

The Impact of Social Security Income on Cognitive Function at Older Ages

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Given population aging, there is considerable interest in understanding the determinants of cognitive function at older ages and in identifying policies that could potentially prevent or delay cognitive impairment. Severe declines in cognition often lead to the onset of Alzheimer's disease (AD) or dementia. Alzheimer's disease (AD) is a progressive brain condition that affects memory, language and reasoning, and can seriously impair an individual's ability to carry out daily activities. In addition, AD and related dementias (ARD) impose a significant financial burden on patients, caregivers and public programs such as Medicare and Medicaid. Aggregate health care payments for persons with AD are expected to grow over the next few years due to the aging of the baby boom generation. Although the causes of ARD are not well understood, there is growing evidence that modifiable factors, such as education, retirement age and childhood environment, influence the risk of cognitive impairment and ARD. In this study, we evaluate the impact of income on cognitive function at older ages.

Income may affect cognition via several pathways, including lower financial strain or better access to health care, which have been shown to be positively related to cognition. Higher income reduces financial strain, resulting in lower stress and fewer depressive symptoms. Several studies have documented the detrimental effects of stress on cognitive functioning at older ages and depressive symptoms are correlated with cognitive decline. Individuals with greater income typically have more access to health care. Even among Medicare beneficiaries, income is correlated with more coverage through the purchase of supplemental Medigap coverage. Greater access to health care services can affect neurocognitive health directly by resulting in earlier detection of mild cognitive impairment, thereby enabling treatment that may delay progression to AD. Greater access may also affect cognition indirectly via better management of cardiovascular disease, high blood pressure and diabetes, which are associated with an increased risk of cognitive decline. On the other hand, higher income, particularly higher Social Security income, may lead to earlier retirement. There is strong evidence that being engaged in work is protective of cognitive impairment and that early retirement leads to faster declines in cognition. Therefore, early retirement or reduced work may offset the other beneficial pathways through which higher income affects cognition. Thus, the net effect of income on cognition is theoretically ambiguous.

Prior research on the relationship between income and cognitive function finds that higher income is associated with better cognitive function; however, any observed association

may represent spurious correlation due to unmeasured confounders that are correlated with both income and cognition. For example, childhood environment has been shown to impact both labor market earnings and old-age cognition. This project estimates the impact of Social Security income on cognition using a quasi-experimental approach based on changes to Social Security benefits due to amendments to the Social Security Act in 1972 and 1977, commonly referred to as the “Social Security Notch”. Prior to 1972, Social Security payments were not indexed for inflation and instead benefits had been periodically increased by Congress. In 1972, the Social Security Act was amended to provide an annual automatic cost-of-living adjustment for benefits. However, the formula used to index benefits was flawed leading to a faster increase in benefits relative to inflation (referred to as “double indexation”), so that workers born after 1910 received an unintended windfall gain. This error was corrected by Congress in 1977 leading to a reduction in benefits for those born in 1917 or later. These changes resulted in different cohorts receiving different benefits for the same work history.

Data and Methods. Using data from the 1993 wave of the Study of Assets and Health Dynamics among the Oldest Old (AHEAD), we compare the cognitive outcomes of persons in nearby cohorts with differing Social Security income due to the 1977 amendments. Specifically, we employ an instrumental variables (IV) model that involves two stages. In the first stage, we regress household Social Security income on the instrument, a binary indicator that takes the value one for households whose primary beneficiary was born during 1915-1917 and zero for households whose primary beneficiary was born in any other year between 1901 and 1930. Prior studies have documented that the birth years 1915-17 represent the peak of the benefits notch and the largest deviation of Social Security income from the trend throughout the period between 1901 and 1930. To construct this instrument, we first determine the primary Social Security beneficiary for each household. The instrumental variable is then created based on the primary beneficiary’s year of birth. Since the majority of married women in this population were affected by the 1977 amendments via their husband’s earnings, the year of birth of the male member is used to create the instrument in the case of two member households. For households with no male members in which the respondent is a never-married female, we use her year of birth.

Following previous studies on the Social Security benefits notch, we restrict our analysis to households whose primary Social Security beneficiary was born between 1901 and 1930. In addition, we exclude households that report a Social Security income of less than \$100 per

month and observations with missing or incomplete data on any analysis variable. We also exclude widowed or divorced women since information on their former or deceased husband's year of birth is not available in the AHEAD.

In the second stage of the IV model, we regress cognition on predicted Social Security income obtained from the first stage. The AHEAD includes the following well-validated measures of cognition:

Serial 7 measures working memory and is based on a task in which respondents are asked to subtract 7 from 100 and to continue subtracting 7 from each subsequent number for a total of five times. Word recall, a measure of episodic memory, is based on a list of 10 nouns read to the respondent who is then asked to recall as many words as possible immediately and again after approximately 5 minutes. Mental status is based on various tests designed to measure knowledge, language and orientation, including backwards counting from 20, object naming, date naming and president/vice-president naming. Total Cognition Score, an overall measure of cognition, sums the mental status and word recall scores. In addition, we classify individuals as normal, cognitively impaired but not demented (CIND), or demented based on a 27 point score composed of the word recall, serial 7, and backwards counting tests. We also classify individuals as cognitively impaired if they score 8 or lower on the total cognition score.

All regressions include a basic set of covariates – own age and gender, the primary beneficiary's age, race and ethnicity, census region of residence, a binary indicator for residing in an MSA and indicators for the type of household – male head- married or male head – single (female head – never married forms the reference category).

Finally, to examine the heterogeneity of the impact of income by level of health, we estimate instrumental variable quantile regression which estimates the impact of income at various quantiles of the distribution of cognition. Specifically, we focus on the 0.10, 0.25, 0.5, 0.75, and 0.90 quantiles and restrict this analysis to the total cognition score.

Results. We find that annual Social Security income (in 1993 dollars) is \$1,160 higher for individuals born between 1915 and 1917 compared to other cohorts. Further, we find a statistically significant, positive impact of Social Security income on the serial 7 and mental status measures. Relative to the sample mean, there is a 2.2% increase in the serial 7 score, and a 1.1% increase in the mental status score. We also find a 2% increase in the word recall score and a 1.4% increase in the total cognition score, although these effects are imprecisely estimated. In

addition, there is a statistically significant decline in the rates of demented individuals by 1.9 percentage points and in the number of individuals that are cognitively impaired of approximately 1 percentage point. Thus, higher Social Security benefits due to the notch changes resulted in clinically relevant improvements in cognitive function. Further, we find a larger effect of income at higher quantiles, which suggests that relative differences in cognition increase sharply with income. At the 10th quantile, a \$1000 increase in Social Security income leads to a 0.2 unit increase in the total cognition score while at the 90th quantile a similar amount of income results in a 1.3 increase in the total cognition score. This suggests that individuals with better cognition benefit more from increases in income.

Conclusion. Our study contributes to the literature by providing the first evidence on the causal impact of Social Security income on multiple dimensions of cognition using a quasi-experimental approach. We find robust evidence that higher Social Security income improves cognitive function among the elderly. Further, these changes represent clinically meaningful improvements in cognitive function.

The findings of our study have important implications for aging populations and for public policy. Much of the evidence on the determinants of cognitive function has focused on factors that cannot be easily modified (e.g. genes) or on early life interventions (e.g. education). In contrast, our focus on Social Security income suggests that interventions even late in life can significantly improve cognition. Further, results from our study provide information on the potential impact of changes to Social Security benefits on an important measure of elderly health that is associated with substantial Medicare costs. Given concerns about the depletion of the Social Security Trust Fund, several proposals that aim to improve the financial sustainability of the program are under consideration including using the chained Consumer Price Index (CPI) to index benefits, which would result in lower annual increases for recipients or increasing the minimum Social Security benefits for low-wage workers. During a period of renewed policy discussion around changes to entitlement programs for the elderly, it is important to understand whether changes to Social Security might influence the health and well-being of the elderly.