Healthy, Wealthy and Wise? The Impact of the Old Age Assistance Program on Elderly Mortality in the United States

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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 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 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 22 percent of the elderly in the United States (2.8 million people) were receiving OAA payments at its peak in 1950. 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 (1997) and Costa (1998) 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 will allow me to estimate the impact of OAA income on elderly mortality between 1931-1955. Quantifying the impact of income on health is a difficult task.[1] 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 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 and 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 1931-1955, OAA decreased elderly mortality by 3 percent.[2] Using simulated instruments to

[1] The sign and size of the effect of income on health remains largely unsettled. See the reviews in Cutler et al. 2006 and Smith 1999.

[2] Unless otherwise specified, the estimated effect of OAA on mortality refers to the overall decline in yearly mortality following the introduction of OAA, calculated relative to the level that would have prevailed in the program's absence.

correct for income endogeneity, however, reveals that the actual impact of OAA was much larger (22 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 population sub-groups. While the effect on the most vulnerable groups— those at risk of suicide ("desperate") and poor elderly men—was very sizable, the effect of OAA was low or insignificant on less vulnerable groups.[3] Furthermore, OAA had a large impact on elderly mortality in non-southern states, but no effect in southern ones. Since neither black nor white mortality in southern states was affected by OAA, I argue that the most probable explanation was the low level of OAA funding in this region, rather than discrimination.

To better understand the channels through which income affects mortality, I disaggregate results by the underlying cause of death. I classify mortality into three main groups: mortality from treatable illnesses (represented by infectious diseases during this time period), mortality from behavioral causes (tobacco, drinking, and driving related death causes, as well as cardiovascular mortality), and mortality from chronic diseases (non-smoking related cancers). Using the introduction of antibiotics in 1944 as a shock to advances in medical care, I show that the effect of OAA on elderly mortality from infectious diseases was large after 1944 (37 percent decline), but insignificant in the preceding time period. Together, these results suggest that OAA income enabled the elderly to take advantage of the new life-saving medical technologies.

I also show that OAA had a strong impact on behavioral mortality, especially at high levels of aid—the estimated decline in deaths from risky behaviors was 33 percent, while that in cardiovascular mortality (which has a smaller behavioral component) was 22 percent. These results are consistent with an inverted U-shaped effect of income on health operating through

[3] The estimated IV declines were 31 percent for suicides, and 35 percent for male mortality. Female mortality was unaffected by OAA. In sections 5.2 and 6.2 I explore in detail why this was the case.

changes in consumption of risky goods, and I confirm this finding using family survey data on elderly consumption from 1936. Together, the declines in mortality from suicides, infectious, and behavioral and cardiovascular diseases explain 84 percent of the decline in overall mortality between 1931 and 1955.

The paper is organized as follows. Section 1 provides a background on the OAA program, including historical evolution, rules, and recipient characteristics. Section 2 describes the data sets that I have constructed, 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 these effects by gender and race. In section 6, I examine the channels through which the impact of OAA on mortality occurs, and how these channels aggregate. Section 7 discusses how these estimated effects relate to other findings in the literature, and section 8 offers policy implications and conclusions.

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.[4]

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

[4] In 1931 there were only 76,349 recipients in all of the United States, of which 47,000 were in New York state, 11,000 in Massachusetts, and 9,800 in California.

administered. OAA, on the other hand, was need-based and intended to be temporary, until OASI was 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 (2.8 million people) were receiving benefits, this number declined to 14 percent in 1960, and to less than 7 percent by 1974.[5] Since after 1955 OASI was much 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 1931-1955 time period.

1.2 Size and Variation of the OAA Program

Figure 1 shows the large expansion of the OAA program after the passage of the Social Security Act, and panels A and B of Figure 2 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 average personal after-tax income, and about 20 percent of elderly per capita income.[6] For the poor OAA recipients, the additional income from OAA benefits constituted a large increase in overall

[5] The decline in the size of the OAA program was, not surprisingly, associated with the increase in OASI; between 1950 and 1960, the number of elderly receiving Social Security increased from 17% to 62% (Costa 1998, p.172).
[6]The magnitude of elderly incomes prior to 1950, especially among the poor, is subject to some debate due to the lack of adequate data (see for instance 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 (quoted in Gratton 1996). In the 1935-1936 Survey of Consumer Purchases (discussed in section 6), where the very poor elderly are excluded, average income per capita among the elderly was about $800.

income; in 1944, for instance, OAA benefits were on average 3.5 larger than recipients' income.[7]

At the inception of the OAA program in 1936, the majority of OAA recipients constituted a new group of public dependents. They were not transferred from other welfare programs, and 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.[8] Moreover, throughout the time period under study, the great majority of OAA recipients did not receive relief other than OAA. In 1936 and 1937 for instance, only about 25 percent of OAA recipients received other forms of assistance, and moreover, this other form of assistance was usually another OAA grant (most likely for a spouse). The only exception was the joint receipt of OAA and OASI beginning in 1950s. Since prior to 1950 OAA had low coverage and included richer recipients compared to OAA, the overlap between OASI and OAA recipients was initially small.[9] When the provisions of OASI were liberalized in 1950, the number of new OASI beneficiaries receiving minimum benefits—and hence in continued need of assistance—increased. As a result, the concurrent receipt of OAA and OASI among OAA recipients increased to about 13 percent in 1952 (White 1953). I therefore control in my estimations for the level of OASI benefits per elderly person in each state and year.

The evolution of the OAA program depicted in Figures 1 and 2, however, masks enormous variation across states and time. In 1937, for instance, benefits varied from $61 in Mississippi to $380 in California, and OAA recipiency rates from 4 percent in Maine to 50 percent in Oklahoma. There was also a large variation in benefits and recipiency rates within

[7] 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.

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

[9] In 1944 for instance, less than 2 percent of OAA beneficiaries also received OASI, and by 1948 this number was less than 5 percent.

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.

I show elsewhere (Balan Cohen 2006) that states' responsiveness to the federal matching schedule was much higher along the intensive (benefits) margin compared with the extensive (recipients) margin, largely due to political factors.[10] Despite these differences, both OAA benefits and recipiency rates were very sensitive to own and cross-prices, as well as to the federal (income) contribution to OAA.[11] In turn, these prices were a function of the federal matching schedule, state income and revenue per capita, and the fraction of the population 65

[10] The own price intensive elasticity was twice as large as the own price extensive one. OAA benefits per recipient for instance, were more responsive to own prices during gubernatorial reelection years, and were less responsive in states with a high fraction of black population. By contrast, the responsiveness of recipients per elderly population was less sensitive to political factors, and more sensitive to employment conditions. 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.

[11] The price of additional benefits is the marginal state contribution times the number of recipients, while the price of additional recipients is the average state share times the average benefit per recipient. Baicker (2005) finds a strong responsiveness of AFDC to own and cross prices for the 1948-1963 time period, but the magnitude is similar along the extensive and intensive margins.

years old (and poor). In estimating the impact of OAA on elderly mortality, I therefore control for a rich set of state-level covariates to ensure that OAA payments, rather than state characteristics, are the driving factor behind the change 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 1.

*Mortality Data***.** The mortality data between 1927-1955 were collected from United States Historical Vital Statistics Reports (see Appendix A). The 1934-1955 data are aggregated by state-year-age-groups, and cover all 48 continental states, and 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 my focus is elderly mortality, I also provide estimations of the impact of OAA on the non-elderly, as a specification check. In the 1931-1933 data, elderly mortality is available for those 65 years and older only, so estimations including this time period include a single age group. 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 1931-1955, and contains yearly information on average state benefit levels and number of OAA recipients, as well as on the distribution of OAA payments, sources of funds (state vs. federal government), and state OAA 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 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 (expressed in tens of thousands).[12] The dependent variable is log (mortality rate).[13] *OAA per elderly person* is defined as the product of the OAA average benefit per recipient times the recipiency rate.[14] 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

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[12] I construct annual, state- and age group- specific population estimates by fitting separate cubics to the 1930 to the 1960 census data in each age-group cell. To control for potential measurement error in my imputed population estimates, I have also performed estimations with the log of deaths in each cell as the dependent variable (rather than the log of the mortality rates) but the results are not very sensitive to this alternative specification.
[13] 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 dependent variable is log ((deaths+1)/population).
[14] The recipiency rate is the number of recipients divided by the number of people 65 years and older.

than current) population 65 years and older. This modified OAA measure is expressed in US$ 1982 real terms, and is corrected for differences in the cost of living across states (using data from Lindert and Williamson 1980).

The unit of observation is the *state-age group-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 of interest 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.[15] Regressions are weighted by the square root of population in each cell.[16] I use robust standard errors, corrected for clustering on state and age group. Finally, I omit Louisiana 1946-1952 from the estimation.[17]

3.2 Instrumental Variables Estimation

The OLS estimates can document the relationship between OAA and mortality, but do not establish a causal relationship. Although the covariates, fixed effects, and interactions control for determinants of mortality and correlates of OAA, the OLS results can still be biased

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[15] Another concern is the fact that the OAA data is not available separately by age group, resulting in measurement error and possibly attenuation bias. Social Security publications reveal that this is somewhat of a concern, but not a very big one; the distribution of OAA benefits and recipients across elderly recipients 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 75plus age group.

[16] 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.

[17] Due to the populist policies of the governors Jimmy Davis and Earl Long, OAA data during 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 very 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).

due to the endogeneity of income, as both mortality and OAA benefits are functions of individual resources. Since OAA recipients had few resources besides OAA, the absolute levels of these resources are not likely to be a major source of bias. However, unobserved *differential* shocks to the incomes of OAA (and/or non-OAA) recipients during this period, that varied within states and age groups over time, would bias OLS coefficients towards zero. The size of the bias could be large despite the small size of OAA recipients' other resources, since relative (rather than absolute) income differences would be the source of the problem.[18]

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.[19] Since no published payment schedules existed for OAA, changes in laws were most often driven by bureaucratic attempts to clarify the complex aspects of determining need and resources.[20] Political factors also

[18] 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.

[19] 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; richer states had, for instance, slightly more generous OAA legislation (though not always).

[20]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

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 a larger fraction of elderly population and a lower fraction of blacks (Balan Cohen and Ban 2006). OAA legislation reflected certain of these effects (the electoral year increases) but not others (e.g. racial discrimination in southern states). Since uniform treatment of recipients was a pre-condition for OAA federal funding, southern states could not discriminate (on paper) against specific recipient groups; such discrimination was more likely to occur in the administration of laws.[21] Furthermore, in non-southern states, legislation was driven by ideological and political battles over the relative roles and sizes 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.[22]

In addition to being exogenous, the simulated OAA measure is also relevant and strong in most specifications; the raw correlation between the actual and simulated OAA measures is 0.60. In some specifications, however, 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 that are robust to the presence of weaker instruments. I construct confidence intervals for β using the Conditional Likelihood Ratio (CLR) test proposed by Moreira (2003).[23] For point estimation, I use Fuller's (1977) estimator with

not necessitated further changes and clarifications during the next OAA legislature session. See Linford (1949) for an account of legislative changes in Massachusetts for instance.

[21] In southern states local administrators were basically granted full autonomy in determining need; one of the administrator rights for instance, was the assignment of an OAA recipient to a non-local parish for the purposes of receiving aid, thus allowing them to manipulate OAA distribution according local labor needs (Quadagno 1988).

[22] 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".

[23] 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.

parameter equal to 1.[24]

4. OAA and Overall Elderly Mortality

From 1900 and until 1930, mortality among people aged 65 years and older (henceforth referred to as elderly) in the United States fluctuated around a relatively constant trend, of about 950 deaths per 10,000 people (Figure 3). 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 900 deaths per people) but then rose back to close 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?

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 4 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.[25] Furthermore, panel B shows that near-elderly mortality trends do not show this pattern.[26]

Table 2 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

[24] The Stata algorithm reports the CLR-based confidence interval along with the limited information maximum likelihood (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. (2005a,b) showed that this estimator performs reasonably well, even in the presence of weak instruments.

[25] By 1939 all states had OAA programs. Furthermore, the first expansion in the OAA program occurred in 1939, when the federal maximum was increased from $30 per month per person to $40.

[26] Mortality among 45-64 years old declined continuously during this time period, 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.

proxies for elderly political power and income.[27] Of these variables, the only significant 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.[28] 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.[29]

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 2 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 21.4 percent relative to

[27] The proxies for elderly political power and wealth are the percentage of the population 65 years and older (reflecting the possibility for greater mobilization for OAA) and the percentage of housing that is owner occupied (since elderly people's resources were often in the form of housing during this time period). I have also performed specifications with alternate proxies for health (number of doctors per capita) and education (the percentage of population with high school degree or higher) but the results are the same. Specifications including the percentage of the population that is urban (to reflect the urban mortality penalty-see Cutler and Miller 2001), the ratio of divorces per new marriages, and the percentage of the population that is catholic (to proxy for private charitable expenditures—see Gruber 2005) were also similar, and all these proxies were statistically insignificant.

[28] States fiscal capabilities were also mentioned in the literature as important determinants of states' spending on welfare (Altmeyer 1945). To proxy for states' fiscal capabilities, I have also performed estimations controlling for states' total revenue per capita, but this measure was not statistically significant and results were essentially unchanged.

[29] This is the nationwide sum of the declines in yearly deaths following the introduction of OAA, calculated relative to the level that would have prevailed in the program's absence.

the level that would have prevailed in the absence of OAA. Expressed differently, one standard deviation increase in OAA per elderly spending would have decreased mortality by 0.056 standard deviations.[30]

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.[31] However, the first stage F statistic reveals that although instruments are strong enough to provide unbiased estimation, they are borderline weak regarding correct test size (the first stage results are presented in column 3).[32] Estimations robust to the presence of weaker instruments confirm this; the point estimate of β using Fuller's (unbiased) 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 3, I restrict my attention to the post-1936 time period only, and include in the estimation state and age specific mortality trends, constructed based on data between 1926 and 1935.[33] The results, however, are essentially unchanged—the estimated mortality decline is now 20.7 percent rather than 21.4 percent. Columns 2 and 3 present some further specification checks. In column 2, I

[30] The effect at the mean level of OAA per elderly person ($599) is $1-e^{-0.062*5.99}=31\%$. OAA is expressed in hundreds of 1982 $.

[31] The statistic is equal to 1.94 and we cannot reject the null hypothesis of exogeneity of instruments since the p-value is 0.17.

[32] 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 (19.38) for correct test size (Stock and Yogo 2005).

[33] 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. Fishback et al. (2005) use a similar approach to control for past mortality trends during the New Deal period.

extend the analysis to include the 1931-1933 period by combining all persons aged 65 years and older in a single age group;[34] and in column 3, I check the sensitivity of results to OAA data prior to the passage of the Social Security Act.[35] One final concern with the estimation is the possibility that OASI rather than OAA is driving the results. Since OASI was federally administered, I cannot estimate its causal impact on mortality directly. However, we can gauge its impact indirectly, by restricting the estimation to the 1934-1950 time period, when the OASI program was small. The results, presented in column 4, suggest that OASI was unlikely to have had a big contribution to the mortality decline.

Although the analysis so far reveals a strong negative impact of OAA on elderly mortality, it is worthwhile to consider some placebo tests in order to confirm its causal nature. In column 5 of table 3, 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 welfare programs set up under the Social Security Act –which were not targeted at the elderly—had no impact on the mortality of older people (columns 6 and 7).

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?[36] Since the mortality data is not available separately by income levels, I cannot answer this question directly. I provide some plausible answers, however, by analyzing the

[34] Elderly mortality data for 1931-1933 is not available by age groups. With a single age group in this specification, I can only include stage and year fixed effects, and region*year interactions.

[35] Specifically, I set the values of OAA benefits to be zero in the years and states states without federally approved OAA plans. The rationale behind this robustness check is that data might be noisier; prior to federal approval OAA data was not collected in a systematic manner, and OAA benefits were puny.

[36] The poorer elderly had lower health levels to begin with. The National Health Survey of 1936 revealed that the relative amount of illness in relief versus non-relief families was large. The number of days of disability per year for those aged 65 years and older was twice as high in relief families compared to non-relief ones, and the severity of illnesses was also higher. Moreover, poor families were less likely to receive medical care compared to other groups (White 1940, p.194-5).

impact of OAA on suicides, and disaggregating the effect of OAA on overall mortality by gender and race.

5.1 Evidence From Suicides

In rational suicide models, death occurs when the remaining lifetime utility falls below a certain threshold; suicides therefore are 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.[37] Analyzing the effect of OAA on suicides therefore can provide us with valuable insights into the impact of OAA on elderly welfare.

The aggregate trends in elderly and near elderly suicide mortality between 1931 and 1955 (figure 3) suggest a negative correlation between suicides and OAA. 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 4 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 the endogeneity of income in the estimation (columns 1 and 2).[38] 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). Furthermore,

[37] For instance suicides have been shown to be negatively correlated with age, income fluctuations (Hammermesh and Soss 1974, Fishback et al. 2005), divorce (Cutler et al. 2001), and unemployment (Ruhm 2000). Suicides are also correlated with depression and mental illness however.

[38] Since suicides are rare count events, a nonlinear specification (Poisson) might be a more appropriate estimation technique compared to OLS. As Cameron and Trivedi (1998) point out, OLS estimation of count data models following log-linearization (with adjustment for zeros, like I do) is necessarily more ad-hoc. Estimating equation 1 using a Poisson fixed effect estimator (Cameron and Trivedi 1998) yields results very similar to OLS, however.

placebo estimations of the effect of OAA on the non-elderly, and of the effect of ADC on elderly mortality (column 6 and 7) yield insignificant results. The estimated effect of OAA on elderly suicides was large; between 1931 and 1955, OAA decreased suicide mortality by 30 percent.

5.2. 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 some more light on this issue, I disaggregate the effect of OAA on overall mortality by demographic groups. 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, this is unlikely to be a major concern.

Table 5 shows the results by gender. The contrast between the effect of OAA on male and female mortality is striking; while OAA reduced male mortality by 35 percent (coefficient –0.1), the impact on female mortality was insignificantly different from zero. The number of female OAA recipients was slightly higher compared to that of males, however. 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 the OAA program became larger 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. Therefore, the gender composition of OAA beneficiaries is unlikely to explain the differential mortality impact of OAA.

The most likely explanation for this difference lies in the differential nature of the life 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; in the 1920s, almshouse residents were more than twice as likely to be men compared to women (Lerman, p.37). [39,40] The advent of OAA, however, provided needy men with sufficient resources for independent living, and thus enabled them to avoid the poorhouse.[41] Since institutionalization conditions in almshouses were deplorable, it is not surprising that OAA would have a stronger impact on men's welfare compared to women's.

5.3. Results by Region

Disaggregating mortality results by region and race provides further evidence on whether OAA had a stronger impact on its poor target population. Before 1946, the expansion of the OAA program was uneven across regions. During the early years of OAA, the main recipients of OAA federal subsidies were northern and western states; [42] OAA benefits in the South were initially low, and recipiency rates, especially in the cotton belt counties, even lower.

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[39] Partly as a heritage of old poor laws, women's destitution in general (and at older ages in particular) was generally viewed more sympathetically by their close families; furthermore, the fact that government outdoor relief prior to 1930s was also more forthcoming for needy elderly women compared to their male counterparts, and the fact that women could help with household duties further reinforced families' behavior by lowering the relative price of older women care (Gratton 1986)

[40] The share of elderly living in almshouses was about 1.8% in the late 1920s (Gratton 1986). The share among poor people is unknown, but believed to be significantly higher. Elderly were also more likely to be institutionalized in mental hospitals and asylums during this time period, which served as de facto nursing homes.

[41] I have collected data on admissions to mental hospitals by gender and age. Estimations of the effect of OAA on admissions to mental hospitals among the elderly confirms that OAA decreased the risk of institutionalization for men, but not for women.

[42] Since some of these 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, since these states were richer on average, they were able to afford larger OAA programs. Also, southern states were often unwilling to increase OAA programs for fear of subsidizing entire black farming families, and thus disrupting local cotton labor markets and tenant arrangements (Quadagno 1988).

In 1946, a major change in federal OAA subsidization formula created incentives for states to admit a larger share of recipients.[43] These incentives, coupled with southern states' desire to attract a larger share of federal funding, resulted in large expansions of OAA recipients in the South.[44] 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 2006), responded to the federal subsidy by increasing benefits rather than recipients. As a result, the increase in recipients in the southern states relative to non-southern states was large (figure 6).

The extent to which this translated into income increases for the poorest elderly in the South is unclear however. Some authors, for instance, have suggested that not all recipiency increases were real;[45] furthermore, even as recipiency rates increased, benefits were initially cut.[46] Elderly need was large in the South, however, and economic and political considerations were changing—for example the increased mechanization of agriculture reduced the need for agricultural labor, and could have thus diminished states' resistance to expanding OAA. Indeed, Figure 5 indicates that benefits in the South did increase eventually, but the change was smaller compared to that in non-southern states. Since data on the size of benefits by race is not available, it is still possible that increased benefits and recipiency rates occurred mostly among white (rather than the poorer black) elderly.

To disentangle some of these hypotheses, I estimate the impact of OAA on elderly mortality by race and region. Results are presented in Table 6. Panels A and B show that OAA

[43] The federal subsidy was changed to be 66 percent of the first $15 per month, and 50 percent of the remaining difference up to the federal maximum Previously, the federal subsidy had been the same up to the federal maximum. This formula was changed again in 1948 and 1952.
[44] As Quadagno (1988) notes, 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 (p. 138)
[45] Some increases were simply accounting tricks, since states sometimes divided (formerly joint) OAA payments between husbands and wives (Quadagno 1988)
[46]For instance Alabama increased the number of recipients by 40 percent, but reduced the average payment by $1.16(Quadagno 1988, p.141)

had a large impact on mortality in non-southern states (31 percent decline for whites and 17 percent decline among blacks), but it had no effect on mortality in the South, either for whites or for blacks.[47,48] The lack of an effect of OAA on southern mortality suggests that benefit amounts were low, either in absolute terms, or relative to recipients' incomes. For whites, the second effect is most certainly part of the explanation. Unlike blacks, white elderly in the south had been receiving large Confederate pensions even prior to the passage of the Social Security Act (Quadagno 1988). As a result, the advent of OAA for this group resulted in a shift in the source of funding for their pensions, rather than in an actual increase in income.[49] The persistence of this effect even after the 1946 expansion (table 6, panel C) suggests that OAA benefits were probably low in absolute terms as well. Since mortality among both blacks and whites was unaffected by OAA, it seems unlikely that direct discrimination was the major factor driving these results, at least after 1946.[50] The more likely story is that southern states were constrained in expanding OAA by their lower levels of resources.

6. Mechanisms Leading to Lower Mortality

As the previous two sections show, OAA income decreased elderly mortality substantially between 1931 and 1955, and it did so more for the vulnerable groups (provided that states were able to afford sufficient OAA payments). 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

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[47] Since blacks represented a smaller fraction of OAA recipients in northern states—mirroring their smaller share in the overall elderly population—, the relative sizes of the mortality declines due to OAA are not surprising. In table 6, the sample is restricted to states who had more than 1 percent black population in 1937 when I estimate the effect of OAA on mortality among blacks in non-southern states. If the sample is restricted to states where the percentage of blacks was greater than the median in 1937 (3.4 percent), the effect of OAA on mortality doubles.

[48] The results in Table 6 are for males only. Consistent with the discussion in section 5.2, results for women were insignificant across all IV specifications and are available from the author upon request.

[49] Confederate pensions were certainly similar in magnitude to OAA payments in the early years of OAA (Quadagno 1988, p.136).

[50] 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, southern governments provided uniformly lower standards of OAA assistance.

education, nutritional improvements, sanitation, social status, psychological risk factors, and technological advances.[51] In the absence of detailed survey data, the independent contributions of these factors to the change in mortality cannot be identified. Instead, I disaggregate results by cause of death in order to provide evidence on the most plausible channels through OAA reduced mortality.

I divide mortality into three groups: mortality from treatable diseases, from behavioral causes, and from chronic diseases. During this time period, medication existed mainly for infectious diseases (ID), and therefore mortality from these causes constitutes the treatable category.[52] Mortality from behavioral causes refers to tobacco, alcohol, and driving related mortality, as well as cardiovascular deaths.[53] Finally, mortality from chronic diseases (non-smoking cancers) is analyzed as a control.

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.[54] 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.[55] 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 some 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

[51] See for instance the review of the literature in Cutler et al. (2006).
[52] 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).
[53] See Cutler (2004) on the link between behavior and cardiovascular disease.
[54] Author's calculation based on data from Cutler and Meara (2001)
[55] 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

this period, led to overuse, the development of resistant strains, and frequent fatalities.[56] In the 1940s more pharmaceutical discoveries followed. Penicillin first became available in 1943, 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.[57] 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).[58]

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 new (pricey) medical technologies? By examining the effect of OAA on ID mortality we can provide answers to this question.

I start by estimating equation (1) by OLS, and performing a Quandt Likelihood ratio (QLR) test to detect if there are breaks in the OAA coefficient.[59] Since the test reveals that there is a break in the impact of OAA on elderly mortality in 1944, I perform estimations for the 1931-1943 and 1944-1955 time periods separately. The results, presented in Table 7, show that the estimate of β is insignificantly different from zero prior to 1944, and strongly negative afterwards—between 1944-1955, OAA decreased elderly mortality by 37 percent relative to the level that would have prevailed in the absence of OAA. Moreover, OAA had no impact on non-elderly mortality during both time periods. This latter result suggests that although access to medical care played an important role in the decline in ID deaths among the elderly, it was not the only channel through which income affected their mortality. Housing conditions most likely

[56] In 1941, 1 in every 1500 cases of pneumonia treated with sulfonamides died directly as a result of the treatment (McGrew 1985).
[57] In this section, therefore, by infectious diseases I refer to all diseases that were responsive to antibiotics and sulfa drugs: tuberculosis, pneumonia and flu, syphilis, dysentery, and viral gastrointestinal diseases
[58] The only exception was penicillin. Since it had been discovered prior to 1930s, penicillin could not be patented, and, as a result, its price declined dramatically following mass production: from essentially priceless in 1940, to $3955 per pound in 1945, and $282 in 1950.
[59] The QLR test performs Chow tests on the coefficients at all possible break points in the data. The highest of these F statistics is the QLR statistic. If there is a discrete break in the data, the QLR test rejects with high probability; moreover, the date 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 in 1944.

played an important role as well. Given the high contagion rates of infectious diseases, the lack of spillover effects from OAA income on non-elderly mortality is consistent with our discussion in section 5.2, suggesting that the additional income shifted the living arrangements of the elderly away from crowded housing conditions—family living for women, and poorhouses for men—and towards independent living.

6.2. Behavioral and Cardiovascular Mortality

Health behaviors and income are closely associated. Compared to poorer groups, richer people smoke less (Cutler and Glaeser 2006), seek medical care more actively (Case et al. 2005), and are more likely to wear seatbelts (Lerner et al.2001; Shinar et al. 2001). The causal nature of the association between behaviors and income is unclear, however.[60]

To analyze the potential impact of OAA on elderly mortality through this channel, I first 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 driving.[61] 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 8, reveal that OAA had a large effect on elderly mortality from these causes, but no impact on the mortality of the 45-64 year olds. OAA decreased elderly cardiovascular and behavioral mortality by 23 and 33 percent respectively.[62]

These results are consistent with the literature documenting a negative association between socioeconomic status and health behaviors like drinking, exercise, eating habits, and the use of preventive care (Adler et al.1994, Goldman and Smith 2002). However, the results are seemingly in contradiction with some recent findings in the literature suggesting that economic

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[60] For a review of this literature, see Cuter et al. (2001).

[61] 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 (2004).

[62] I have also performed separate estimations for each of the groups of behavioral causes (smoking, drinking, driving) and the results are essentially the same.

upturns might increase riskier health behaviors and thus have no effect on (or even increase) cardiovascular mortality (Fishback et al. 2005, Ruhm 2000, Ruhm 2006).

To understand how these findings could be reconciled, I use the 1936 Survey of Consumer Purchases to analyze the effect of income on the consumption of riskier goods by the elderly. The results are presented in Table 9, panels A and B. For both elderly and the non-elderly, the OLS and probit estimates in columns (1)-(5) reveal a nonlinear effect of income on smoking consumption measures—cigarette expenditures, and the probability of smoking.[63] Furthermore, columns (6)-(7) show that although the number of miles driven increases linearly with income, careless driving—proxied by the probability of getting a fine—also displays an inversely shaped U pattern with respect to income.[64] These estimates suggest a shifting of behavior away from current risk and towards long life at sufficiently high levels of income. The reason for this is that at low income levels, present consumption of risky goods initially increases with additional resources through the income effect. However, since the value of life also increases with income, at sufficiently high levels of resources the latter effect can dominate.[65]

The income inflection points in the consumption estimations are low compared to the size of OAA payments between 1934-1955, which could explain my finding a negative effect of OAA income on behavioral-related mortality.[66] To show this more formally, I disaggregate the effect of OAA on elderly mortality by income level categories. The results show that OAA had no impact on mortality from smoking-related causes at income levels below the (survey

[63] The number of cigarettes purchased also follows this pattern, but the nonlinear effect is insignificant in elderly households, most likely due to the small sample size. In the larger sample of non-elderly households, the effects are significant.
[64] Since the survey does not contain information on alcohol expenditures, I focus on the consumption of reckless driving and smoking related goods only.
[65] See for instance Costa and Kahn (2004) and Oster (2006) on the relationship between income and the value of life. Cutler and Glaeser (2006) also document a non-monotonic relationship between income and smoking.
[66] Since the value of life effect depends on income, inflection points are going to differ by income groups. To ensure comparability with the OAA recipient group, I perform estimations similar to those in table 9 on a restricted "poorer" sample of elderly people, with per capita incomes below $800. The estimated income inflection point (expressed in 1982 dollars) is about $1250. By comparison, the average OAA payment per recipient in 1936 was $1350.

estimated) income inflection point, and that it decreased mortality at higher income levels (Table 10, columns 1-2). More generally, the effect of OAA on behavioral and cardiovascular mortality was statistically insignificant in the two bottom OAA quartiles, and negative and large in the third quartile. In the topmost quartile, however, OAA had a slightly smaller effect on behavioral mortality, and a slight positive effect on cardiovascular mortality (Table 10, columns 3-6).

Disaggregating the consumption results by gender reveals that although the relationship between income and consumption of risky goods for men mirrors the patterns in the overall population, for women it does not; smoking among women is positively (and linearly) related to income, and reckless driving is insensitive to it (Table 11, panel B). Women's smoking is more related to emotional and psychological factors compared to men's, and is therefore less responsive to price and income changes (Carpenter et al. 2005, Chaloupka et al. 1998).[67] 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 that we discussed in section 5.2. Panels A and B of Figure 8 show that the aggregate mortality trends for men and women in states with high (above the median) and low levels of OAA benefits per elderly person are consistent with this story. Panel A of Figure 8 reveals that while female mortality trends were essentially similar in both groups of states, male ones were not. Consistent with consumption patterns, male mortality was increasing in states with low OAA levels, and decreasing in high OAA states.

6.3.Relative Contributions to Overall Mortality Declines

Between 1934 and 1955, OAA had a large impact on infectious, behavioral and cardiovascular mortality among the elderly, but not on the 45-64 year olds who were ineligible for OAA. Also, OAA had no impact on elderly mortality from conditions that are less likely to be responsive to

[67] 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).

income, chronic diseases.[68] This provides further evidence that the effect on ID, behavioral and cardiovascular mortality (which are more acute conditions) is unlikely to be spurious. The decline in these causes suggest three main mechanisms through which OAA income decreased elderly mortality: providing access to health care, shifting living arrangements away from crowded housing conditions, and reducing risky health behaviors. Together, these channels explain 84 percent of the decline in elderly mortality from OAA between 1934-1955.[69]

7. Discussion

The IV results in this paper reveal that OAA income decreased elderly mortality by 22 percent between 1931 and 1955. This effect is large; it translates into an increase in life expectancy at age 15 of about 2.4 years—or slightly more than a third of the life expectancy increase between 1900 and 1940. In all the specifications, the IV coefficient is 3 to 6 times larger than the OLS estimates suggest. I have already discussed in section 3.2 how conventional omitted variable bias could explain this difference. Another potential explanation could be measurement error. Temporary variation in benefits due to local funding shortages, for instance, would make OAA a less accurate measure of actual benefits at a given point in time. If the measurement error is classical, this would result in attenuation bias in the OLS results.

Another explanation for larger IV value is the fact that it estimates 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 income 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 among OAA recipients due to their

[68] Chronic diseases refer to non-smoking cancers. The IV coefficient (-0.03) is statistically insignificant—the CLR region is (-inf, .068]U[.939, +inf).
[69] Changes in ID, behavioral and cardiovascular mortality account for 7 percent, 24.2 percent, and 51.8 percent of the overall mortality decline, respectively.

lower initial health and resource levels. 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 4-7 times larger than the OLS estimates.[70]

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.[71] Evans and Snyder (2004) use the exogenous changes in social security 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 population, mortality was not affected in beneficial ways by the income change.

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 estimates of the effect of income on health are slightly smaller than those found by Case for

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[70] 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, respectively.

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

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.[72] 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 –0.2 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 estimate that the yearly cost per elderly life saved was about $82,676 (expressed in 2000 dollars), well under the typical benchmark for the value of life of $100,000 per year. Impressively, this compares favorably with programs such as Medicaid, which are targeted more directly at increasing health (Currie and Gruber 1996). The estimates of the cost per life saved are also lower than those found in Fishback et al. (2005), which is consistent with the fact that OAA was much 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 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

[72] 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.

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.[73]

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

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

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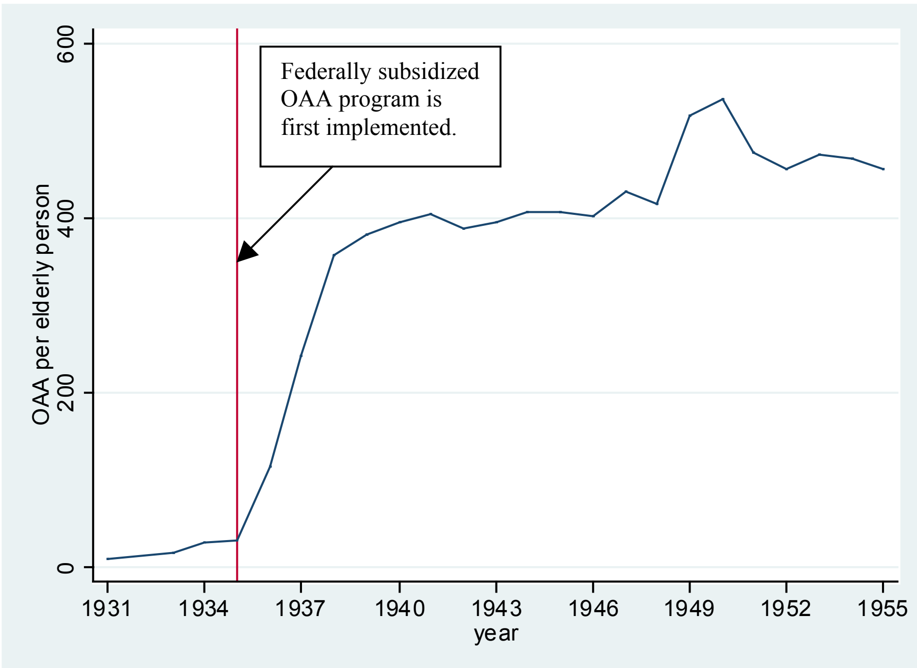
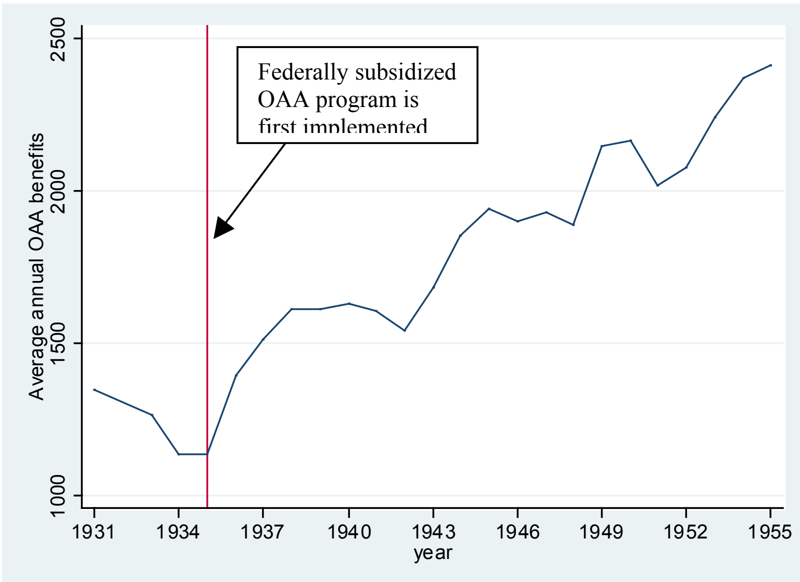
Figure 1. Average OAA per Elderly Person, 1931-1955.



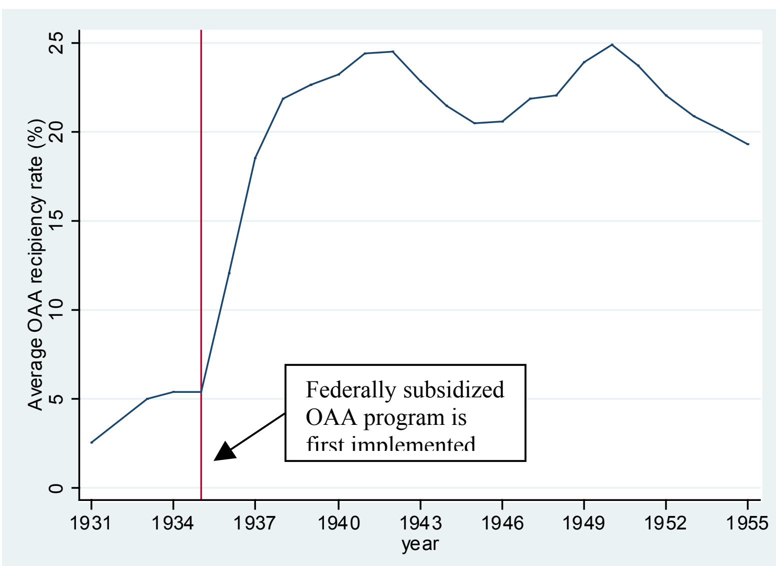
Note: The OAA data was collected from various Social Security publications. The yearly state population data was constructed by fitting cubics to the US 1930-1960 census data. The figure shows OAA benefits per elderly person in a given year, averaged across all continental states. OAA per elderly person 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 2. Average OAA Benefits and Recipiency Rates, 1931-1955.

Panel A: Average annual OAA benefits

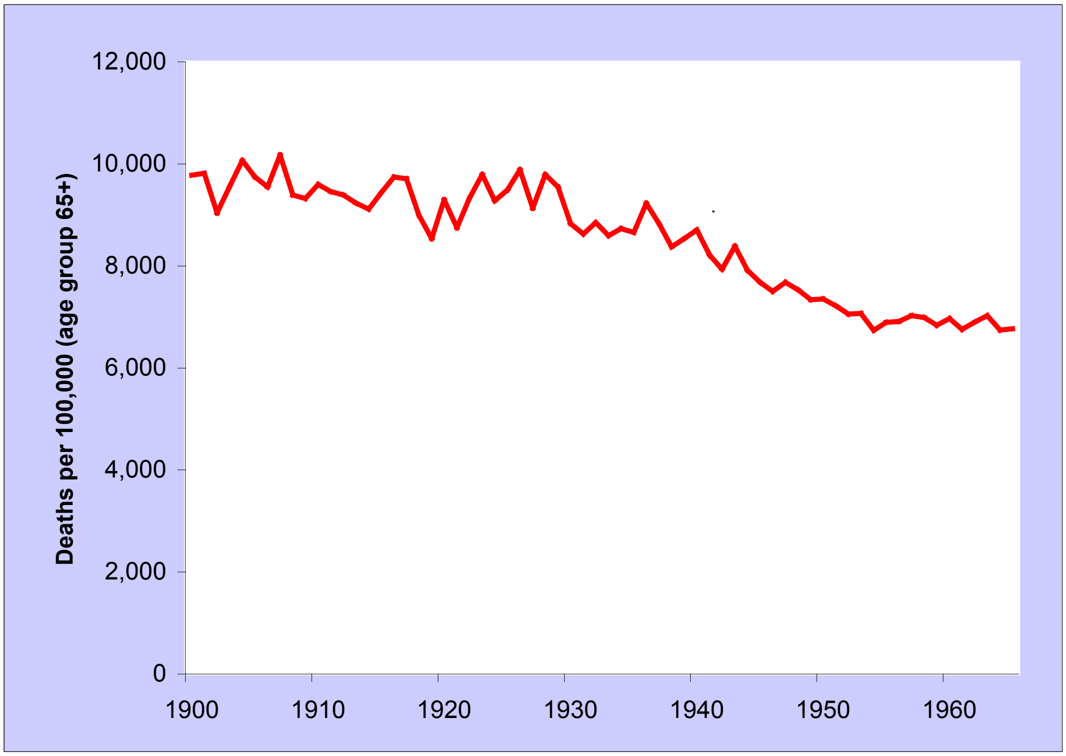


Panel B: Average OAA recipiency rate



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.

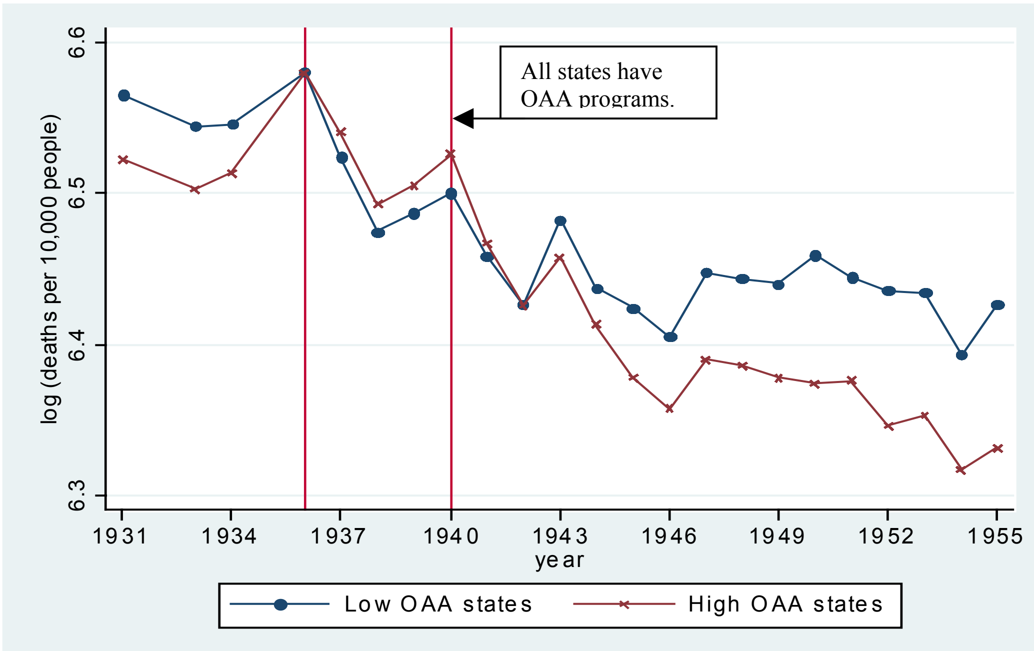
Figure 3. Mortality Rate Among People 65 Years And Older, 1900-1965



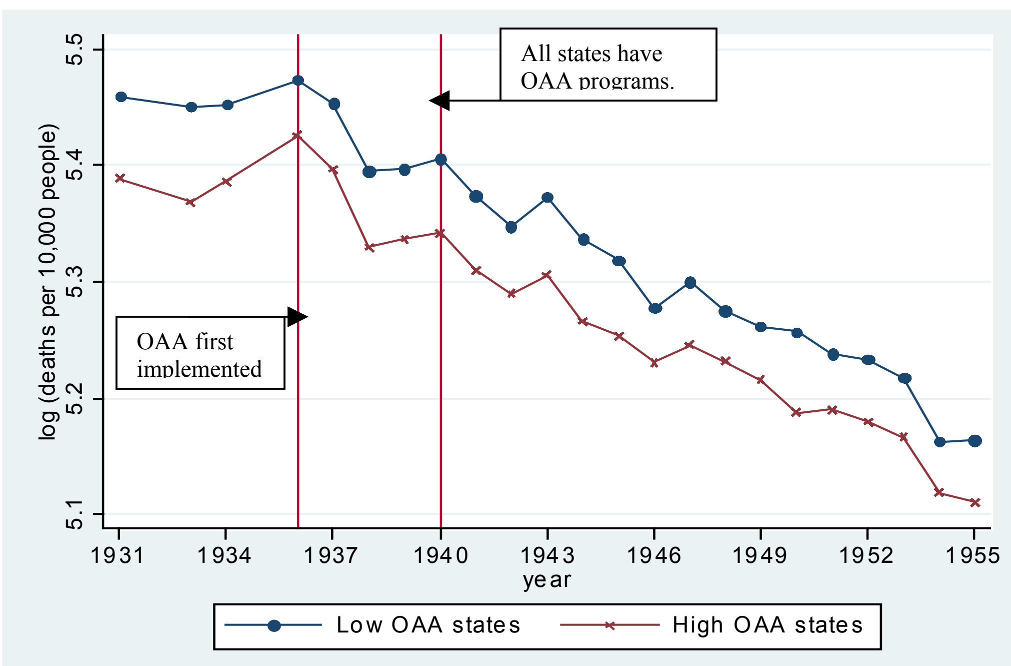
Note: The Figure is reproduced from Cutler and Meara, 2001, Figure 4. The mortality rate in each year is the weighted sum of mortality rates for 65-74, 74-85, and 85+ age groups in that year, with weights reflecting the age distribution of the 65+ population in 1990. I am grateful to Ellen Meara and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

Figure 4. Elderly and Non-Elderly Mortality Rates Between 1931-1955, by Low and High Levels of OAA.

Panel A: Mortality Rates for people 65 and Older

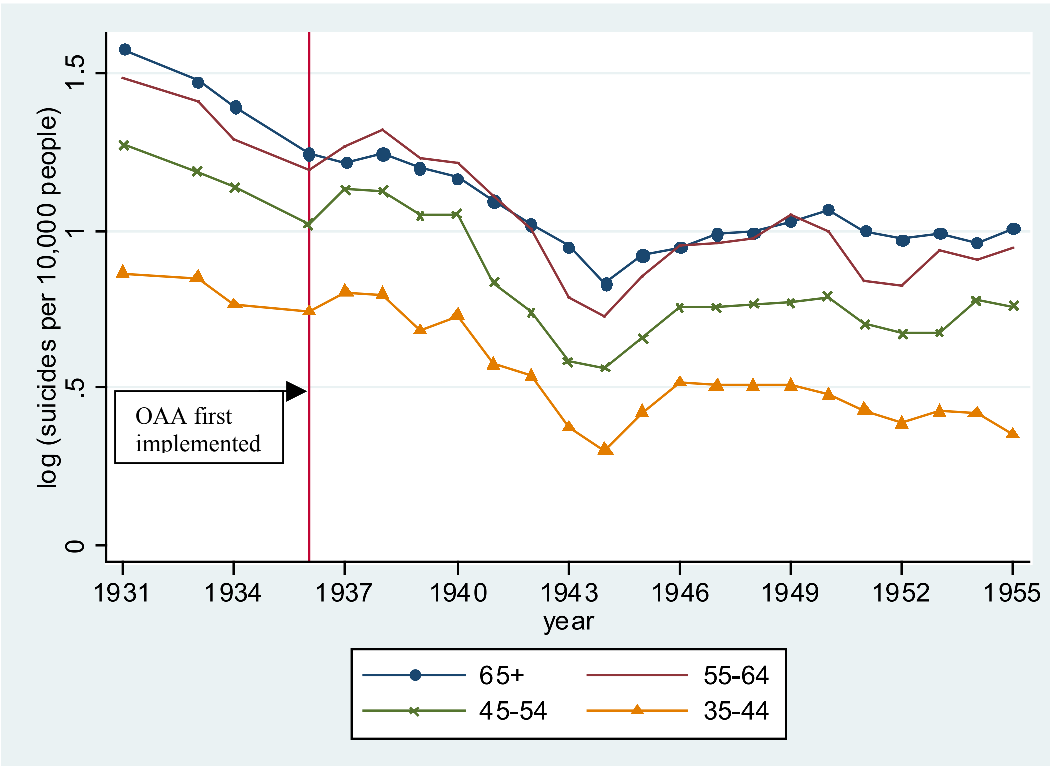


Panel B: Mortality Rates for 55-64 age group



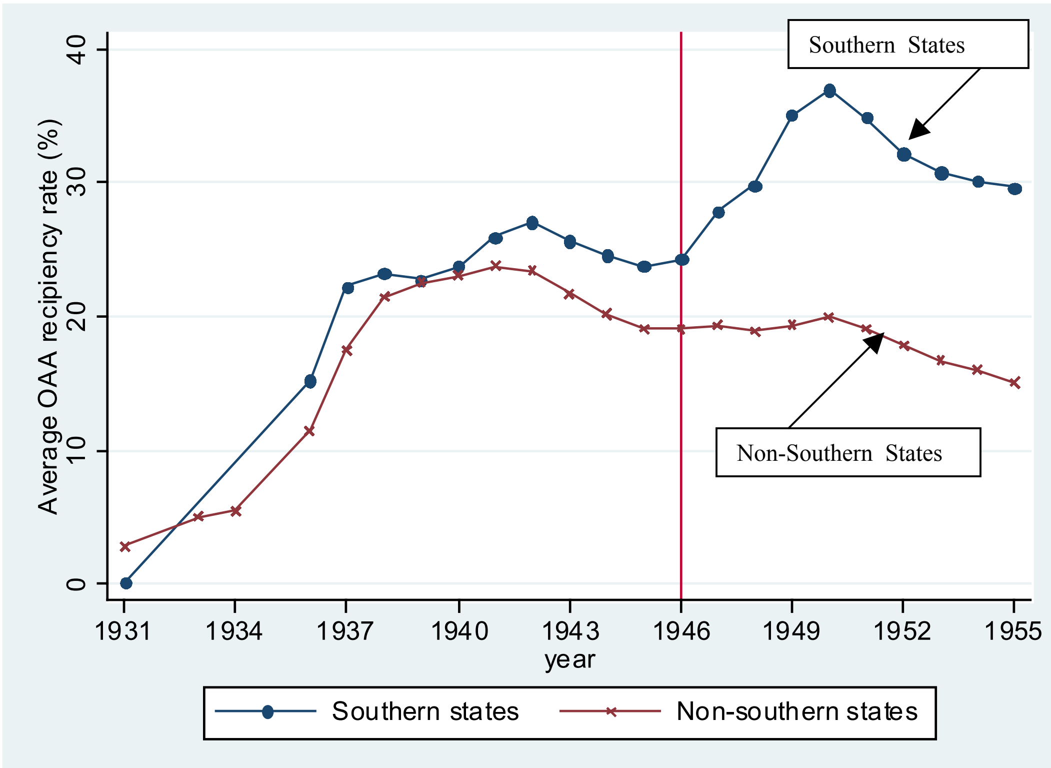
Note: Number of deaths by state, year and two age groups (55-64, and 65 years and older) was collected from the Vital Statistics of the United States. The yearly state population was constructed by fitting cubics to the US 1930-1960 census data. Mortality rates are in logs, and the unit of measurement 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 5. Suicides By Age Group, 1931-1955



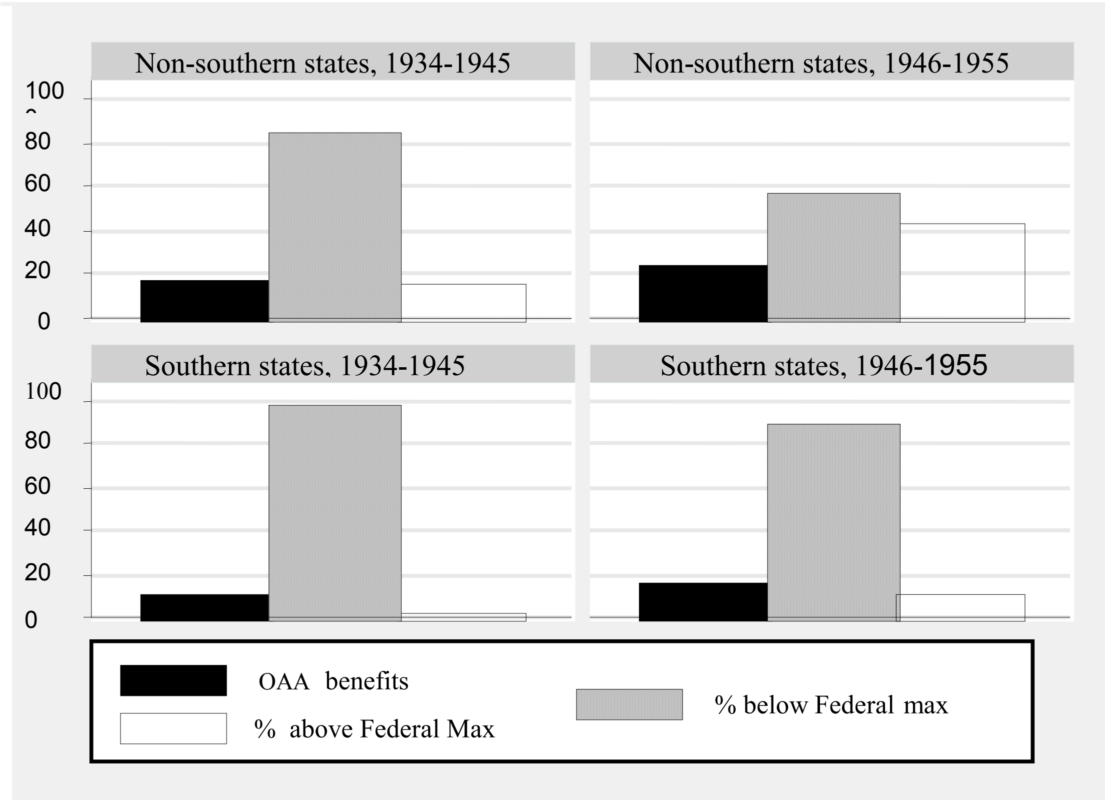
Note: Number of suicides by state, year and four age groups (35-44, 45-54, 55-64, and 65 years and older) was collected from the Vital Statistics of the United States. The yearly state population was constructed by fitting cubics to the US 1930-1960 census data. Suicide rates are in logs, and the unit of measurement is deaths per 10,000 people. Suicide 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 6. Average OAA Recipiency 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.

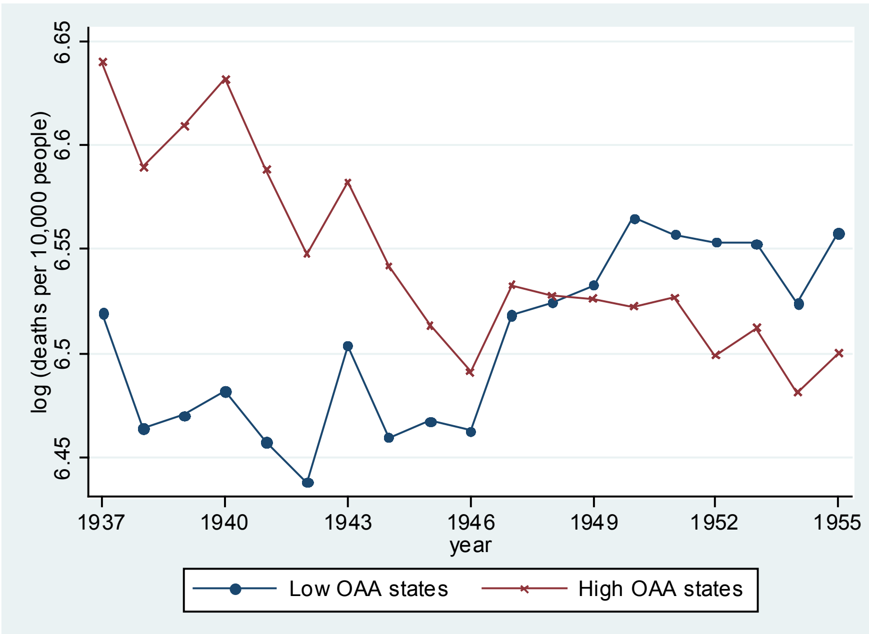
Figure 7. OAA Average Benefit and Distribution , Before and After 1946



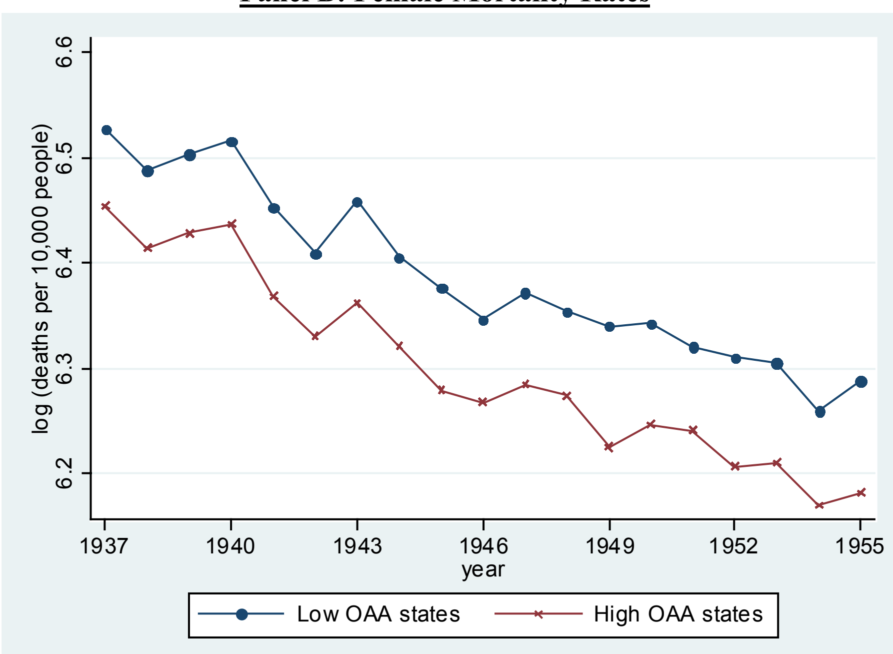
Note: The OAA benefits per recipient in each year represent averages (across states) of OAA state annual amounts, expressed in real terms (hundreds of US$ 1982), and corrected for differences in the cost of living using Lindert and Williamson (1980). The percentage above (below) the Federal maximum represents 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 8. Male and Female Mortality Rates Among the Elderly Between 1937-1955, by Low and High 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.

Table 1. 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: The OAA benefits and recipients data was collected from various Social Security publications. Controls data was collected from various sources, particularly United States Statistical Abstracts. (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 dollars 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 of the United States. The yearly state population for each age group was constructed by fitting cubics to the US 1930-1960 census data. The unit of measurement for mortality rates 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 diseases (excluding hypertension and arteriosclerosis) and from stroke. The data covers all 48 continental states and the time period 1931-1955.

Table 2: 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), all 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. 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 first proposed by Moreira (2003).

Table 3: 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 Table2, 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 years plus)—and hence does not include state*age and age*year interactions—and covers the entire 1931-1955 time period. In column (3), OAA 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 4: 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(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 5: 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: Males		
OAA per Elderly	-0.020	-0.10	-0.10	-0.10
	(0.011)+	(0.05)*	(0.2)**	(-.12, -.084)**
Observations	5364	5364	5364	5364
Adjusted R-squared	0.95	0.93	0.93	0.99
		Panel B: Females		
OAA per Elderly	0.0029	0.0062	0.0062	0.0066
	(0.0017)+	(0.0058)	(0.0052)	(-.0049, .018)
Observations	5362	5362	5362	5362
Adjusted R-squared	0.97	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-race-gender cell. All regressions cover three age groups (65-74,75-84,85-94), two race groups (whites and nonwhites), 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, age group and race fixed effects, as well as state*age, age*year and region*year interactions, as well as the full set of state-level covariates from Table2. Observations are weighed by the mean cell population. Standard errors are clustered at the state*age group*race 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 6: 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	-0.032	-0.088	-0.088	-0.12	-0.0037	-0.049	-0.049	-0.051
	(0.017)+	(0.049)*	(0.023)**	(-.17, .081)**	(0.0078)	(0.032)	(0.028)+	(-.11, .0061)+
Observations	1926	1926	1926	1926	1017	1017	1017	1017
Adjusted R-squared	0.96	0.93	0.96	0.99	0.95	0.95	0.95	0.99
				Panel B: Southern States				
		Whites				*Non-Whites*		
OAA per Elderly	0.0018	-0.013	-0.013	-0.013	0.010	-0.036	-0.036	-0.037
	(0.0024)	(0.019)	(0.0096)	(-.040, .0046)	(0.0077)	(0.14)	(0.042)	(-.22, .035)
Observations	756	756	756	756	756	756	756	756
Adjusted R-squared	0.99	0.99	0.99	0.99	0.96	0.90	0.95	0.99
				Panel C: Southern States Post 1946				
		Whites				*Non-Whites*		
OAA per Elderly	0.0052	-0.0019	-0.0021	-0.0031	0.0012	-0.020	-0.020	-0.017
	(0.0022)*	(0.025)	(0.019)	(-inf, +inf)	(0.0055)	(0.053)	(0.055)	(-inf, +inf)
Observations	390	390	390	390	390	390	390	390
Adjusted R-squared	0.99	0.99	0.99	0.99	0.97	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-race cell. All regressions cover three age groups (65-74,75-84,85-94). Estimations are performed on male whites in columns (1)-(4), and on male nonwhites in columns (5)-(8) nonwhites only. 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 A, columns (5)-(8) nons-outhern states refer to non-southern states that had more than 1 percent black population in 1937. 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 Table2. 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. 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 7: The Impact of OAA on Infectious Disease Mortality Rates, 1934-1955

Dep. Var = ln(Infectious Disease Mortality)	(1) OLS	(2) IV	(3) Fuller	(4) CLR	(5) Non-elderly
	Panel A: 1934-1943				
OAA per Elderly	0.018	0.0087	0.0087	0.0087	0.029
	(0.045)	(0.015)	(0.014)	(-.011, .029)	(0.012)*
Observations	1140	1140	1140	1140	760
Adjusted R-squared	0.99	0.99	0.99	0.99	0.94
	Panel B: 1944-1955				
OAA per Elderly	-0.016	-0.096	-0.096	-0.10	-0.017
	(0.0074)*	(0.042)*	(0.020)**	(-.13, -.076)**	(0.021)
Observations	1686	1686	1686	1686	1124
Adjusted R-squared	0.98	0.96	0.97	0.99	0.97

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). 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 (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, as well as the full set of state-level covariates from Table2. 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. 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 8: The Impact of OAA on Behavioral and Cardiovascular Mortality, 1934-1955

	(1)	(2)	(3)	(4)	(5)
	OLS	*IV*	*Fuller*	*CLR*	*IV, non-elderly*
			Panel A: Behavioral Mortality		
OAA per Elderly	-0.017	-0.089	-0.089	-0.086	-0.012
	(0.007)*	(0.034)*	(0.014)**	(-.103, -0.07)	(0.011)
Observations	2826	2826	2826	2826	1884
Adjusted R-squared	0.98	0.97	0.97	0.99	0.98
			Panel B: Cardiovascular Mortality		
OAA per Elderly	-0.010	-0.065	-0.065	-0.062	-0.004
	(0.006)	(0.036)+	(0.014)**	(-.076,-.05)	(0.006)
Observations	2826	2826	2826	2826	1884
Adjusted R-squared	0.98	0.96	0.97	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 Table2. 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 9: Consumption of Risky Goods, by Income and Age Group, 1936-1937

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
	Probit	Probit	Probit	OLS	OLS	OLS	Probit
Dependent variable=	*Smoke 0/1*	*Smoke 0/1*	*smoke 0/1*	*Cigarette exp. per capita*	*Nb of cigarettes*	*Nb of miles per capita*	*Auto fine 0/1*
				Panel A: 65+ Age Group			
Income	0.2	0.039	0.52	4.99	0.68	2451.2	0.005
	(0.067)**	(0.012)*	(0.12)**	(1.89)**	(0.4)+	(871.96)**	(0.0006)**
Income squared	-0.087	-0.018	-0.31	-1.4	-0.25	-525.6	-0.0038
	(0.032)**	(0.006)*	(0.10)**	(0.77)+	(0.37)	(380.41)	(0.0004)**
Obs.	647	167	647	110	110	382	73
R2/pseudo R2	0.19	0.39	0.19	0.20	0.13	0.34	0.64
				Panel B: 45-64 Age Group			
Income	0.19	0.10	0.34	6.52	1.11	1932	0.038
	(0.047)**	(0.039)**	(0.073)**	(2.34)**	(0.41)**	(1107.6)+	(0.019)+
Income squared	-0.053	-0.025	-0.16	-1.87	-0.24	-95.1	-0.009
	(0.018)**	(0.014)+	(0.046)*	(0.93)**	(0.12)+	(456.5)	(0.005)+
Obs.	2106	1169	2106	480	480	1397	820
R2/pseudo R2	0.11	0.13	0.12	0.14	0.13	0.24	0.17
Note	*Entire sample*	*Household heads*	*Unscaled income per capita*	*Smokers*	*Smokers*	*Auto owners*	*Non-zero miles driven*

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 community level. The survey covered 30 states, and the communities surveyed were designed to be representative at the national level. The expenditure section of the 1936 Consumer Purchases Study 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 were available for the entire household. I construct measures of income and expenditure per capita by dividing household values by the number of people in the household (column 3) and adjusting these measures for household economies of scale using IPUMS poverty threshold levels (columns 1-2 and 4-7). Income is expressed in thousands of 1936 dollars. Panels A and B show results for samples on the 65 plus and 45-64 year old individuals respectively. The estimation sample cover all individuals in the specified age group in columns (1) and (3). In columns (2) and (4)-(7) the estimation samples are restricted to individuals in the specified age group who are household heads (column 2), smokers (columns 4-5), auto owners (column 6 and who have actually driven their car during the past year (column (7). The dependent variable is an indicator for smoking (columns 1-3), cigarette expenditures and number of cigarettes per (adjusted) capita (columns 4 and 5) , the number of auto miles driven per (adjusted) capita (column 6), and an indicator variable for having received a driving related fine (column 7). Estimation is by OLS (columns 4-6) and probit (columns 1-3 and 7). Coefficients in the probit estimations represent marginal effects. Controls (in all specifications) include dummy variables for sex, race, urban residence, employment and marital status, as well as for family size. Data on education levels was not available.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.

Table 10. Behavioral and Cardiovascular Mortality, by Quartile of OAA

	(1)	(2)	(3)	(4)	(5)	(6)
	OAA<1250	*OAA >=1250*	Q1	Q2	Q3	Q4
			Smoking-related Mortality			
OAA per elderly person	0.12	-0.0547				
	(0.26)	(0.032)+				
Observations	417	2409				
R-squared	0.99	0.99				
			Behavioral Mortality			
OAA per elderly person			-0.083	0.246	-0.30	-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
			(0.058)	(0.31)	(0.11)**	(0.004)+
Observations			393	825	816	792
R-squared			0.99	0.99	0.97	0.99
Mean OAA per elderly (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 8, but the sample sizes are restricted to include observations with OAA benefit levels below (above) 1250 (columns 1-2), and in the first-fourth quartiles of OAA benefits per elderly person (columns 3-6). 1250 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.

Table 11. Consumption of Risky Goods, by Income and Gender, 1936-1937

	Probit	*OLS*	*OLS*	*Probit*
	Smoke 0/1	Cigarette exp per capita	Nb cigarettes	Fine 0/1
		Males		
Income	0.19	11.37	1.12	0.055
	(0.048)**	(3.47)**	(0.41)**	(0.029)+
Income squared	-0.05	-1.83	-0.025	-0.015
	(0.02)**	(1.1)+	(0.12)*	(0.009)+
Observations	2135	660	453	541
R2/pseudo R2	0.17	0.26	0.32	0.087
		Females		
Income	0.24	11.04	0.65	0.24
	(0.11)+	(4.76)*	(0.4)+	(0.041)
Income squared	-0.004	-2.33	-0.14	-0.096
	(0.005)	(1.49)	(0.19)	(0.28)
Observations	517	229	131	130
R2/pseudo R2	0.17	0.31	0.55	0.26

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 community level. The survey covered 30 states, and was designed to be representative at the national level. The expenditure section of the 1936 Consumer Purchases Study 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 were available for the entire household. 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 of 1936 dollars. Panels A and B show results for males and females respectively. To increase sample sizes, estimation covers individuals of specified sex who are 45 years and older. The patterns of consumption with respect to income for the 65 year old group are similar to those presented in the table .The estimation samples cover all individuals of specified age and sex (column 1). In columns (2)-(4) the estimation samples are restricted to individuals in the specified sex and age group who are smokers (columns 2-3), and who have actually driven their car during the past year (column 4). The dependent variable is an indicator for smoking (column 1), cigarette expenditures per (adjusted) capita (column 2) , and an indicator variable for having received a driving related fine (column 4). Estimation is by OLS (columns 2-3) and probit (columns 1 and 4). Coefficients in the probit estimations represent marginal effects. Controls (in all specifications) include dummy variables for race, urban residence, employment and marital status, as well as for family size. Data on education levels was not available. 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.

Appendix A: Mortality Data

The 1934-1955 mortality data set was collected by hand from the United States Historical Vital Statistics Reports, and it covers all 48 continental states. The mortality data are 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.[74] 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.[75] 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.[76] 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

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

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

[76] 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.

revisions to ensure a consistent aggregation of causes of death across time.[77]

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. 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.[78]

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.

[77] 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).

[78] 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 Publishers,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.

State Legislation Data Sources, continued

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

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.[79] 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.[80] 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 per elderly measure is calculated using the population 65+ 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.[81]

By using a national sample, we abstract from selection issues at state level. Since the 1936 Survey 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 (measured differently in the survey and the census data) was low compared to the magnitude of OAA benefit

[79] 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.
[80] 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.
[81] The correlation coefficients between the simulated benefits measures calculated in these different ways range between 0.8 and 0.9.