly relevant at present. In developing countries access to sanitation and basic medical technologies (including antibiotics) is an important issue for elderly populations, and the rise in obesity, diabetes, and cardiovascular disease—in countries as different as the United States and India—illustrates how health and lifestyle issues are still major concerns.

variable are 1982 dollars (in hundreds) per elderly person in 1931, we obtain that the cost per year of life saved was $77,716 (expressed in 2000 dollars).

[64] Author's calculations based on data from McGarry 2000.

Appendix A: Mortality Data

The 1934-1955 mortality dataset was collected by hand from the United States Historical Vital Statistics Reports, and it covers all 48 continental states. The mortality data is organized by year, state, five-year age groups, and cause of death. Between 1937-1955, the data are also available separately by gender and race. Since the unit of observation in my analysis is the state-year-age group cell, and since for less populous states and low count mortality causes some cells are small, I aggregate the mortality data by ten-year age group intervals in order to reduce sample variability. The dataset used in this paper therefore contains five age groups, two for the non-elderly (45-54, 55-64) and three for the elderly (65-74, 75-84, 85-94). Between 1931-1933, the mortality data for the elderly were reported together in a single age category, 65 years and older. All specifications including this time period, therefore, contain only one age group for the elderly.

One concern about the mortality data is the fact that the United States had no national system of death records until 1933. However, official mortality data from a "death registration area" exists from as early as the 1900s.[65] I collected this data for the years 1927-1933 from the Census Bureau's Mortality Statistics. Data for 1930 was not available. The "death registration area" comprised only 10 states in 1900, but by 1927 when my data series begins, it included all continental states except Nevada, New Mexico, Oklahoma and Texas.[66] Mortality data from these states was, however, collected and published even before their inclusion in the registration area, and there seems to be a general agreement among demographers that data collection and reporting was good for at least a couple of years before the completion of the national registration system. Another concern about the mortality data is the existence of a break in the data series in the year 1937, when the mortality data started being tabulated by place of residence (rather than by place of occurrence, which had previously been the case).

Since the OAA program started expanding in earnest in 1937, the core of my analysis focuses on the 1937-1955 time period, and hence neither of these mortality concerns is crucial for the results. To alleviate concerns about the reliability of mortality data prior to 1933, as well as regarding the 1937 data series change, I have also analyzed the impact of OAA on mortality during the 1937-1955 time period only. These results were essentially the same as those from the full specifications (1931-1955) reported in the paper.

Another factor affecting the reliability of the mortality data is the fact that mortality by cause of death is tabulated differently across the years. However, since the listing of each cause of death is accompanied by its corresponding three-digit International Classification of Diseases (ICD) code, a consistent aggregation of the mortality data by cause of death across the years is possible.[67] The official ICD classification of diseases changed twice during my sample, however, in 1939, and in 1949. This could result in spurious changes in mortality over time, due to either changes in the classification of medical conditions or in the rules that determine the selection of the underlying cause of death. Fortunately, comparability studies of mortality data under various ICD classifications are routinely done as part of the implementation of a new revision. I have used the comparability studies between the 4th and 5th, as well as between the 5th and 6th ICD revisions to ensure a consistent aggregation of causes of death across time.[68]

As these studies discuss, since most ICD changes tend to occur across related cause of death rubrics, breaks in the mortality data trends can be minimized by aggregating data across larger categories.

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[65] Haines, Michael R. (2001) "The Urban Mortality Transition in the United States, 1800-1940." *NBER Historical* Working Paper No. 134.

[66] These states joined the death registration area in 1929, 1929, 1928 and 1933 respectively.

[67] The International Classification of Diseases (ICD) is designed by the World Health Organization to promote international comparability in the collection, processing and presentation of mortality data, including a common format for reporting causes of death on death certificates. The ICD is revised roughly every ten years by WHO to incorporate changes in the medical field.

[68] United States Department of Health, Education, and Welfare; Public Health Service (1964)."Comparability Ratios based on Mortality Statistics for the Fifth and Sixth Revision, United States 1950." *Vital Statistics, Special Reports*, 51(3) and, respectively, United States Department of Commerce, Bureau of the Census (1944) "Comparison of the Cause of Death Assignments by the 1928 and 1938 Revisions of the International List of Deaths in the United States 1940." *Vital Statistics,* Special Reports, 19(14).

Throughout my analysis, I therefore focus on broader cause of death categories: mortality from infectious, behavioral, cardiovascular, and chronic (non-smoking cancers) diseases. Even though suicides constitute a narrower cause of death category, I also include them in my analysis. Comparability ratios for suicides, however, are very high, being essentially 1 across both ICD changes.[69]

For the first ICD change, comparability ratios are close to one (about 0.99) for all of the mortality causes included in my analysis. For the second ICD change, the comparability ratios are slightly lower than one for smoking cancers and tuberculosis (0.95), and slightly higher for heart diseases (1.08). This suggests that the potential bias from changes in ICD classification should move in opposite directions for non-smoking and smoking cancers compared to heart diseases. However, in my estimation of the effect of OAA on mortality I find a negative impact on *both* cardiovascular and smoking mortality, and no effect on non-smoking cancer mortality. In addition, comparability studies reveal that changes in ICD classifications affected comparability ratios in roughly similar ways for the non-elderly (45-64 years old) and the young elderly (65-74 years old). Since I find that the impact of OAA on mortality is strongly negative for the elderly, but insignificant for the non-elderly, this further reinforces our conviction that the effect of OAA on mortality is not merely an artifact of the changes in the ICD classification. Also, the direction of my results is essentially unchanged (but the magnitude is predictably slightly smaller) if I restrict my sample to the 1940-1949 time period when there were no changes in the ICD classification.

Finally, there are some concerns regarding the accuracy in the reporting of the mortality rates at older ages for blacks (see for instance Preston and Elo1994, Preston et al.1996, 1998). Mortality rates among blacks calculated using vital statistics counts in the numerator and census counts in the denominator tend to be too low, due to age over-reporting in the censuses (Preston and Elo 1994). In the vital statistics data, age was usually determined by the funeral directors, and was thus considered reliable. In the censuses, however, age was self-reported (or reported by a family member), and hence age overestimation among elderly during the early censuses was likely. This was due to the lack of birth registration in their states of birth when these elderly black cohorts were born, as well as to the high levels of illiteracy. We would expect these inaccuracies in age reporting to be strongest in the South, and thus to bias us *in favor* of finding a strong effect of OAA on black mortality there. However, I find that OAA had no impact on elderly mortality among blacks in the South, which suggests that this is not a major concern in the estimation.

[69] The comparability ratio is defined as the ratio of deaths assigned to a certain ICD classification divided by the number of deaths assigned to the previous ICD classification.

Appendix B1: OAA and Controls Data Sources

Number OAA recipients and Average Benefits per Recipient:

Year	*Source*
1930, 1931	Connecticut Commission to Investigate the Subject of Old Age Pensions, Report on Old Age Relief, Hartford, 1932
1933	Florence E. Parker, "Experience Under State Old-Age Pension Acts in 1934", *Monthly Labor Review*, August 1935
1934	United States Department of Labor, *Public Old Age Pensions and Insurance in the United States and In Foreign Countries*, Government Printing Office, Washington, 1932.
1935	"Old Age Assistance in the United States, 1938" *Monthly Labor Review*, July 1939.
1937-1940	*Social Security Board Annual Report*, various issues
1941-1948	*Social Security Yearbook*, various issues
1949-1955	*Social Security Bulletin*, various issues

***State Legislation Data Sources*:**

Year	Source
1934	Maxwell, Stewart. *Social Security*, New York: WW Norton and Company 's,Table II, pp.371-372. 1935
1935	Emerson P. Schmidt. "Provisions of Old Age Assistance laws in the United States as of October 15, 1935", in *Old Age Security*, p.169-171, 1936.
1936	Social Security Board, *Characteristics of state plans for old-age assistance*. United States Government Printing Office, Washington, D.C, April 1937
1937	Social Security Board, *Characteristics of state plans for old-age assistance*. United States Government Printing Office, Washington, D.C, December 1937
1939	Social Security Board, *Characteristics of state plans for old-age assistance*. United States Government Printing Office, Washington, D.C, October 1939
1940	Social Security Board, *Characteristics of state plans for old-age assistance*. United States Government Printing Office, Washington, D.C, July 1940.
1941	"Eligibility For Public Assistance Under Approved State Plans, as of December 1941", *Social Security Yearbook* 1941, pp.97-113.
1941	"Legislative Changes In Public Assistance, 1941". *Social Security Bulletin*, November 1941,pp.14-19.

Year	Source
1943	"Eligibility For Public Assistance as of December 1943", *Social Security Yearbook* 1943, pp.56-58
1944	Bureau of Public Assistance, *Preliminary tables on incomes and living arrangements of recipients of old-age assistance in 21 states*, 1944 .Washington, D.C. : FSA, SSB, 1945.
1945	Berman, Jules & Jacobs, Haskell. "Legislative Changes In Public Assistance, 1945,"*Social Security Bulletin*, April 1946. "Legislative Changes, 1945" in *Social Security Yearbook*, 1945, pp.163-165.
1946	United States Bureau of Public Assistance, *Characteristics of state plans: old-age assistance, aid to the blind, aid to dependent children*. Washington, D.C., Federal security agency, Social security administration, Bureau of public assistance, 1946
1948	United States Bureau of Public Assistance, S*upplement To Characteristics of state public assistance plans under the Social Security Act*,Washington, D.C., Federal security agency, Social security administration, Bureau of public assistance, 1948.
1946	"Public Assistance and Related Legislation, 1946", *Social Security Bulletin*, May 1947, pp.30-36.
1947	"Legislative Changes in Public Assistance, 1947" in *Social Security Yearbook*, 1947, pp.59, p.62. Berman, Jules. "Legislative Changes In Public Assistance, 1947". *Social Security Bulletin*, November 1947, p.7-15. "Social Security Legislation in 1947", Social Security Bulletin, September 1947, pp.13-15
1951	Berman, Jules & Blaetus, George. "State Public Assistance Legislation, 1951". *Social Security Bulletin*, December 1951,p.3-10.
1953	United States Bureau of Public Assistance, *Characteristics of state public assistance plans under the Social Security Ac*t,Washington, D.C., Federal security agency, Social security administration, Bureau of public assistance, 1953.
1954	Berman, Jules & Blaetus, George. "State Public Assistance Legislation, 1953". *Social Security Bulletin*, January 1954,p.3-10.
1955	United States Bureau of Public Assistance, Characteristics of state public assistance plans under the Social Security Act, Washington, D.C., Federal security agency, Social security administration, Bureau of public assistance, 1956

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Appendix B2: State Level Controls Data Sources

-The state net income and number of IRS returns data are from IRS returns, published every year in the *Statistical Abstract of the United States*.
-Data on the percentage of population employed in manufacturing and wages in the manufacturing sector are from the *Census of Manufactures*. The data was collected every two years, and is available for all odd years, except for 1941, 1943 and 1945. Data for years in between was imputed using linear interpolation.
-Data on the percentages of total population that was illiterate, lived in urban areas, was black or white foreign born are from the *Statistical Abstract of the United States*. Data for years in between census years was imputed using a linear interpolation by state.
-Data on states' population comes from the censuses. The yearly state population data was constructed by fitting cubics to the 1930-1960 census data.
-Data on average value of farmland and average acre per farm was reported in the *Statistical Abstract of the United States* for census years. Average farm value was constructed as the product of these two measures. Data for non-census years was generated using a linear interpolation by state.
-Data on the percentages of housing owner occupied and on the percentage of farms that were tenant operated come from the censuses. Data for years in between census years was imputed using a linear interpolation by state
-Data on number of physicians was collected from several years of the *American Medical Directory.* Missing values were imputed using linear interpolation by state.
-Data on number of hospitals was published yearly in the hospital issue of the *Journal of the American Medical Association*. Missing values for 1954 and 1955 were imputed using linear interpolation by state.
-State total revenues and expenditures, and state expenditures on health were published in the *Financial Statistics of States* for the years 1930 and 1937-1945, and in the *Compendium of State Government Finances* for the years 1947, 1948, 1952,1953, 1955, 1956. Missing values were generated using a linear interpolation by state.
-Data on the number of ADC , AB and OASI recipients and benefits were collected from several issues of the *Social Security Board Annual Report* (1937-1940), Social Security Yearbook (1941-1948), and the *Social Security Bulletin* (1949-1955). Data for OASI is only available 1941 and onwards.
-Data on the number of people employed come from Lee, Everett S., A. Miller, C. Brainerd, and R. Easterlin (1957).*Population Redistribution and Economic Growth: United States, 1870-1950*. (Vol.1:Methodological Considerations and Reference Tables. Philadelphia: The American Philosopical Society). Missing values were generated using a linear interpolation by state.
-Data on first admissions to mental hospitals by state, year, age group and gender was collected from several issues of the *Patients in hospitals for mental disease* (Census Bureau 1931-1949).

Appendix C: Simulation Details

I construct simulated measures of benefits and recipiency rates, which are used to instrument the actual state OAA benefits and recipiency rates during the time period under study, 1934-1955.

I use the 1936 Survey of Consumer Purchases to construct a "national" sample of elderly people (aged 65 years and older). The sample contains all elderly people from the survey with non-missing income observations. I then estimate the yearly income of each individual in the sample, assuming that the rate of growth of their (survey) income levels between 1934 and 1955 was the same as the yearly rate of growth in the (nationwide) net personal income per return.[70] State legislation is then used to determine what fraction of the national elderly sample would qualify for OAA in each state and year (on the basis of state legislation only), and the total amount of benefits that the eligible people would receive. Specifically, in any given state and year, an individual "qualifies" for OAA if their estimated resources (less certain state specific disregards for work and minimal expenses) are below a multiple of that state's resource cutoffs for the given year. For each eligible individual, OAA benefits are then calculated as the difference between the maximum legislated OAA benefit in that state and year, minus a multiple (generally one) of the eligible individual's resources.[71] Non-eligible individuals are assigned zero benefits. Simulated OAA benefits per elderly person in each state and year are then calculated as the sum of individual OAA benefits, divided by the elderly sample size. Since the actual OAA measure is calculated using the population 65 years and older in 1930 in the denominator (rather than current population), the simulated OAA benefits are also adjusted in a similar manner.

Simulations using more complex state rules (separate state maximum benefits and resource constraints for married and single individuals, allowing eligibility to depend on individuals' living arrangements and/or on house ownership status) yield very similar estimates of simulated benefits compared to the simpler ones on which the results in the paper are based.[72]

By using a national sample, we abstract from selection issues at state level. Since the 1936Survey of Consumer Purchases was not a fully representative sample of the elderly population during this time period, I have also performed simulations using an elderly sample drawn from the 1950 Census, but the results are very similar—the correlation between the simulated OAA measure derived on the basis of the Survey of Consumer Purchases data and that based on the census data is 0.9. This is not surprising given that the relative size of recipients' resources, though measured differently in the survey and in the census data, was low compared to the magnitude of the OAA benefits.

[70] Various other assumptions about elderly income growth during this time period (for instance equal to the yearly rate of growth in average GDP per capita) yielded similar results.

[71] A few states (in some years) had no legislated state benefit maxima. For these observations, I assume that state maximum benefits are equal to the federal maximum benefits in that year. Assuming that state maximum benefits were equal to a weighted average of neighboring states' maximum benefits produces qualitatively similar results.

[72] The correlation coefficients between the simulated benefits measures calculated in these different ways all range between 0.7 and 0.9.

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Table I. Summary statistics

Variable	*# Obs*	*Mean*	*St.dev*
OAA per elderly (h)	3,309	5.99	5.87
Simulated OAA per elderly (h)	3,309	12.26	8.49
OASI (per elderly) (h)	3,309	4.66	7.61
ADC per elderly (h)	3,309	1.80	1.91
AB per elderly (h)	3,309	0.19	0.22
Hospitals per sq mile	3,309	0.004	0.006
Health Expenditures per capita (th)	3,309	0.028	0.024
Net Income per Return (th)	3,309	17.10	5.58
% Black	3,309	9.18	12.25
Manufacturing Wages per capita	3,309	752.80	650.60
% Employment in manufacturing	3,309	16.48	10.90
% with HS degree or higher	3,309	28.41	8.94
% Illiterate	3,309	3.66	2.74
% Pop 65+ in 1931	3,309	5.68	1.42
% Housing owner occupied	3,309	51.93	8.69
% Tenant operated farms	3,309	25.73	16.15
% Employed	3,309	38.13	3.04
Average farm value (th)	3,309	64.72	50.22
% White foreign born	3,309	16.64	12.26
Mortality rates, 65+ age group			
Overall mortality rate	3024	1131.05	673.89
Infectious disease mortality rate	3312	80.75	77.42
Behavioral mortality rate	3312	130.50	135.70
Cardiovascular mortality rate	3312	566.61	433.99
Suicide mortality rate	3024	2.89	2.24
Mortality rates, 45-64 age group			
Overall mortality rate	2206	148.26	60.71
Infectious disease mortality rate	2208	16.24	10.83
Behavioral mortality rate	2208	24.48	15.26
Cardiovascular mortality rate	2208	63.93	34.86
Suicide mortality rate	2110	0.72	0.67

Note: (Th) and (h) denote data expressed in thousands and hundreds, respectively. All monetary values (net income, OAA, OASI, ADC, AB benefits, average farm value, manufacturing values per capita) are expressed in 1982$ and are corrected for differences in the cost of living across states using Lindert and Williamson (1980). Number of deaths by state, year and 5 age groups (45-54, 55-64, 65-74, 75-84,85-94) was collected from the Vital Statistics. The yearly state population for each age group was constructed by fitting cubics to the US 1930-1960 census data. The unit of measurement is deaths per 10,000 people. Infectious disease mortality refers to deaths from tuberculosis, pneumonia & flu, syphilis, dysentery, and viral gastrointestinal diseases. The behavioral mortality category includes deaths from digestive and lung cancer, hypertension and arteriosclerosis. Cardiovascular mortality includes all deaths from heart disease (excluding hypertension and arteriosclerosis) and from stroke. The data covers 48 continental states and the time period 1931-1955.

Table II The impact of OAA on elderly mortality rates, 1934-1955

Dependent Var = ln(Overall Mortality)	*(1) OLS*	*(2) IV*	*(3) IV 1st Stage*	*(4) Fuller*	*(5) CLR*
OAA per Elderly	-0.009	-0.062		-0.062	-0.059
	(0.006)+	(0.035)+		(0.013)**	(-.072 -.048)**
Simulated OAA per Elderly			0.11		
			(0.018)**		
1931 % Pop 65+	0.53	0.40	-2.16	0.40	0.31
	(0.31)+	(0.25)	(1.69)	(0.09)**	(0.11)**
% Housing Owner Occupied	0.014	0.037	0.47	0.037	0.032
	(0.01)	(0.02)+	(0.12)**	(0.008)**	(0.004)**
% Tenant Operated Farms	-0.007	-0.026	-0.38	-0.026	-0.025
	(0.005)	(0.015)+	(0.094)**	(0.006)**	(0.003)**
ln(Avg Net Personal Income)	0.10	0.13	0.49	0.13	0.12
	(0.09)	(0.10)	(1.32)	(0.09)	(0.05)*
% Employment in Manufacturing	0.20	0.27	0.84	0.27	0.19
	(0.15)	(0.17)	(1.07)	(0.06)**	(0.03)**
ln(Health Spending Per Capita)	0.023	0.064	0.62	0.064	0.050
	(0.026)	(0.042)	(0.36)+	(0.023)**	(0.014)**
OASI per elderly	-0.045	-0.044	-0.64	-0.044	-0.028
	(0.03)+	(0.03)	(0.39)	(0.02)**	(0.01)*
Hospitals Per Mile	88.79	76.87	-181.43	76.87	71.20
	(51.89)+	(44.65)+	(219.4)	(14.28)**	(7.33)**
ln(Manufacturing Wages Per Capita)	-521.09	-623.61	-2391.41	-623.61	-541.14
	(318.48)	(337.65)+	(1533.3)	(106.80)**	(45.05)**
% Illiterate	-0.045	-0.054	-0.071	-0.054	-0.059
	(0.029)	(0.038)	(0.39)	(0.013)**	(0.01)**
ln(Avg Farm Value)	0.15	0.12	-0.70	0.12	0.15
	(0.14)	(0.14)	(1.50)	(0.055)*	(0.047)**
% Employed	0.92	-2.62	-61.30	-2.62	-2.88
	(1.44)	(2.23)	(15.63)**	(1.01)**	(0.61)**
% Black	0.077	0.10	0.47	0.10	0.088
	(0.042)+	(0.055)+	(0.34)	(0.016)**	(0.006)**
% Whites Foreign Born	0.023	0.035	0.31	0.035	0.030
	(0.014)	(0.021)	(0.14)*	(0.006)**	(0.003)**
Observations	2826	2826	2826	2826	2826
Adjusted R-squared	0.97	0.96	0.96	0.96	0.99

Note: + significant at 10%; * significant at 5%; ** significant at 1%. Standard errors (in parentheses) are clustered at the state*age group level. The unit of observation is the state-year-age group cell. The sample in all regressions covers 3 age groups (65-74, 75-84,85-94), 48 continental states, and the years 1934-1955. The dependent variable is the log of number of overall deaths divided by the mean cell population; the unit of measurement is deaths per 10,000 people OAA per elderly person in each cell is defined as the ratio between total state OAA benefits, divided by the population 65 years and older in 1930. Benefits are expressed in real terms (hundreds of US$ 1982), and are corrected for differences in the cost of living across states. All regressions include state, year, age group fixed effects, as well as state*age, age*year and region*year interactions. Observations are weighed by the mean cell population. Estimation is by OLS in column (1) and by instrumental variables in column (2). The instruments are simulated OAA per elderly person and an indicator variable for states that had no legislated state OAA maximum in a given year (specifications are not sensitive to including the latter instrument). Column (3) shows the first stage results. Estimation in column (4) is performed using Fuller (1997)'s estimator with parameter 1 and provides unbiased estimates for the effect β of OAA on mortality. Column (5) shows the 95% confidence region for β, calculated using the Conditional Likelihood Ratio Test proposed by Moreira (2003).

Table III Mortality robustness checks

Dependent Var = ln(Overall Mortality)	(1) With Trends	(2) Elderly 31-55	(3) Adj OAA Measure	(4) Pre 1950 Only	(5) Non-Elderly	(6) ADC	(7) AB
OAA per Elderly	-0.060	-0.065	-0.062	-0.066	-0.0035		
	(0.033)+	(0.030)*	(0.034)+	(0.040)	(0.0064)		
ADC per Elderly						-0.11	-.613
						(0.084)	(.442)
1931 % Pop > 65	0.41	0.41	0.40	0.46	-0.041	0.60	0.79
	(0.25)+	(0.29)	(0.25)	(0.29)	(0.070)	(0.40)	(0.53)
% Housing Owner Occupied	0.034	0.040	0.037	0.011	0.0004	0.021	0.028
	(0.020)+	(0.019)*	(0.021)+	(0.015)	(0.005)	(0.016)	(0.019)
% Tenant Operated Farms	-0.028	-0.026	-0.025	-0.035	-0.0034	-0.0024	0.007
	(0.016)+	(0.016)	(0.015)+	(0.023)	(0.0038)	(0.0066)	(0.008)
ln(Avg Net Personal Income)	0.11	0.11	0.13	0.025	0.071	0.13	0.133
	(0.095)	(0.15)	(0.10)	(0.090)	(0.047)	(0.14)	(0.13)
% Employment in Manufacturing	0.25	0.29	0.27	0.065	-0.0009	0.28	0.17
	(0.16)	(0.18)	(0.17)	(0.12)	(0.049)	(0.19)	(0.16)
ln(Public Health Spending Per Capita)	0.057	0.066	0.065	0.10	0.0043	0.041	0.026
	(0.038)	(0.054)	(0.042)	(0.059)+	(0.012)	(0.040)	(0.04)
OASI per elderly	-0.037	-0.052	-0.044	0.20	0.001	-0.035	-0.07
	(0.027)	(0.037)	(0.028)	(0.53)	(0.014)	(0.03)	(0.049)
Hospitals Per Mile	76.48	79.67	76.82	44.81	-3.47	117.12	115.66
	(43.57)+	(45.09)+	(44.64)+	(34.76)	(9.61)	(72.58)	(74.72)
ln(Manufacturing Wages Per Capita)	-582.50	-671.79	-623.62	-395.82	25.93	-740.63	-400.1
	(316.94)+	(279.62)*	(337.77)+	(299.79)	(71.62)	(449.24)	(279.69)
% Illiterate	-0.059	-0.042	-0.054	-0.039	0.0081	-0.039	-0.057
	(0.039)	(0.050)	(0.038)	(0.040)	(0.014)	(0.034)	(0.43)
ln(Avg Farm Value)	0.15	0.13	0.12	0.28	-0.041	0.18	0.39
	(0.15)	(0.19)	(0.14)	(0.21)	(0.055)	(0.17)	(0.3)
% Employed	-2.37	-2.74	-2.62	1.03	0.40	-2.00	1.9
	(2.11)	(2.85)	(2.23)	(2.48)	(0.81)	(2.69)	(2.66)
% Black	0.11	0.11	0.10	0.077	0.0017	0.14	0.091
	(0.056)+	(0.053)+	(0.055)+	(0.052)	(0.0095)	(0.093)	(0.055)
% Foreign Born Whites	0.034	0.038	0.035	0.037	-0.0026	0.027	0.032
	(0.021)	(0.022)+	(0.021)	(0.024)	(0.004)	(0.02)	(0.022)
Observations	2826	942	2826	1986	1884	2823	2820
Adjusted R-squared	0.96	0.65	0.96	0.97	0.99	0.96	0.87

Note: + significant at 10%; * significant at 5%; ** significant at 1%. Robust standard errors in parentheses. Estimations are similar to those in column 2 of **Error! Reference source not found.**, with the following modifications. Column (1) includes as additional controls predicted mortality trends, constructed from the 1926-1935 data; column (2) contains a single age group (65+)—thus does not include state*age and age*year—and covers the entire 1931-1955 time period. In column (3), OAA per elderly per person is modified to be zero prior to 1936. Column (4) shows the results for the 1934-1950 time period only. In column (5) the estimation is performed on the non-elderly sample (2 age groups 45-54, 55-64), and in columns (6) and (7) OAA benefits are replaced with AB and ADC benefits per elderly person. The ADC (AB) per elderly person in each cell is defined as the ratio between total state ADC(AB) benefits, divided by the population 65+ in 1930. Benefits are expressed in real terms (hundreds of US$ 1982), and are corrected for differences in the cost of living across states.

Table IV The impact of OAA on elderly suicide rates, 1934-1955

Dep Var = ln(Suicides)	*(1)* *OLS*	*(2)* *IV*	*(3)* *Fuller*	*(4)* *CLR*	*(5)* *IV Nonelderly*	*(6)* *IV ADC*
OAA per Elderly	-0.019	-0.088	-0.088	-0.084	-0.0029	
	(0.008)*	(0.04)*	(0.019)**	(-.113,-.057)**	(0.01)	
ADC per Elderly						-0.082
						(0.098)
1931 % Pop > 65	0.67	0.50	0.50	-0.75	-0.15	0.76
	(0.36)*	(0.30)	(0.18)**	(0.28)**	(0.12)	(0.43)+
ln(Avg Net Personal Income)	0.01	0.13	0.13	0.12	0.11	0.11
	(0.19)	(0.19)	(0.15)	(0.13)	(0.11)	(0.23)
% Employment in Manufacturing	0.17	0.26	0.26	0.14	-0.18	0.21
	(0.18)	(0.20)	(0.11)*	(0.080)+	(0.074)*	(0.22)
ln(Health Spending Per Capita)	-0.041	0.011	0.011	-0.009	-0.052	-0.036
	(0.045)	(0.057)	(0.041)	(0.034)	(0.030)+	(0.057)
OASI per elderly	-0.014	-0.014	-0.014	0.011	-0.013	-0.07
	(0.039)	(0.045)	(0.032)	(0.028)	(0.030)	(0.047)
Hospitals Per Mile	111.95	96.44	96.44	87.75	11.75	136.19
	(53.86)+	(48.30)*	(21.78)**	(17.69)**	(13.43)	(75.43)+
ln(Manuf. Wages Per Capita)	-498.58	-631.94	-631.95	-510.24	174.16	-641.25
	(362.71)	(374.58)+	(148.11)**	(108.8)**	(103.22)+	(516.64)
% Illiterate	-0.018	-0.029	-0.029	-0.037	-0.041	-0.010
	(0.038)	(0.049)	(0.028)	(0.024)	(0.020)*	(0.042)
% Employed	0.44	-4.17	-4.17	-4.62	-0.55	-0.90
	(2.27)	(2.99)	(1.79)*	(1.47)**	(1.46)	(3.56)
% Black	0.075	0.11	0.11	0.087	-0.015	0.12
	(0.046)+	(0.058)+	(0.02)**	(0.014)**	(0.011)	(0.1)
% Foreign Born Whites	0.015	0.030	0.030	0.024	-0.022	0.016
	(0.016)	(0.024)	(0.009)**	(0.007)**	(0.005)**	(0.021)
Observations	2826	2826	2826	2826	1884	2823
Adjusted R-squared	0.72	0.65	0.69	0.89	0.83	0.66

Note: + significant at 10%; * significant at 5%; ** significant at 1%. Standard errors (between parentheses) are clustered at the state*age group level. The unit of observation is the state-year-age group cell. Regressions cover 48 continental states, and the years 1934-1955. The samples are the elderly (65-74,75-84,85-94) in columns (1)-(4) and (6), and the non-elderly(45-54,55-64) in column(5).The dependent variable is the log of suicides (plus one) divided by the mean cell population; the unit of measurement is deaths per 10,000 people. OAA (ADC) per elderly person in each cell is defined as the ratio between total state OAA (ADC) benefits, divided by the population 65 years and older in 1930. Benefits are expressed in real terms (hundreds of US$ 1982), and are corrected for differences in the cost of living across states. All regressions include state, year, age group fixed effects, as well as state*age, age*year and region*year interactions. Observations are weighed by the mean cell population. Additional state-level covariates in all columns include the log of average farm value, the percentage of housing that is owner occupied, and the percentage of farms operated by tenants. Estimation is by OLS in column (1) and by instrumental variables in column (2). The instruments are simulated OAA per elderly person and an indicator variable for states that had no legislated state OAA maximum in a given year. Estimation in column (3) is performed using Fuller's estimator with parameter 1 and provides unbiased estimates for the effect (β) of OAA on mortality. Column (4) shows the correct-size 95% confidence region for β, calculated using the Conditional Likelihood Ratio Test proposed by Moreira (2003)

Table V The impact of OAA by gender on elderly mortality rates, 1937-1955

	(1)	(2)	(3)	(4)
Dependent Var = ln(Overall Mortality)	*OLS*	*IV*	*Fuller*	*CLR*
		Panel A: Men		
OAA per Elderly	-0.02	-0.11	-0.11	-0.10
	(0.01)+	(0.06)*	(0.02)**	(-.13, -.08)**
Observations	2682	2682	2682	2682
Adjusted R-squared	0.96	0.94	0.94	0.99
		Panel B: Women		
OAA per Elderly	0.001	0.005	0.004	0.006
	(0.001)	(0.004)	(0.003)	(-.0004, .01)
Observations	2682	2682	2682	2682
Adjusted R-squared	0.99	0.99	0.99	0.99

Note: + significant at 10%; * significant at 5%; ** significant at 1%. The unit of observation is the state-year-age group cell. All regressions cover three age groups (65-74,75-84,85-94), all 48 continental states, and the years 1937-1955. In Panel A and Panel B estimations are performed on males, and females only respectively. The dependent variable is the log of number of overall deaths divided by the mean cell population; the unit of measurement is deaths per 10,000 people. OAA per elderly person is defined as the ratio between total state OAA benefits, divided by the population 65 years and older in 1930. Benefits are expressed in real terms (hundreds of US$ 1982), and are corrected for differences in the cost of living across states. All regressions include state, year and age group fixed effects, as well as state*age, age*year and region*year interactions, as well as the full set of state-level covariates from Table II. Observations are weighed by the mean cell population. Standard errors are clustered at the state*age group level. Estimation is by OLS in column (1) and by instrumental variables in column (2). The instruments are simulated OAA per elderly person and an indicator variable for states that had no legislated state OAA maximum in a given year. Estimation in column (3) is performed using Fuller (1997)'s estimator with parameter 1 and provides unbiased estimates for the effect (β) of OAA on mortality. Column (4) shows the 95% confidence region for β, calculated using the Conditional Likelihood Ratio Test proposed by Moreira (2003).

Table VI The effect of OAA on mental hospital admission rates, by gender and age group

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Var = ln(Admission Rates)	*OLS*	*IV*	*Fuller*	*CLR*	*OLS*	*IV*	*Fuller*	*CLR*
	Panel A: Men							
	Age 65+				*Age 55-64*			
OAA per Elderly	-0.03	-0.21	-0.21	-0.3	-0.03	-0.09	-0.09	-0.14
	(0.04)	(0.12)+	(0.1)*	(-.88, -.012)+	(0.03)	(0.11)	(0.1)	(-.79, .28)
Observations	465	465	465	465	465	465	465	465
Adjusted R-squared	0.68	0.63	0.63	0.63	0.62	0.62	0.62	0.6
	Panel B: Women							
	Age 65+				*Age 55-64*			
OAA per Elderly	-0.05	-0.17	-0.17	-0.21	-0.05	-0.17	-0.17	-0.21
	(0.04)	(0.11)	(0.11)	(-1.8, .17)	(0.04)	(0.11)	(0.11)	(-1.8, .17)
Observations	465	465	465	465	465	465	465	465
Adjusted R-squared	0.72	0.7	0.7	0.63	0.72	0.7	0.7	0.63

Note: + significant at 10%; * significant at 5%; ** significant at 1%. The unit of observation is the state-year- gender cell for each age group. All regressions cover the 48 continental states, and the years 1937-1950. In Panel A and Panel B estimations are performed on males, and females only respectively. The dependent variable is the log of first time admissions to mental hospitals divided by the mean cell population; the unit of measurement is admissions per 10000 people. The sample mean admission rates among 65+ year olds was 17.65 , and the standard deviation 9.2 OAA per elderly person is defined as the ratio between total state OAA benefits, divided by the population 65 years and older in 1930. Benefits are expressed in real terms (hundreds of US$ 1982), and are corrected for differences in the cost of living across states. All regressions include state, year fixed effects, region*year interactions, as well as the full set of state-level covariates from Table II. Observations are weighed by the mean cell population. Standard errors are clustered at the state level. Estimation is by OLS in columns (1) and (5) and by instrumental variables in columns (2) and (6). The instruments are simulated OAA per elderly person and an indicator variable for states that had no legislated state OAA maximum in a given year. Estimations in columns (3) and (7) are performed using Fuller (1997)'s estimator with parameter 1 and provide unbiased estimates for the effect (β) of OAA on institutionalization rates. Columns (4) and (8) show the confidence region for β, calculated using the Conditional Likelihood Ratio Test proposed by Moreira (2003).

Table VII. The impact of OAA by race and region on elderly mortality rates, 1937-1955

Dependent Var ln(Overall Mortality)	*(1)* *OLS*	*(2)* *IV*	*(3)* *Fuller*	*(4)* *CLR*	*(5)* *OLS*	*(6)* *IV*	*(7)* *Fuller*	*(8)* *CLR*
	Panel A: Non-southern States							
	Whites				*Non-Whites*			
OAA per Elderly	-0.02	-0.05	-0.05	-0.07	-0.01	-0.03	-0.03	-0.03
	(0.01)+	(0.03)+	(0.01)*	(-.10,-.04)**	(0.002)**	(0.02)+	(0.02)+	(-.06, .003)+
Observations	1926	1926	1926	1926	1926	1926	1926	1926
Adj R-squared	0.98	0.97	0.97	0.99	0.94	0.94	0.94	0.99
	Panel B: Southern States							
	Whites				*Non-Whites*			
OAA per Elderly	0.0002	0.0009	0.0009	0.001	0.01	-0.05	-0.05	-0.05
	(0.02)	(0.02)	(0.02)	(-.01, .02)	(0.01)+	(0.08)	(0.04)	(-.35, .02)
Observations	756	756	756	756	756	756	756	756
Adjusted R-squared	0.99	0.99	0.99	0.99	0.97	0.96	0.96	0.99
	Panel C: Southern States Post 1946							
	Whites				*Non-Whites*			
OAA per Elderly	0.04	0.03	0.03	0.08	0.01	0.14	0.15	0.16
	(0.002)+	(0.02)	(0.02)	(-inf,.04)U(.001,+inf)	(0.01)	(0.1)	(0.1)	nf,.04)U(.001,+inf)
Observations	390	390	390	390	390	390	390	390
Adjusted R-squared	0.99	0.99	0.99	0.99	0.97	0.92	0.94	0.99

Note: + significant at 10%; * significant at 5%; ** significant at 1%.The unit of observation is the state-year-age group-race cell. All regressions cover three age groups (65-74,75-84,85-94). Estimations are performed on whites in columns (1)-(4), and on nonwhites in columns (5)-(8). In Panel A (B) estimations are performed on the sample of non-southern (southern) states for the years 1937-1955. Southern states refer to states in the South Atlantic, East South Central and West South Central census regions. In panel C, estimations are performed on the southern states sample in the 1946-1955 time period. The dependent variable is the log of number of overall deaths divided by the mean cell population; the unit of measurement is deaths per 10,000 people. OAA per elderly person is defined as the ratio between total state OAA benefits, divided by the population 65 years and older in 1930. Benefits are expressed in real terms (hundreds of US$ 1982), and are corrected for differences in the cost of living across states. All regressions include state, year, age group fixed effects, as well as state*age, age*year and region*year interactions, as well as the full set of state-level covariates from Table II. Observations are weighed by the mean cell population. Standard errors (in parentheses) are clustered at the state*age group level. Estimation is by OLS in columns (1) and (5) and by instrumental variables in columns (2) and (6). The instruments are simulated OAA per elderly person and an indicator variable for states that had no legislated state OAA maximum in a given year. Estimations in columns (3) and (7) are performed using Fuller(1997)'s estimator with parameter 1 and provide unbiased estimates for the effect (β) of OAA on mortality. Columns (4) and (8) show the 95% confidence region for β, calculated using the Conditional Likelihood Ratio Test proposed by Moreira (2003).

Table VIII The impact of OAA on infectious disease mortality rates, 1934-1955

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. Var =	*OLS*	*IV*	*Fuller*	*CLR*	*Fuller (CLR)*	*Fuller (CLR)*	*Fuller (CLR)*
ln(Infectious Disease Mortality)			*Entire sample Age 65+*		*Men Age 65+*	*Women Age 65+*	*Age 45-64*
				Panel A: 1934-1943			
OAA per Elderly	0.018 (0.045)	0.0087 (0.015)	0.0087 (0.014)	0.0087 (-.011, .029)	0.54 (-inf, +inf)	0.44 (-inf,.2)U(.08,+inf)	0.03 (0.005, 0.05)*
Observations	1140	1140	1140	1140	1140	1140	760
Adj R-squared	0.99	0.99	0.99	0.99	0.99	0.99	0.99
				Panel B: 1944-1955			
OAA per Elderly	-0.016 (0.0074)*	-0.096 (0.042)*	-0.096 (0.020)**	-0.10 (-.13, -.076)**	-0.12 (-.17,-.08)**	-0.04 (-.08, -.0009)*	-0.02 (-0.05, 0.006)
Observations	1686	1686	1686	1686	1686	1686	1124
Adj R-squared	0.98	0.96	0.97	0.99	0.97	0.97	0.99

Note: + significant at 10%; * significant at 5%; ** significant at 1%.The unit of observation is the state year-age group cell. Regressions cover 48 continental states. The samples are the elderly (65-74,75-84,85-94) in columns (1)-(4), and the non-elderly(45-54,55-64) in column(5). In columns (5) and (6) estimations are performed on the samples of male elderly and female elderly respectively. The years covered are 1934-1943 in Panel A, and 1944-1955 in Panel B. The dependent variable is the (log of) infectious disease deaths divided by the mean cell population; the unit of measurement is deaths per 10,000 people. Infectious disease mortality refers to deaths from tuberculosis, pneumonia & flu, syphilis, dysentery, and viral gastrointestinal diseases. OAA per elderly person in each cell is defined as the ratio between total state OAA benefits, divided by the population 65 years and older in 1930. Benefits are expressed in real terms (hundreds of US$ 1982), and are corrected for differences in the cost of living across states. All regressions include state, year, age group fixed effects, as well region*year interactions, and the full set of state-level covariates from Table II. Regressions in columns (1)-(4) and (7) also include state*age and age*year interactions. Observations are weighed by the mean cell population. Standard errors (in parentheses) are clustered at the state*age group level. Estimation is by OLS in column (1) and by instrumental variables in column (2). The instruments are simulated OAA per elderly person and an indicator variable for states that had no legislated state OAA maximum in a given year. Estimations in column (3) is performed using Fuller(1997)'s estimator with parameter 1 and provides unbiased estimates for the effect (β) of OAA on mortality. Column (4) shows the 95% confidence region for β, calculated using the Conditional Likelihood Ratio Test (Moreira 2003). Columns (5)-(7) contain the estimates of β from Fuller estimations (as in column 3) and the confidence intervals are estimated using the Conditional Likelihood Ratio Test (Moreira 2003).

Table IX The impact of OAA on behavioral and cardiovascular mortality, 1934-1955

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
	Entire sample Age 65+			*Age 45-64*	*Men Age 65+*	*Women Age 65+*
	OLS	*IV*	*Fuller (CLR)*	*Fuller (CLR)*	*Fuller (CLR)*	*Fuller (CLR)*
	Panel A: Behavioral Mortality					
OAA per Elderly	-0.017	-0.089	-0.089	-0.012	-0.15	-0.03
	(0.007)*	(0.034)*	(-.103, -0.07)*	(-0.02,0.0002)	(-0.17,-.1)**	(-.04, -.009)*
Observations	2826	2826	2826	1884	2682	2682
Adj. R-squared	0.98	0.97	0.97	0.98	0.98	0.98
	Panel B: Cardiovascular Mortality					
OAA per Elderly	-0.010	-0.065	-0.065	-0.004	-0.11	0.02
	(0.006)	(0.036)+	(-.076,-.05)*	(-0.01,0.003)	(-.13,-.07)**	(.01,.03)*
Observations	2826	2826	2826	1884	2682	2682
Adj R-squared	0.98	0.96	0.97	0.99	0.99	0.99

Note: + significant at 10%; * significant at 5%; ** significant at 1%.The unit of observation is the state-year-age group cell. Regressions cover 48 continental states and the time period 1934-1955. The samples are the elderly (65-74,75-84,85-94) in columns (1)-(4) , and the non-elderly(45-54,55-64) in column(5). In panel A, the dependent variable is the (log of) behavioral deaths divided by the mean cell population. In panel B, the dependent variable is the (log of) cardiovascular deaths divided by the mean cell population. In both panels, the unit of measurement is deaths per 10,000 people. The behavioral mortality category includes deaths from digestive and lung cancer, and aortic aneurysm. Cardiovascular mortality includes all deaths from heart diseases (excluding aortic aneurysm) and from stroke. OAA per elderly person in each cell is defined as the ratio between total state OAA benefits, divided by the population 65 years and older in 1930. Benefits are expressed in real terms (hundreds of US$ 1982), and are corrected for differences in the cost of living across states. All regressions include state, year, age group fixed effects, as well as state*age, age*year and region*year interactions, as well as the full set of state-level covariates from Table II . Observations are weighed by the mean cell population. Standard errors are clustered at the state*age group level. Estimation is by OLS in column (1) and by instrumental variables in column (2). The instruments are simulated OAA per elderly person and an indicator variable for states that had no legislated state OAA maximum in a given year. Estimation in column (3) is performed using Fuller(1997)'s estimator with parameter 1 and provides unbiased estimates for the effect (β) of OAA on mortality. Column (4) shows the 95% confidence region for β, calculated using the Conditional Likelihood Ratio Test first proposed by Moreira (2003).

Table X Smoking behavior, by gender and age group: survey data (1936-1937)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
	Entire sample		*Age 65+*		*Men*		*Women*	
Dep variable	*Smoke 0/1*	*Nb cigarettes*	*Smoke 0/1*	*Nb cigarettes*	*Smoke 0/1*	*Nb cigarettes*	*Smoke 0/1*	*Nb Cigarettes*
Log (income)	0.14 (0.03)**	0.28 (0.04)**	0.12 (0.05)*	0.06 (0.2)	0.16 (0.04)**	0.27 (0.05)**	0.12 (0.06)*	0.31 (0.12)*
Log (income) squared	-0.04 (0.01)**	-0.09 (0.05)+	-0.03 (0.02)+	-0.09 (0.08)	-0.03 (0.01)*	-0.09 (0.05)+	-0.03 (0.02)*	-0.16 (0.15)
Obs.	3567	910	582	107	3279	845	702	207
R2/pseudo R2	0.16	0.37	0.29	0.62	0.17	0.37	0.19	0.58
Estimation Method	*Probit*	*OLS*	*Probit*	*OLS*	*Probit*	*OLS*	*Probit*	*OLS*

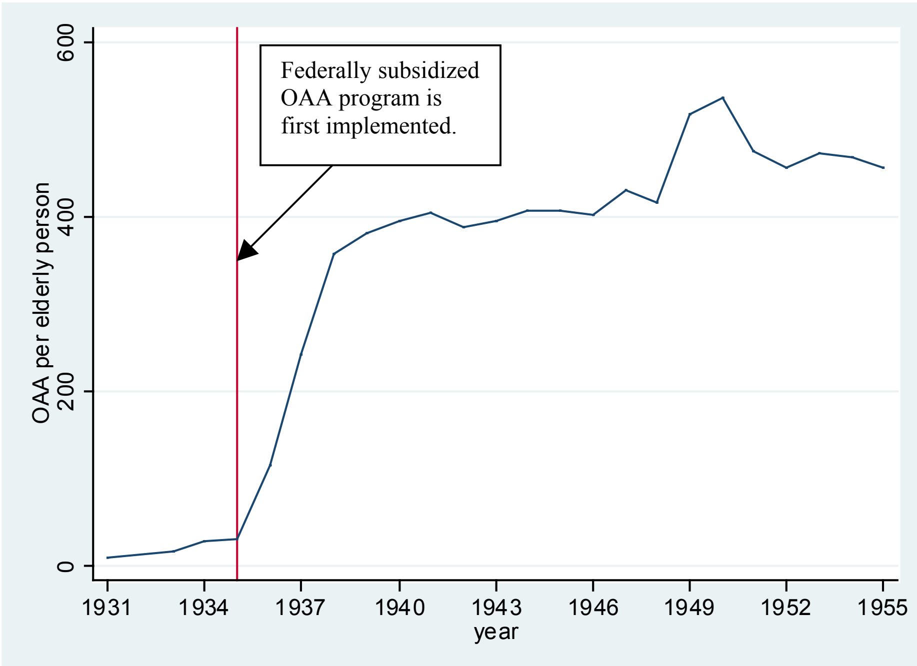
Note: + significant at 10%; * significant at 5%; ** significant at 1%. The data is from the 1935-1936 Survey of Consumer Purchases. Standard errors (in parentheses) are clustered at the state level. The survey covered 30 states, and the communities surveyed were designed to be representative at the national level. The expenditure section of the survey was limited to native-born husband and wife families with a minimum income of at least $500 (in large cities) and at least $250 (in smaller cities). The data on age, sex, race, employment status is at the individual level, but income and expenditure data are available for the entire household only. I construct measures of income and expenditure per capita by dividing household values by the number of people in the household and adjusting these measures for household economies of scale using IPUMS poverty threshold levels. Income is expressed in thousands. Columns (1)-(2) and (3)-(4) show results for the entire adult samples (35+) and the elderly samples (65+) respectively. The estimation covers only males (females) aged 35+ in columns (4)-(5) ((6)-(7) respectively). In columns (2), (4),(6), (8) the estimation is restricted to individuals who are smokers in the respective age and gender categories. The dependent variable is an indicator for smoking (columns 1,3,5,7), and the log number of cigarettes smoked (columns 2,4,6,8). Estimation is by OLS or probit as indicated in the last row in the table. Controls in all specifications include dummy variables for education attainment, race, urban residence, employment and marital status, as well as for family size. Columns (1)-(4) also include indicators for gender. Results are robust to the inclusion of indicators for household ownership and an index for household wealth (constructed via factor analysis from indicators for availability of household durable goods). All regressions include state and ten-year age group fixed effects, as well as state*age group interactions.

Table XI Behavioral and cardiovascular mortality, by quartile of OAA

	(1)	(2)	(3)	(4)	(5)	(6)
	OAA<1320	*OAA >=1320*	Q1	Q2	Q3	Q4
			Smoking-related Mortality			
OAA per elderly person	0.54	-0.056	-0.61	0.23	-0.3	-0.016
	(0.73)	(0.033)+	(0.11)	(0.30)	(0.12)**	(0.006)**
Observations	573	2253	393	825	816	792
R-squared	0.99	0.99	0.99	0.99	0.97	0.99
			Behavioral Mortality			
OAA per elderly person			-0.083	0.246	-0.31	-0.012
			(0.064)	(0.32)	(0.13)**	(0.006)**
Observations			393	825	816	792
R-squared			0.99	0.98	0.97	0.99
			Cardiovascular Mortality			
OAA per elderly person			-0.019	0.12	-0.29	0.007
			(0.03)	(0.21)	(0.08)**	(0.004)+
Observations			393	825	816	792
R-squared			0.99	0.99	0.97	0.99
Mean OAA per elderly person (h)			0.7	3.35	6.04	13.29

Note: + significant at 10%; * significant at 5%; ** significant at 1%.Estimations are similar to those in column (2) of Table IX, but the sample sizes are restricted to include observations with OAA benefit levels below (above) 1320 (columns 1-2), and in each quartile of OAA benefits per elderly person (columns 3-6). 1320 represents the income inflection point in the 1935-1936 Study of Consumer Purchases data. The OAA measures are expressed in real terms (hundreds of US$ 1982), and are corrected for differences in the cost of living across states. The unit of measurement for mortality rates is deaths per 10,000 people.

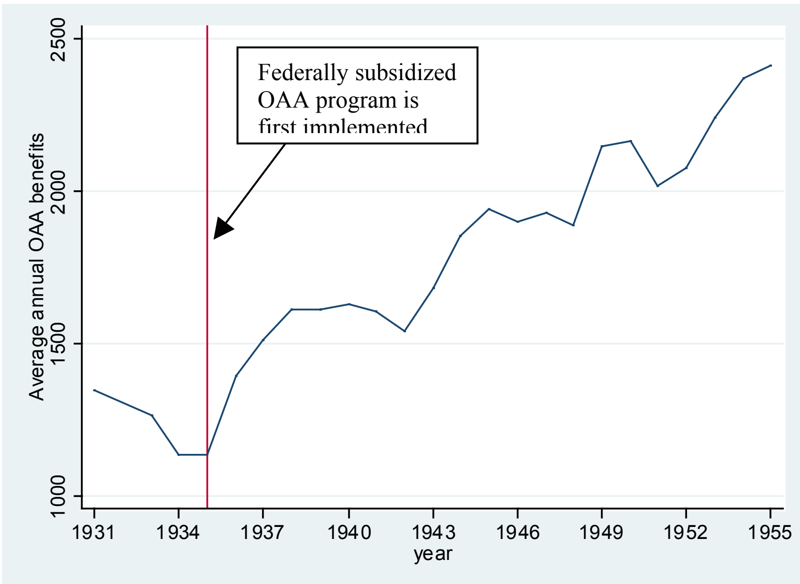
Figure I. Average OAA per elderly person, 1931-1955



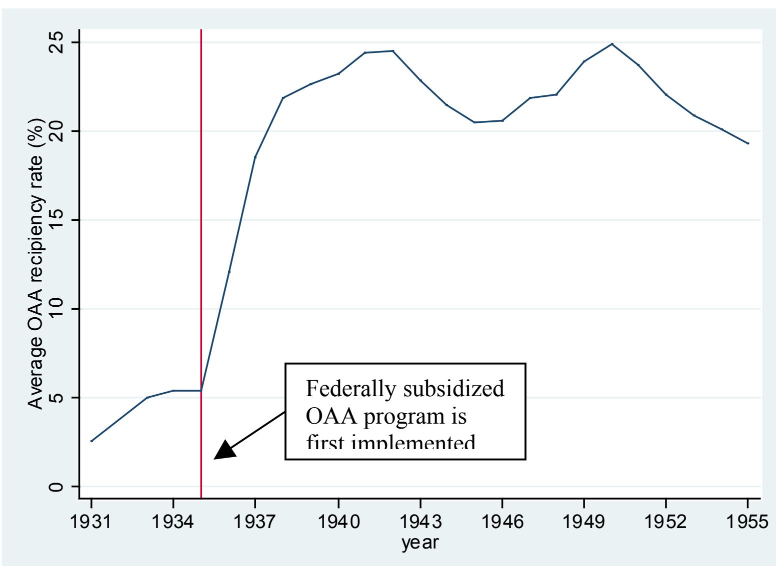
Note: The OAA data was collected from various Social Security publications. The yearly state population data was constructed by fitting cubics to the US 1930-1960 census data. The figure shows OAA benefits per elderly person in a given year, averaged across all continental states. OAA per elderly person in each state-year cell is defined as the ratio between total OAA benefits, divided by the population 65 years and older. Benefits are expressed in real terms (US$ 1982), and are corrected for differences in the cost of living across states using Lindert and Williamson(1980).

Figure II Average OAA benefits and recipiency rates, 1931-1955.

Panel A: Average annual OAA benefits

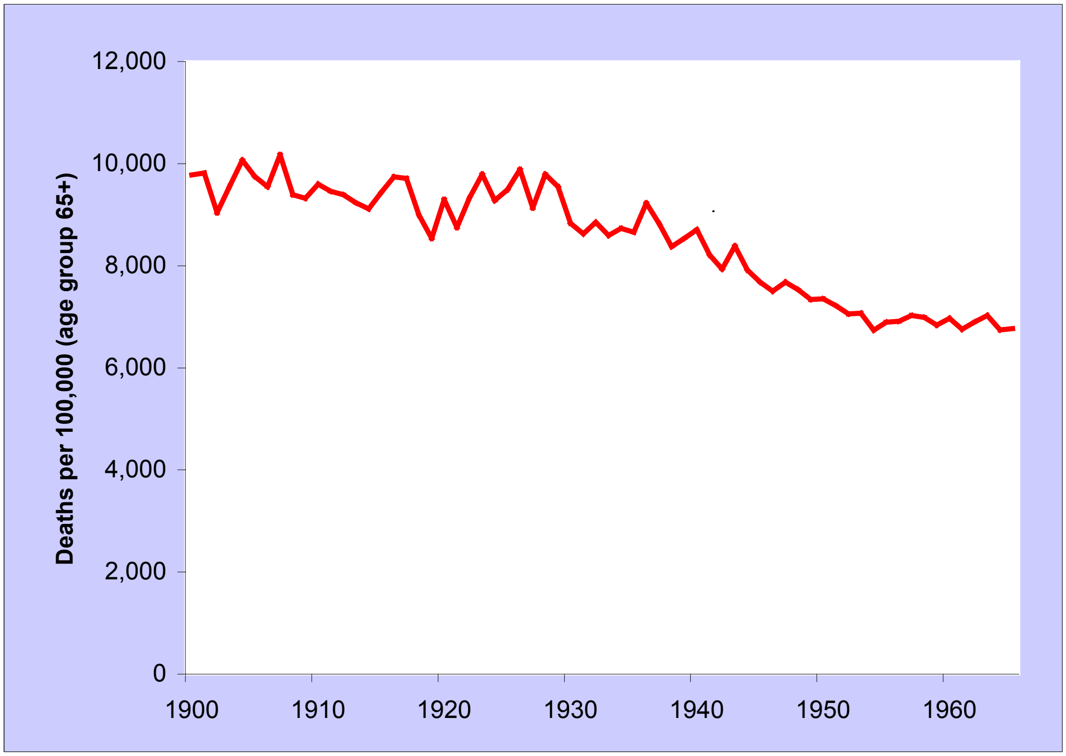


Panel B: Average OAA recipiency rate



Note: The OAA benefits and recipients data was collected from various Social Security publications. The yearly state population data was constructed by fitting cubics to the US 1930-1960 census data. OAA benefits per recipient in each year represent averages (across states) of OAA state annual amounts, expressed in real terms (US$ 1982), and corrected for differences in the cost of living using Lindert and Williamson (1980). OAA recipiency rate in each state-year cell is the ratio between the number of OAA recipients divided by the population 65 years and older. The average OAA recipiency rate in each year is averaged across states and is expressed in percentages.

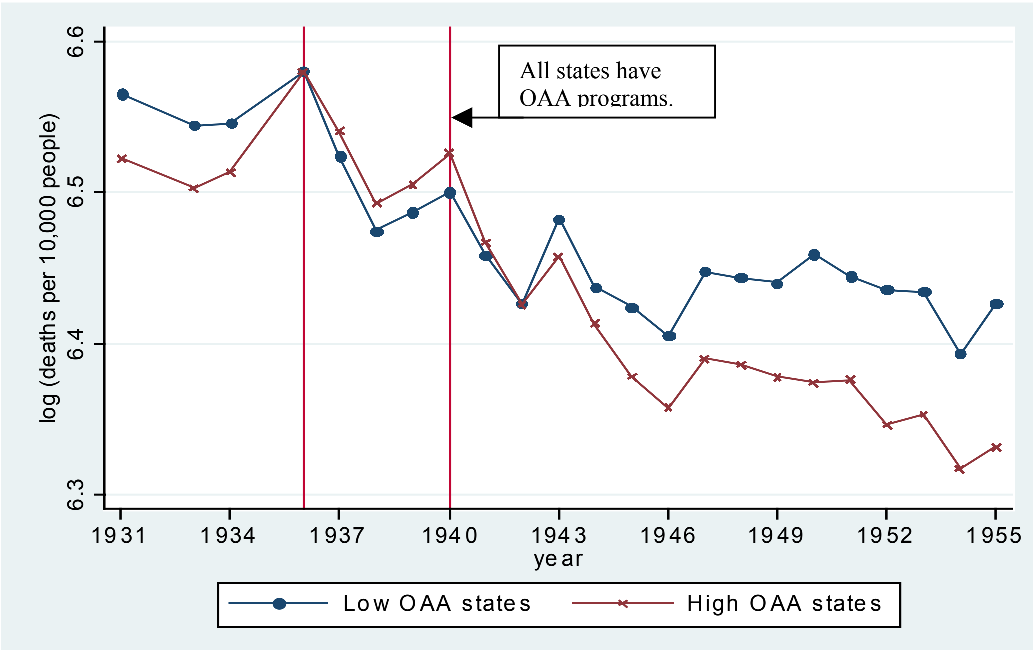
Figure III. Mortality rate among people 65 years and older, 1900-1965



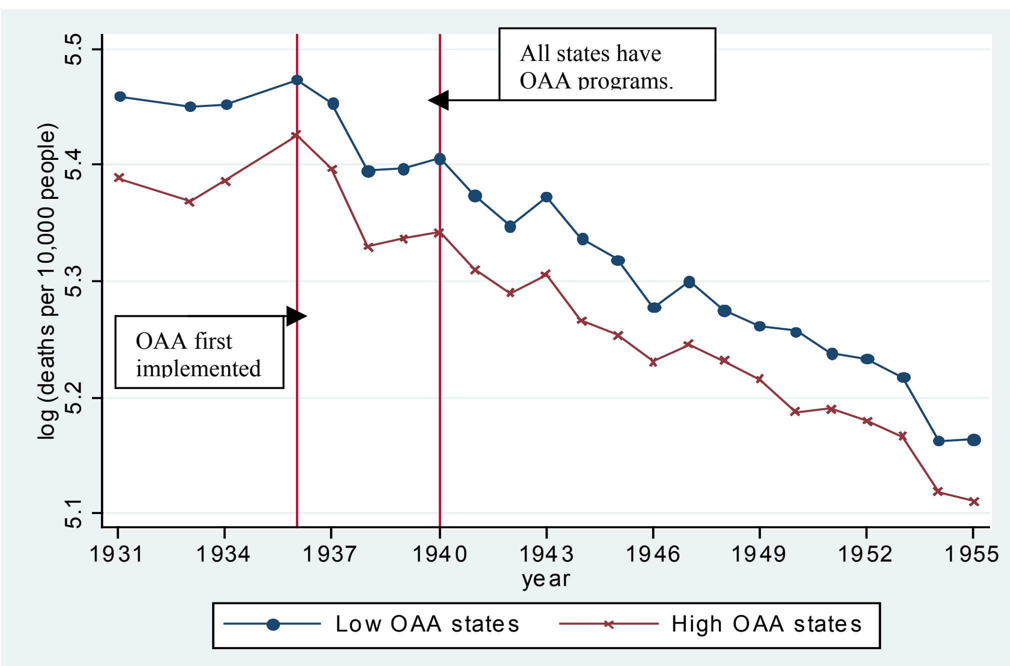
Note: The figure is reproduced from Cutler and Meara (2001), Figure 4. The mortality rate in each year is the weighted sum of mortality rates for 65-74, 74-85, and 85+ age groups in that year, with weights reflecting the age distribution of the 65+ population in 1990. I am grateful to Ellen Meara and David Cutler for providing me with the data underlying their figure.

Figure IV. Elderly and non-elderly mortality 1931-1955, by low and high levels of OAA.

Panel A: Mortality rates for people 65 and older



Panel B: Mortality rates for 55-64 age group



Note: Number of deaths by state, year and two age groups (55-64, and 65 years and older) was collected from the Vital Statistics of the United States. The yearly state population was constructed by fitting cubics to the US 1930-1960 census data. Mortality rates are in logs, and the unit of measurement is deaths per 10,000 people. High (low) OAA states are those where OAA benefits per elderly person were above (below) the median. In both panels, mortality in a given year is a weighted average across states, with weights proportional to the mean state-year population for each age-group.

Figure V. Suicides by age group, 1931-1955

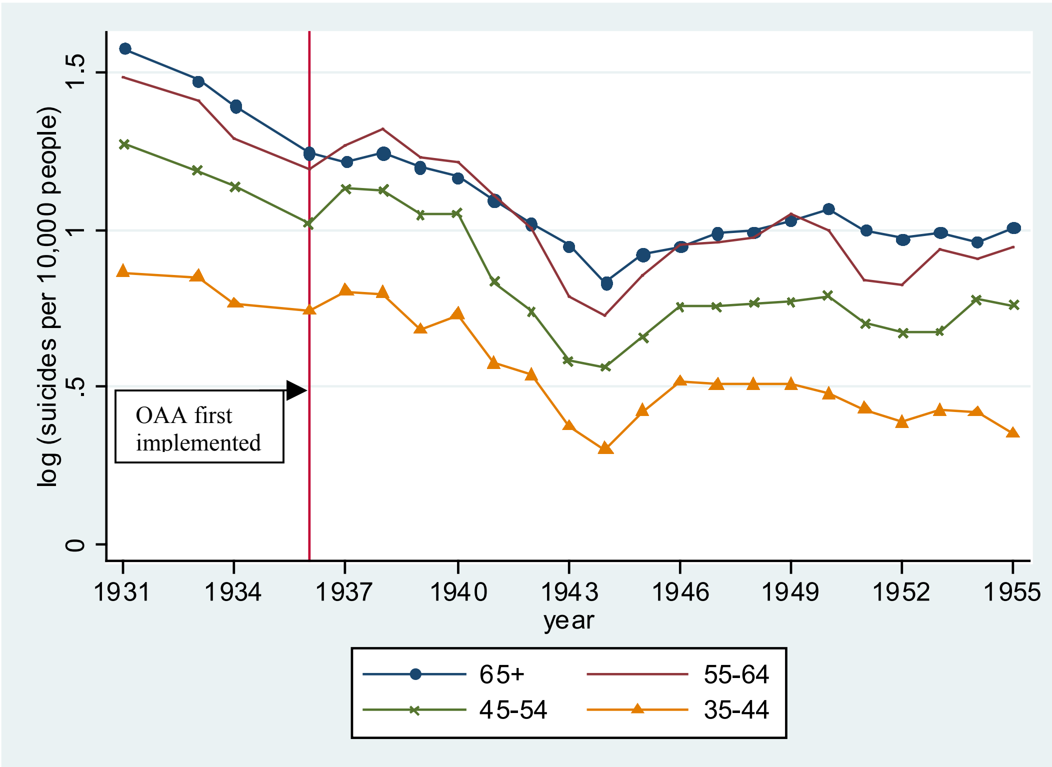
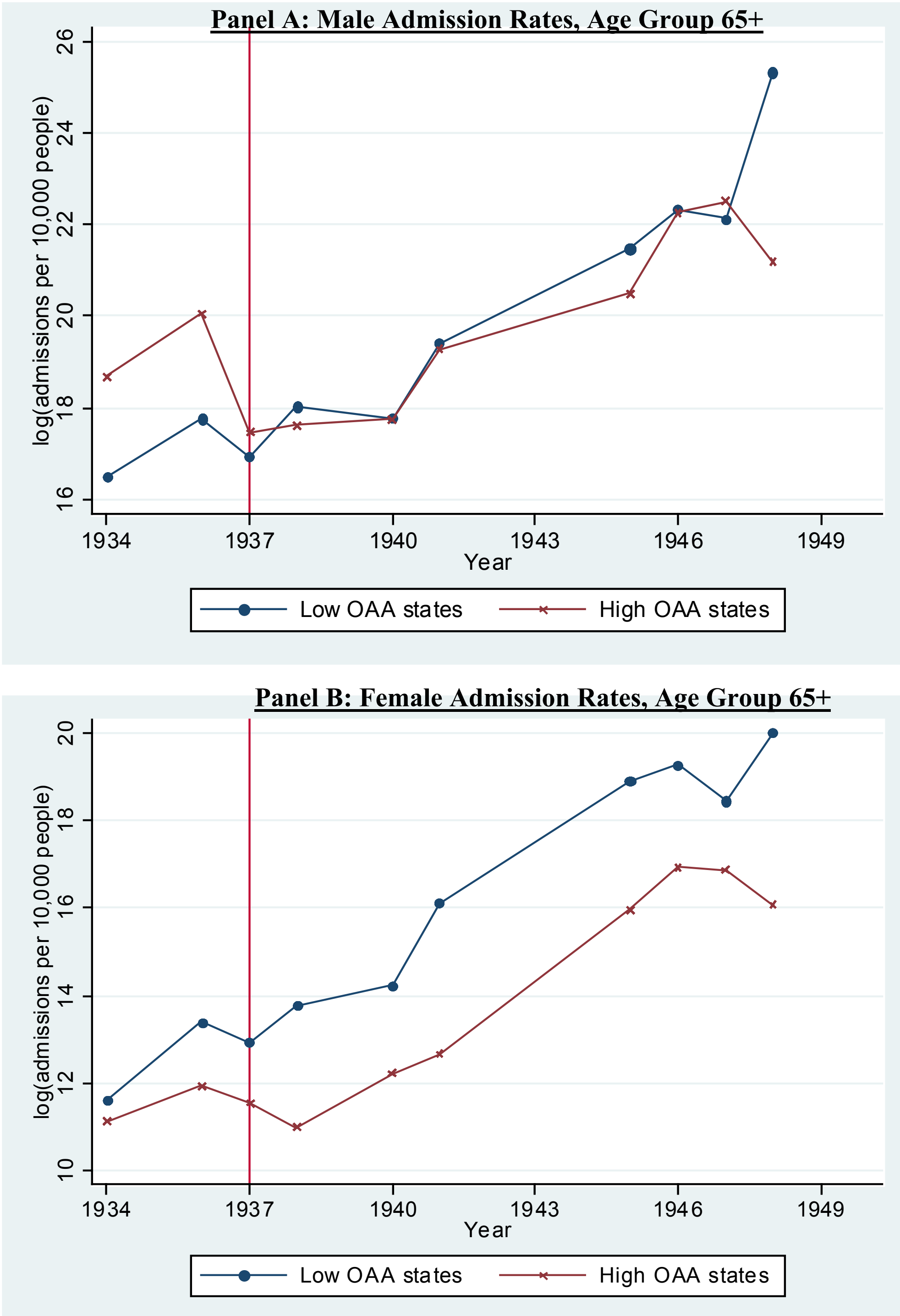
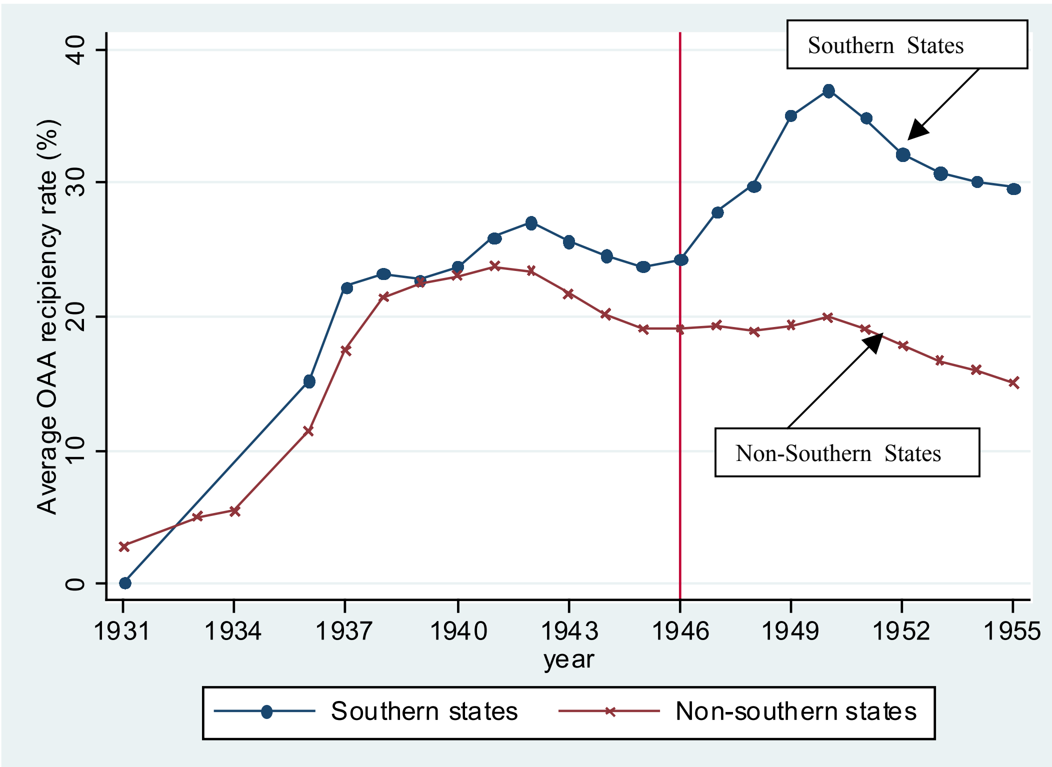


Figure VI. Male and female mental hospital admissions 1937-1950, by low and high levels of OAA.



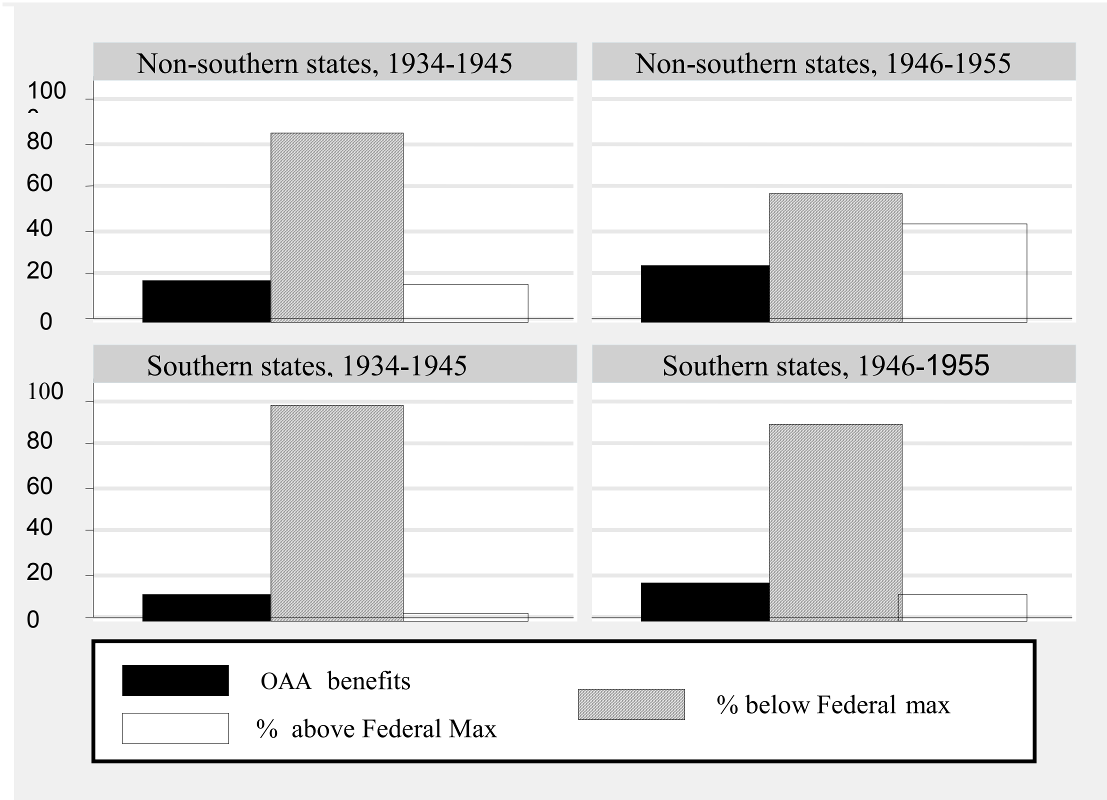
Note: Number of first admissions to mental hospitals by state, year and gender among the 65 plus year olds was collected from census publications (Appendix B). The yearly state population was constructed by fitting cubics to the US 1930-1960 census data. Admission rates are in logs, and the unit of measurement is admissions per 10,000 people. High (low) OAA states are those where OAA benefits per elderly person were above (below) the median. In both panels, admission in a given year is a weighted average across states, with weights proportional to the mean state-year population for each age-group.

Figure VII Average OAA recipiency rates , before and after the 1946 federal subsidy change



Note: The OAA recipiency rate in each state-year cell is the ratio between the number of OAA recipients divided by the population 65 years and older. The average OAA recipiency rate in each year is averaged across states and is expressed in percentages. The OAA recipients data was collected from various Social Security publications. The yearly state population data was constructed by fitting cubics to the US 1930-1960 census data. Southern states refer to states in the South Atlantic, East South Central and West South Central census regions.

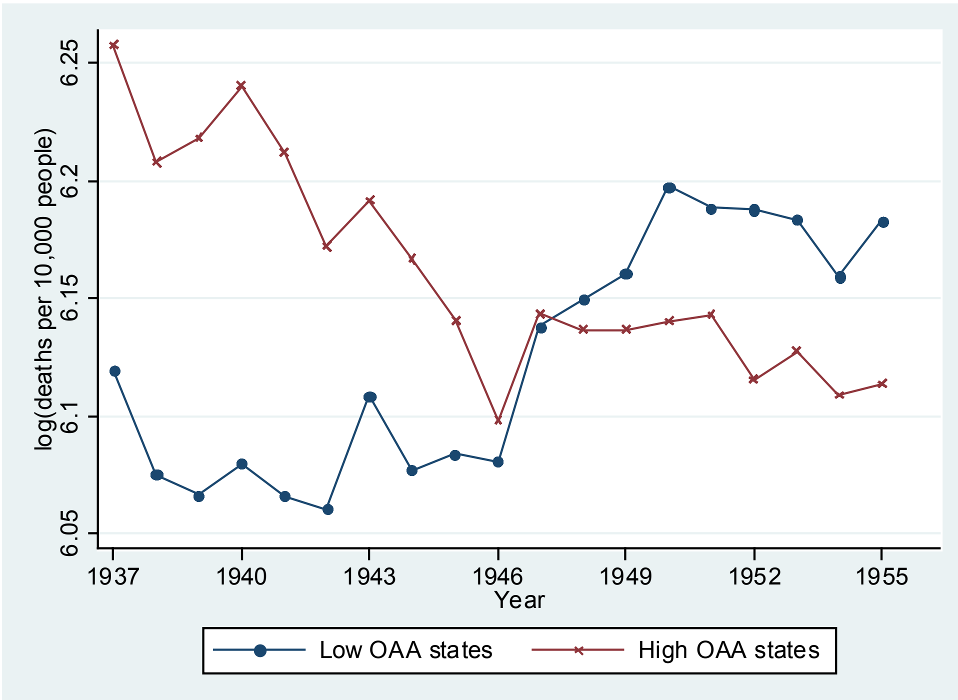
Figure VIII OAA average benefit and distribution, before and after 1946



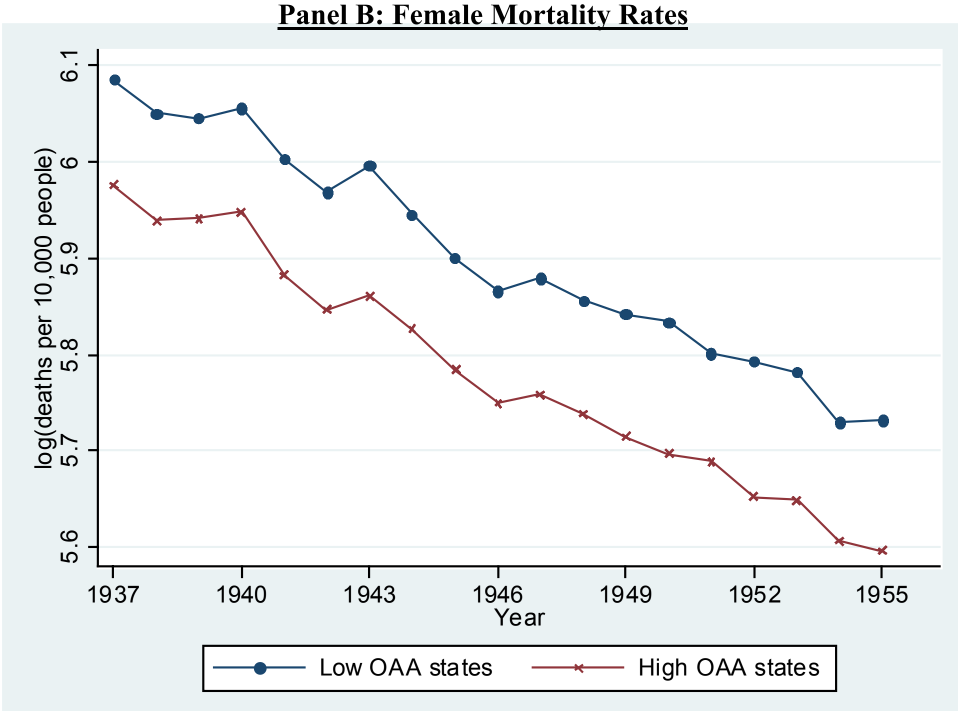
Note: The OAA benefits per recipient in each year represent averages (across states) of OAA state annual amounts, expressed in real terms (hundreds of US$ 1982), and corrected for differences in the cost of living using Lindert and Williamson (1980). The percentage above (below) the Federal maximum represents the ratio between the number of OAA recipients whose benefits (in a given state and year) are above (below) the federal maximum amounts for that year ,divided by the population 65 years and older; this ratio is expressed in percentages and averaged across states. The OAA recipients data was collected from various Social Security publications. The yearly state population data was constructed by fitting cubics to the US 1930-1960 census data. Southern states refer to states in the South Atlantic, East South Central and West South Central census regions.

Figure IX Elderly mortality rates, by gender and levels of OAA

Panel A: Male Mortality Rates

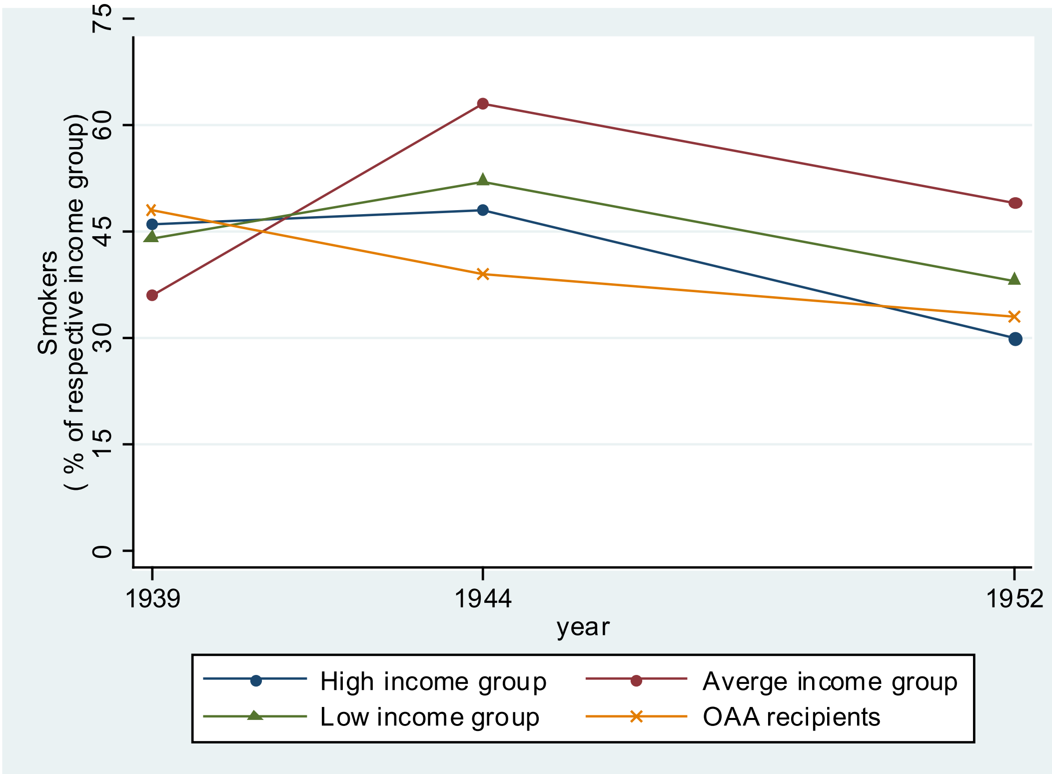


Panel B: Female Mortality Rates



Note: Number of deaths by state, year and gender among the 65 plus year olds was collected from the Vital Statistics of the United States. The yearly state population was constructed by fitting cubics to the US 1930-1960 census data. Mortality rates are in logs, and the unit of measurement is deaths per 10,000 people. High (low) OAA states are those where OAA benefits per elderly person were above (below) the median. In both panels, mortality in a given year is a weighted average across states, with weights proportional to the mean state-year population for each age-group.

Figure X. Percentage of elderly who smoke, by income group, 1939-1952



Note: The average percentage of people 65 years and older who smoke in each income category was calculated by the author from data from the following Gallup Polls: 160 (June 14, 1939), 336 (December 1944), 489 (April 1952). The sample elderly sizes for each poll-year were, respectively: 259, 357, 258. The Gallup Poll question asked in 1944 and 1952 was "Do you smoke cigarettes (pipe,cigars)-or don't you smoke at all?" In 1939, the question was simply phrased "Do you smoke?", but since the following question was "What do you prefer to smoke-cigarettes, cigars, pipe?" the question is essentially the same as in 1944 and 1952. The high, average, low income group levels refer to the following Gallup categories "wealthy" and "average plus"; "average"; and "poor" respectively.