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The Effects of Income on Mental Health: Evidence from the Social Security Notch

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Abstract

Background—Mental health is a key component of overall wellbeing and mental disorders are relatively common, including among older adults. Yet the causal effect of income on mental health status among older adults is poorly understood.

Aims—This paper considers the effects of a major source of transfer income, Social Security retirement benefits, on the mental health of older adults.

Methods—The Social Security benefit "Notch" is as a large, permanent, and exogenous shock to Social Security income in retirement. The "Notch" is used to identify the causal effect of Social Security income on mental health among older ages using data from the AHEAD cohort of the Health and Retirement Study.

Results—We find that increases in Social Security income significantly improve mental health status and the likelihood of a psychiatric diagnosis for women, but not for men.

Discussion—The effects of income on mental health for older women are statistically significant and meaningful in magnitude. While this is one of the only studies to use plausibly exogenous variation in household income to identify the effect of income on mental health, a limitation of this work is that the results only directly pertain to lower-education households.

Implications—Public policy proposals that alter retirement benefits for the elderly may have important effects on the mental health of older adults.

Keywords

Mental Health; Income; Aging; Instrumental Variables

1. Introduction

The importance of mental health and mental illness as a component of overall health status and wellbeing is becoming better understood, in part due to epidemiological evidence on the prevalence of mental illness and in part due to research suggesting that mental illnesses such

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as depression and bipolar disorder account for a large share of disability-adjusted life years in developed economies (1). Mental health problems have severe consequences, leading to significantly lower quality of life, higher disability, higher mortality due to physical health problems, and more suicide (2–4).

While mental health problems frequently first occur at younger ages, they remain a very significant issue for older adults. Many cognitive disorders (e.g., Alzheimer's disease) are generally considered illnesses of old age, but we focus on other common types of mental disorders in old age. For example, the landmark U.S. Surgeon General Report on Mental health noted that eight to 20 percent of older adults in community settings have depressive symptoms, and older adults have the highest suicide rates out of all age groups in the U.S. (3). More recent data from the National Comorbidity Survey Replication reveal 12-month prevalence rates of 7.6% with mood disorders, 11.6% with anxiety disorders, and 2.8% with comorbid mood and anxiety disorder, among non-institutionalized adults 55 and older (5). Population aging only raises the importance of understanding determinants of poor mental health in older ages. In 2010, individuals aged 65 and older comprise comprised 13% of the U.S. population and that group is projected to comprise 19% of the population by 2030 (6).

This paper focuses on the effects of income on mental health in older ages. Figure 1 illustrates the basic, unadjusted relationship between family income and mental health status for non-institutionalized adults in the U.S., using data from the 2000–2006 National Health Interview Surveys. Mental health status is measured using the K-6 scale of psychological distress. The probability of having likely severe mental illness clearly falls with income when looking across all age groups. The relationship is less clear for older adults. The probability of severe mental illness among adults 65 and older falls with income, but only until $50,000, after which there is no clear relationship. While these patterns are suggestive of a negative effect of income on mental health, particularly at lower levels of income, any attempt to identify the causal effect of income on mental health faces several challenges. First, a bidirectional relationship between income and mental health is likely. It is intuitive that poor mental health might lower one's income, and the empirical evidence supports that notion. Second, it is difficult to disentangle any effect of mental health from other unobserved factors that might be correlated with both mental health and income (which might include cognitive skills and noncognitive skills). Even longitudinal data that establishes an intertemporal relationship between income and mental health faces the challenge of omitted variables bias.

Economists have made important contributions to understanding the effects of mental illness and have shown that mental illness has important negative consequences for human capital formation, labor market outcomes, substance use, and delinquent behavior. Other disciplines have a long history of studying risk factors for mental illness, and a consistent finding is that socioeconomic status is inversely related to mental health status. But economics has lagged in understanding the determinants of mental health problems. Recently, the field of "happiness economics" has emerged and rapidly expanded. While we consider happiness as a related, but distinct construct from mental disorder or mental illness, this area of research is clearly relevant. Key findings from this literature (which is too broad to review here) are that mental health is a key component of happiness, and that happiness is positively

correlated with income in microdata.[1] However, most research on the links between individual income or wealth and happiness does not necessarily identify a causal relationship as noted by Blanchflower (7) and Dolan et al. (8).

Why do we expect that income affects mental health? The conventional health economics framework of the Grossman health production model implies that health status (particularly in retirement when the investment role of health is less relevant) increases with income by pushing out the budget constraint (9). The case of mental health, however, may benefit from modifying the conventional model. Specifically, psychosocial stress has been implicated as a major risk factor for mental illness, and it is hypothesized that factors like income and financial well-being are key sources of psychosocial stress. This suggests that aside from working through the budget constraint, income may play a more direct role in the production of mental health.

In this paper we empirically examine the causal effect of income on mental health in older age. Specifically, we focus on the effects of Social Security retirement income and as such also contribute to the public finance literature that studies the effects of Social Security income on the wellbeing of older adults. To briefly preview our approach and main results, we make use of the Social Security "Notch," which as explained in more detail below, created sharply different levels of Social Security retirement income for adjacent birth cohorts, due to exogenous policy changes. We estimate instrumental variables models of mental health outcomes, using the Notch to instrument for Social Security retirement income. We find that increases in Social Security income result in improvements in depressive symptoms that are both statistically significant and economically- and clinically-meaningful. We also find evidence that increases in Social Security income lead to a lower probability of reporting being diagnosed with a mental health problem. However, we only find these effects for women, and we do not find evidence of a causal effect for men.

1.1. Prior Literature

An emerging research literature uses a variety of econometric strategies to attempt to estimate the causal effect of income on mental health across a variety of populations and age groups. An early paper in this literature takes an IV approach with data on non-elderly adults in the U.S. and finds that increases in income lead to improvements in depression symptoms (10). However, these estimates rely on variables such as work experience, parent's education, and spousal characteristics as being identifying instruments, which may not be valid exclusion restrictions in the case of mental health outcomes. More recently, researchers have studied the effects of lottery winnings on psychological stress and mental health among British and Swedish adults and find that lottery winnings improve psychological wellbeing (11, 12). The conclusions of these two innovative papers have several caveats, however. They implicitly focus on a particular subpopulation of people who play the lottery (and who likely play frequently), their income shock most likely comes in the form of a lump-sum transfer, and the causal interpretation relies on the assumption that the likelihood of lottery success is uncorrelated with mental health. Two recent papers focus

[1]Some papers in this literature treat happiness and symptoms of mental illness as reflecting the same construct. We review some of the work from the "happiness" literature that focuses on identifying the causal effects of income below.

on the effects of income increases for mothers with children in their households due to changes in government transfer programs (the Earned Income Tax Credit in the U.S and the Child Benefit system in Canada). One paper finds that mothers in households where EITC expanded reported fewer "poor mental health" days (13), and the other paper finds that mothers in households that receive higher child tax benefits report fewer depression symptoms (14).

Kim and Ruhm (15) is the only study in economics that we are aware of which looks at effects of income on mental health in older age (along with also looking at effects on physical health and health behaviors). Using the same dataset and depression measure that we use, they find that receiving a bequest greater than $10,000 is not associated with subsequent depressive symptoms, under the assumption that large inheritances can be thought of as quasi-exogenous shocks to wealth. While the approach of studying bequests as a shock to income in older ages is innovative, it is not necessarily ideal in the context of mental health. The nature of bequests is that they are associated with the death of a (presumably) loved one, which may exert an independent negative influence on mental health, and large bequests may be anticipated by the recipient which would weaken any effects on health. In addition, it is possible that larger bequests are associated with the death of relatively closer friends or relatives, which would plausibly be correlated with mental health. And similar to the case of lottery winnings, the income shock from a bequest is likely in the form of a lump-sum transfer.[2] The nature of the income transfer may be important for understanding the effects of income on mental health, as extra income in the form of an annuity may be preferable to a lump-sum payment (even though empirically, people tend to prefer lump-sum payments) (16). Overall, the literature on the important issue of causal effects of income on mental health is still limited, particularly so for mental health in older ages, and our paper contributes to further understanding this relationship.

2. Methods

2.1. The Social Security "Notch"

Our overall strategy to study the causal effect of income on mental health in older ages will utilize the Social Security "Notch" (17). Before 1972, neither credited lifetime earnings (which are the basis for post-retirement payments), nor the actual post-retirement payments were indexed for inflation, but rather periodically adjusted by Congress. The Social Security Act was amended in 1972 to automatically index credited earnings to inflation for workers who had not yet retired. This created an unanticipated windfall in retirement benefits for workers from certain birth cohorts because of an error that led the prior earnings of these workers to be doubly indexed for inflation, combined with the high rate of inflation over the following years. In 1977, Congress eliminated the double indexation for future cohorts of retirees, creating a major reduction in Social Security payments for those cohorts born in 1917 or later relative to the preceding cohorts. However, cohorts born prior to 1917 were grandfathered in to their previously doubly-indexed benefits (17). The reduction in Social Security payments affected cohorts born until 1922. Increases in benefits due to cost of

[2]Further, it is worth noting that the bequests measured in the HRS are not necessarily monetary – they may reflect the monetary value of specific assets (a house, a car, etc.).

living adjustments resumed for the subsequent birth cohorts. These policy changes combined with the high rate of inflation over the mid-1970s created a large and permanent difference in Social Security benefit payments across a small number of birth cohorts, known as the Social Security Benefits Notch.

The difference in benefits across cohorts due to the Notch was considerable, and is illustrated by figures in the Social Security Administration's report on the Notch (Chart 6 of Social Security Administration, 1994), and in prior research on the Notch (Figure 1 of Goda et al., 2011). Monthly benefits ramped up sharply for the birth cohorts immediately prior to 1916, peak at 1916, and drop precipitously for the cohorts born immediately after 1916.[3] Prior research has found that the effect of the Notch on Social Security benefits was more pronounced among lower-education retirees, and that annual Social Security income was between $1,149 and $1,448 higher (in 1993 dollars) for retirees born during the peak years than for those born in the years immediately before and afterwards (18, 19). This represented a 15–20% drop in annual benefits, and because these differences persist through the entire post-retirement lifespan it also implies significant differences in the total stream of lifetime Social Security retirement income. Goda et al. (19), estimated that the present discounted value of the extra Social Security income due to the "Notch" from the perspective of a 65 year-old, lower-education retiree is $16,000.

The Notch is an appealing source of variation in income because it is plausibly exogenous (it was unanticipated by retirees, was out of the control of retirees, and because specific birth year within a relatively small window is unlikely to be correlated with later life outcomes), and because it generated substantial and permanent differences in monthly Social Security income across birth cohorts. This is notably different from prior research that uses lottery winnings and bequests as income shocks, as those types of shocks are likely received as lump sum payments. The Notch has already been used to study the effects of income on several outcomes in older age, including labor force participation, living arrangements, prescription drug use, all-cause mortality, obesity, poverty, and long-term care use (18–24), but not for mental health-related outcomes.

2.2. Data

The data for this analysis come from the Assets and Health Dynamics among the Oldest Old (AHEAD) cohort of the Health and Retirement Study (HRS).[4] The HRS is an ongoing longitudinal cohort study that started in 1992 and collects data on a wide range of health and economic topics from a nationally-representative sample of older adults. The AHEAD cohort represents the households of individuals born before 1923, and this cohort was first interviewed in 1993.

We focus on the 1993 survey year because subsequent waves do not have a sufficient sample size to support the IV analysis, due to attrition from death and nonresponse. Following prior Notch analyses, the analytic sample is comprised of individuals in households where the primary Social Security beneficiary was born between 1901 and 1930

[3]Note that the drop in benefits would be smaller for early retirees than for people who retired at age 65.
[4]This study was deemed exempt from institutional review due to the use of non-identifiable secondary data.

(19, 22). Because the Notch instrument varies by the birth year of the household's primary beneficiary, we need to identify the primary beneficiary. Here we also follow prior work which identifies the age of the primary beneficiary in different types of households (married, single male, widowed female, divorced female, and never-married female) (19). In the cases of widowed and divorced females, we assume the primary beneficiary to have been the former husband, and since we do not observe the former husband's age we assume that he was three years older than the widow/divorcee, following prior work (18).

As noted above, prior research shows that the Notch had stronger effects on Social Security income for lower-education households in the HRS. Accordingly, we restrict the analyses to households where the primary Social Security beneficiary had less than a high school education (44% of the sample), because we do not have a sufficiently strong first-stage relationship to credibly estimate our instrumental variables models for the higher-education households (first-stage results for the high-education households available upon request). For the widowed and divorced females, the AHEAD directly asks about the educational attainment of the former spouse, which we use to determine whether the household was high or low-education.

The 1993 AHEAD sample originally included 8,222 individual respondents from 6,047 households. We briefly describe how the analytic sample was constructed for the "any psychiatric diagnosis" outcome (described below).[5] Following prior research, we drop 217 respondents who were in households where the primary beneficiary was born before 1900 or later than 1930. Also following prior research, an additional 1,254 households with less than $100 in monthly Social Security retirement income, or missing Social Security income data were dropped. The vast majority of those observations are dropped due to missing Social Security data. Of the remaining 6,751 observations, 2,854 were in households with lower than a high school education for the primary beneficiary. An additional 266 observations were dropped due to having sampling weights of zero, and 25 other observations were dropped due to missing data on the outcome or covariates (these 25 observations are mostly females who were married, but were missing key information on their spouses), leaving 2,563 observations for analysis.

2.3. Outcome Measures

We will focus on two types of measures of mental health in older age. The first measure is of depressive symptoms, as captured by an adaptation of the Center for Epidemiologic Studies Depression Scale (CES-D). The CES-D is a frequently-used measure of depressive symptoms in the past week. In the 1993 AHEAD survey, respondents completed an eight-question version of the scale which is coded to yield a summary score ranging from 0 (least depressed) to 8 (most depressed). Questions refer to whether much of the time in the past week respondents felt depressed, like everything was an effort, had restless sleep, were happy (reverse coded), were lonely, enjoyed life (reverse coded), felt sad, and felt like they could not get going. The CES-D was originally designed as a continuous measure of depressive symptoms, not as a diagnostic instrument. However, prior research has found that

[5]The pattern of excluded observations and missing data is very similar for the smaller sample corresponding to the CES-D outcome.

a score of three or higher on the AHEAD CES-D scale is a good approximation of clinically-relevant depression, and the most comparable prior research also uses this measure (15). Thus, we also estimate models of the binary outcome of clinically-relevant depression, based on whether the CES-D score is three or higher.

The second measure is a question of whether the respondent reports ever having been diagnosed with an emotional, nervous, or psychiatric problem by a doctor. We recognize that this measure is far from ideal: it reflects lifetime diagnoses, not just post-retirement diagnoses, and it is subject to recall and social desirability biases. Furthermore, this outcome is also affected by the decision to seek help for a mental health problem in the first place, which is likely affected by income. As a result of these limitations, we treat the report of a diagnosis as a secondary measure of mental health in older age. Whereas the CES-D was only collected directly from the respondent in the HRS, proxy responses were allowed for the question about psychiatric diagnosis. Therefore, the analytic sample for models of any psychiatric diagnosis is larger than the sample for the CES-D outcomes and the models also include as a covariate an indicator for whether the interview was conducted via a proxy respondent.

2.4. Data Analytic Procedures

To estimate the causal effect of Social Security Income on mental health, we estimate instrumental variables models that take the following form:

$$SSInc_{hi}=\delta Notch_h+\theta X_{hi}+g(birthyear_h)+\varepsilon_{hi} \quad (1)$$

$$MH_{hi}=\beta S\hat{S}Inc_h+\gamma X_{hi}+g(birthyear_h)+\mu_{hi} \quad (2)$$

Equation 1 estimates annual household Social Security income based on a set of household-level (subscripted with *h*) and individual-level (subscripted with *i*) covariates *X* (including family structure, race/ethnicity, Census region, and residence in a Metropolitan Statistical Area), a flexible linear function of the primary earner's birth year, and the instrument (Notch), which takes a value of 1 if the primary earner was born in the years where Social Security income was highest due to the policy changes (1915–1917) and takes a value of 0 for all other birth years. This approach to the model specification and to coding the instrument maximizes its first-stage strength and has been used in prior research.[6] Equation 2 estimates the causal effect of Social Security income on the measures of mental health (*MH*). In the two-stage least squares framework, the second stage model has the same set of covariates as the first stage, but includes the predicted value of household Social Security income ($S\hat{S}Inc$) from the first stage. The coefficient β will describe the causal effect of Social Security income on mental health.

[6]We also attempted to use the measure of instrumented Social Security income developed by Engelhardt, Gruber, and Perry (2005) (18), but found that this measure led to weak first-stage relationships in many of the models that we estimated. We are very grateful to Gary Engelhardt for sharing the measure with us.

We focus on Social Security Income, as opposed to total household income, for several reasons. First, as described below, we have a strong first-stage relationship between the instrument and Social Security income, which is necessary for the instrumental variables analyses. The relationship between the instrument and total household income is not as strong, which may reflect that lower Social Security income may induce households to seek other forms of income, such as from participating more in the labor market. Second, in our sample, Social Security income is the main source of total household income. On average, Social Security comprises 69% of total household income, and 75% of our sample receives at least half of their total income from Social Security. Third, focusing on the effects of Social Security income, specifically, is useful because levels of Social Security benefits are a key policy parameter, and it is important to understand the effects of changes in Social Security benefits.

In all of our analyses, we stratify by sex. We do this for two reasons. First, patterns of depression and other mental disorders in old age are distinctly different between men and women, with women having higher prevalence (5). Second, stratifying by sex makes the identification of the Notch effect more transparent.[7]

A challenge in all studies that use the Notch instrument is in disentangling the effects of the Notch from underlying age or cohort trends in Social Security income and in the outcome of interest. Prior research that uses a single wave of data takes the approach of testing increasingly flexible specifications (linear, quadratic, and cubic) of primary beneficiary age (19, 22). Cawley and colleagues use multiple years of data and include a quadratic in household head age and individual age dummies (23). Our approach relies on a single wave of data and combines elements of both approaches. For males (who are defined as the household heads), we use the flexible specification of cubic household head birthyear. For females, we use cubic birthyear of household head, along with cubic individual age. Our key assumption, which seems quite plausible, is that being in a household where the primary beneficiary was born in 1915–1917 versus earlier or later years is uncorrelated with outcomes in older ages, conditional on the flexible linear function of primary beneficiary age, and for females, the flexible linear function of own age.

For our IV analyses of the continuous CES-D measure, we estimate linear two-stage least squares models. This outcome is not a true continuous variable -- CES-D is technically a count variable and would be more appropriately modeled with a nonlinear model. In an IV context, using these functional forms entails a two-stage residual inclusion approach (25). Unfortunately, we experienced convergence problems with many of the two-stage residual inclusion models of CES-D that used negative binomial and Poisson functional forms.[8] For the binary outcomes of clinically-meaningful CES-D score and any psychiatric diagnosis, we estimate the IV models using ivprobit in Stata, which uses maximum likelihood to simultaneously estimate both equations of the IV models. For comparison, we also report the results of analogous two-stage least squares models in Appendix Tables A1–A2.[9] We report

[7]We are grateful to an anonymous referee for noting this point.

[8]Furthermore, in the case of two-stage residual inclusion for poisson or negative binomial models, both stages of estimation must be bootstrapped to account for the generated second-stage regressor. We encountered additional problems with this bootstrap, further motivating our use of two-stage least squares models.

the marginal effects from these models for ease of interpretation. We also report the results of "exogeneity" tests, where the significance of the parameter indicates the confidence with which we can reject the null hypothesis that the IV estimates are the same as the single-equation estimates. In the two-stage least squares models, this test statistic is derived from the Hausman test. In the IV-probit models, this test statistic corresponds to significance of the correlation between the errors of the first- and second-stage equations. All models are estimated using the HRS sampling weights, and as in prior Notch studies, the standard errors are clustered on the primary earner's year of birth.

3. Results

Table 1 shows the characteristics of the analysis samples. The CES-D and psychiatric diagnosis samples are quite similar in terms of their overall characteristics. The sample average CES-D score is 1.77 for males and 2.02 for females, 26% of males and 32.8% of females have clinically meaningful depression, and 9.5% of males and 15% of females report having ever been diagnosed with a mental health problem. These gender differences are consistent with prior epidemiological literature on mental health in older ages (5). The average age is 77 years old. The average annual household Social Security income is just over $11,000 for males and just over $9,000 for females. Eighteen percent of the males and 19% of the females in sample are in households where the primary Social Security beneficiary was born in a "Notch" year of 1915–1917.

When we estimate OLS models of CES-D scores (Table 3) we find, as we would expect, that higher Social Security income is associated with significantly lower depressive symptoms. We find that for males, an additional $1000 in annual Social Security income (about 9% relative to the sample mean) is associated with around a 0.07 point improvement in CES-D, or 4% relative to the sample mean. For females, an additional $1000 in annual Social Security income (about 11% relative to the sample mean) is associated with around a 0.03 point improvement in CES-D, or 1.6% relative to the sample mean. However, we do not expect these results to represent the causal effect of Social Security income on mental health, for the reasons described above.

We next turn to the IV estimates of CES-D. The Notch dummy is associated with $1,230 in additional annual Social Security income for males, and $802 additional Social Security income for females. These first-stage estimates represents about an 11% and 86% increase in annual Social Security income for men and women, respectively, which is in line with prior Notch studies. The first-stage F-statistics on the instrument are 7.47 for males and 14.17 for females for the CES-D models. Thus, the IV estimates for females are unlikely to be biased due to weak instruments, based on the conventional threshold of F>10 in a just-identified model (26). However, the IV estimates of CES-D models for males should be interpreted with caution as they may reflect some degree of weak instrument bias.

The IV estimate of CES-D for males does not indicate that Social Security income has an effect on depressive symptoms after correcting for endogeneity. However, the estimate is

[9]The two-stage least squares results for the binary outcomes are stronger in magnitude than the IV-Probit models.

quite imprecise, and the 95% confidence intervals do not allow us to rule out meaningful positive or negative effects on CES-D. In contrast, we find that for females, an additional $1,000 of Social Security income improves CES-D scores by 0.541 points (p=0.043) which is much larger than the OLS coefficient. This is a large effect, as it represents a 27% improvement relative to the CES-D sample mean of 2.02. Alternatively, a one-standard deviation increase in Social Security income ($4,330) leads to a 1.11 standard deviation decrease in CES-D score. The results of the Hausman test indicate that the IV estimates are significantly different from the OLS estimates, which further motivates the IV approach.

Table 4 shows the results of the probit and IV-probit models of having any clinically-meaningful depression, defined as a CES-D score of three or higher. The probit models suggest that an additional $1,000 in Social Security income is associated with a roughly one percentage point reduction in the probability of having clinically meaningful depression for both sexes. Similar to the continuous CES-D score models, the IV results do not show any significant effects for males, but show larger effects for females. For females, $1,000 in additional Social Security income reduces the likelihood of clinically-meaningful depression by eight percentage points ($p<0.001$). This is a substantial effect, representing a 24% reduction in the probability of clinically meaningful depression, relative to the mean. For women, the exogeneity tests indicate that the IV-probit estimates are significantly different from the single-equation probit estimates.

We next turn to our secondary outcome of whether the respondent (or proxy) reports having ever been diagnosed with a mental health problem. As is shown in Table 4, the marginal effects from the probit models show no relationship at all between Social Security income and mental health diagnosis. However, the IV-probit models show a similar gender pattern of effects: higher Social Security Income significantly has no effect on the probability of a mental health diagnosis for males, but significantly lowers the probability of a mental health diagnosis for females by 6.7 percentage points. Weak instruments are not likely to be an issue for these models, as the first-stage F-statistics are from 14.90 for males and 13.38 for females. As with the raw CES-D score, these are nontrivial effects for females, considering that the sample mean of having a psychiatric diagnosis is 15%. Similar to the other outcomes, the results of the exogeneity test suggests that the IV-probit results are significantly different from the corresponding probit estimates for women.

One possible explanation for our results is that the increase in Social Security income due to the Notch could affect physical health, which might in turn affect mental health. To test for whether this is a likely explanation, we re-estimated our models after including a wide array of health measures collected in the HRS. These include self-rated health, hypertension, diabetes, cancer, lung disease, heart disease, stroke, arthritis, hip fracture, incontinence, cataracts, pain, or “other conditions”. While a number of these measures are indeed correlated with poorer mental health, their inclusion does not weaken our point estimates or their statistical significance (results not shown). Although this exercise has obvious limitations due to including endogenous covariates, the results are at least suggestive of a more direct effect of Social Security income on mental health that does not work through physical health conditions. We also considered whether the assumption that former or deceased husbands were three years older than previously-married women might be

introducing error that might bias our results. We estimated models that dropped women whose previous husbands had their birth year imputed, and found results that were similar in magnitude and precision (Appendix Tables A3–A5).[10]

4. Discussion and Conclusion

We find considerable evidence that additional Social Security income has a meaningful effect on mental health in older ages, but only for women. Prior research using the Notch instrument provides some suggestions of possible mechanisms behind this relationship. Moran and Simon found that the higher Social Security income from the Notch led to more prescription drug use (their study period preceded the introduction of Medicare Part D prescription drug coverage for older adults) (22). Although they were unable to identify types of drugs used in the HRS and they do not distinguish effects by gender, increased psychotropic drug use might explain some of the effects we observe. Other research shows that additional Social Security income increases the likelihood of independent living (18), and that these effects were strongest for widowed households (which are largely female). This may be protective of mental health given strong preferences for independent living. But ultimately, our research may simply be adding to the growing body of evidence that income benefits mental health by reducing the psychosocial stress associated with financial hardship.

An important limitation of this research is that the findings only directly apply to lower-education households, as the Notch instrument does not deliver a sufficiently strong first-stage relationship to estimate unbiased effects in higher education households.[11] One possible explanation for why our results differ from Kim and Ruhm's may be if the relationship between income and mental health is weaker among higher education households. Our results are also not generalizable to younger-aged adults. However, our results complement, and are consistent with recent research on the effects of public transfer income on mental health in younger households (13, 14). Our use of the Notch with the HRS data also has other limitations. The results do not necessarily extend directly to widowed or divorced women, for whom our first-stage relationship is quite weak. We are also forced to drop a significant number of observations due to missing data on Social Security income.

Nevertheless, a strength of our research is that the Notch is an appealing source of variation in older age income for several reasons, even aside from the aforementioned arguments in favor of its validity as an instrument. First, it was a very meaningful magnitude, particularly because the differences in benefits generated by the Notch persisted throughout the post-retirement lifespan. Second, Social Security income is a very important component of overall income among the elderly. Social Security retirement benefits comprise about 39% of total income for the elderly population, with 53% of the married elderly and 74% of the unmarried elderly receiving at least half of their income from Social Security benefits (28).

[10]We also ran a robustness check that excluded individuals born in 1918–1919 who may have been exposed to pandemic flu in utero. Our results (not shown) are similar under this sample restriction.

[11]We also note that one study claims that the Notch is limited as an identifying instrument largely on the basis of finding that higher Social Security income due to the Notch resulted in a higher likelihood of earning income, (though no increase in labor force participation) in some (but not all) specifications (27).

Further, Social Security benefits have played a key role in reducing poverty among the elderly (21). Third, Social Security benefit reform is a very timely policy issue, and studying the effects of changes in benefit generosity may be informative of what we might expect from different Social Security reform proposals. Reductions to future benefits should be weighed against the potential consequences for the wellbeing of the elderly, and mental health would seem to be as important as any indicator of wellbeing.

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APPENDIX

Table A1

OLS and IV-2SLS models of clinically meaningful depression

	Males		Females	
	OLS	**IV-2SLS**	**OLS**	**IV-2SLS**
Social Security Income (in $1000's)	−0.012 (0.003)	−0.030 (0.031)	−0.007 (0.004)	−0.119 (0.043)
P-value	0.001	0.342	0.100	0.006
First Stage Notch Coefficient		1.232		0.802
First Stage F-Statistic		7.47		14.17
Hausman Test P-value		0.227		<.001
N	930	930	1342	1342

Note: Models include full set of individual age fixed effects, dummies for household structure, race, ethnicity, and MSA. Robust standard errors clustered on primary beneficiary's year of birth in parentheses.

Table A2

OLS and IV-2SLS models of Any Psychiatric Diagnosis

	Males		Females	
	OLS	**IV-2SLS**	**OLS**	**IV-2SLS**
Social Security Income (in $1000's)	0.00001 (0.003)	−0.011 (0.015)	−0.002 (0.003)	−0.085 (0.020)
P-value	0.997	0.483	0.569	<.001
First Stage Notch Coefficient		1.57		0.787
First Stage F-Statistic		14.36		13.24
Hausman Test P-value		0.968		0.001
N	1098	1098	1465	1465

Note: Models include full set of individual age fixed effects, dummies for household structure, race, ethnicity, MSA, and proxy status. Robust standard errors clustered on primary beneficiary's year of birth are in parentheses.

Table A3

OLS and Two-Stage Least Squares models of CES-D Score, Excluding Widows and Divorced Women

	Females	
	OLS	**IV**
Social Security Income (in $1000's)	−0.035 (0.022)	−0.189 (0.078)
P-value	0.118	0.016
First Stage Notch Coefficient	-	1.87
First Stage F-Statistic	-	11.87
Hausman Test P-value		0.016
N	582	582

Note: Models include full set of individual age fixed effects, dummies for household structure, race, ethnicity, and MSA. Robust standard errors clustered on primary beneficiary's year of birth are in parentheses.

Table A4

Probit and IV-Probit models of clinically meaningful depression, Excluding Widows and Divorced Women

	Females	
	Probit	**IV-Probit**
Social Security Income (in $1000's)	−0.008 (0.004)	−0.043 (0.010)
P-value	0.059	<0.001
First Stage Notch Coefficient	-	1.87
First Stage F-Statistic	-	11.87
Exogeneity Test P-value		0.007
N	582	582

Note: Models include full set of individual age fixed effects, dummies for household structure, race, ethnicity, and MSA. Marginal effects from probit models are presented, with robust standard errors clustered on primary beneficiary's year of birth in parentheses.

Table A5

Probit and IV-Probit models of Any Psychiatric Diagnosis, Excluding Widows and Divorced Women

	Females	
	Probit	**IV-Probit**
Social Security Income (in $1000's)	−0.004 (0.004)	−0.028 (0.014)
P-value	0.389	0.055
First Stage Notch Coefficient	-	1.825
First Stage F-Statistic	-	11.57
Exogeneity Test P-value		0.086
N	622	622

Note: Models include full set of individual age fixed effects, dummies for household structure, race, ethnicity, MSA, and proxy status. Marginal effects are presented in the first row, with robust standard errors clustered on primary beneficiary's year of birth are in parentheses.

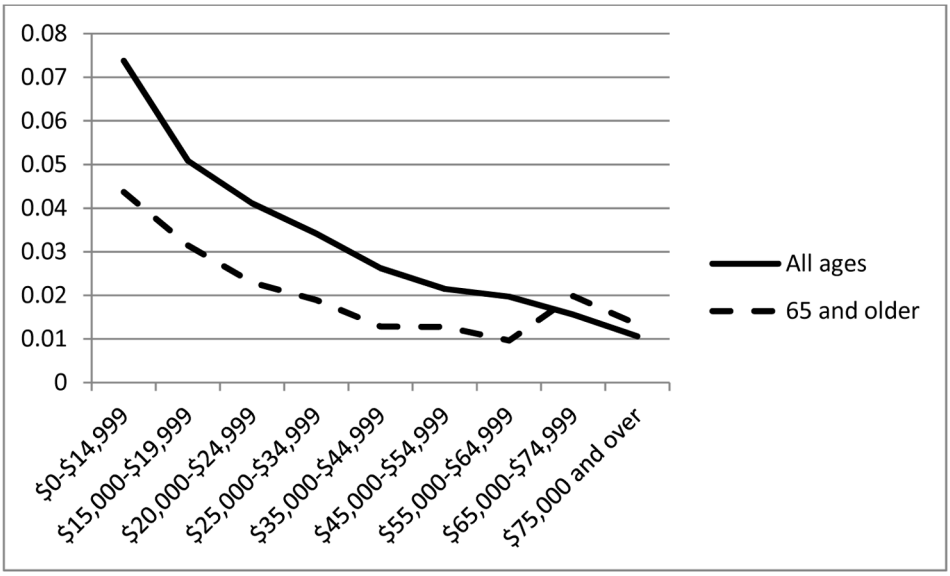

Figure 1. Probability of Severe Mental Illness by Family Income
Source: Author's Calculations from 2000–2006 National Health Interview Surveys

Table I

Summary Statistics – CESD Sample

	Males N=930		Females N=1342	
	Mean	**SD**	**Mean**	**SD**
CES-D Score	1.77	2.00	2.02	2.11
Clinically-meaningful depression	0.260		0.328	
Household SS Inc ($1000s)	11.08	4.37	9.32	4.33
Age of Individual	77.45	5.46	76.65	5.90
Primary Beneficiary Race				
White	0.852		0.884	
Black	0.130		0.097	
Other	0.018		0.019	
Primary Beneficiary Hispanic	0.057		0.056	
Household Structure				
Married couple	0.718		0.416	
Unmarried male	0.282		-	
Divorced female	-		0.042	
Widowed female	-		0.515	
Never-married female	-		0.027	
Notch instrument	0.182		0.195	

Notes: Data from 1993 AHEAD households with a primary beneficiary with less than a high school education. Weighted using the AHEAD sampling weights.

Table II

Summary Statistics – Psychiatric Diagnosis Sample

	Males N=1098		Females N=1465	
	Mean	**SD**	**Mean**	**SD**
Any Psychiatric Diagnosis	0.095		0.151	
Household SS Inc ($1000s)	11.21	4.38	9.26	4.32
Age of Individual	77.10	5.09	77.07	5.43
Primary Beneficiary Race				
White	0.845		0.880	
Black	0.132		0.100	
Other	0.023		0.020	
Primary Beneficiary Hispanic	0.058		0.060	
Household Structure				
Married couple	0.745		0.410	
Unmarried male	0.255		-	
Divorced female	-		0.040	
Widowed female	-		0.524	
Never-married female	-		0.026	
Proxy respondent	0.147		0.075	
Notch instrument	0.182		0.191	

Notes: Data from 1993 AHEAD households with a primary beneficiary with less than a high school education. Weighted using the AHEAD sampling weights.

Table III

OLS and Two-Stage Least Squares models of CES-D Score

	Males		Females	
	OLS	**IV**	**OLS**	**IV**
Social Security Income (in $1000's)	−0.067 (0.012)	−0.009 (0.088)	−0.032 (0.018)	−0.541 (0.270)
P-value	<.001	0.919	0.084	0.043
First Stage Notch Coefficient	-	1.23	-	0.802
First Stage F-Statistic	-	7.47	-	14.17
Hausman Test P-value		0.583		0.010
N	930	930	1342	1342

Note: Models include full set of individual age fixed effects, dummies for household structure, race, ethnicity, and MSA. Robust standard errors clustered on primary beneficiary's year of birth are in parentheses.

Table IV

Probit and IV-Probit models of clinically meaningful depression

	Males		Females	
	Probit	**IV-Probit**	**Probit**	**IV-Probit**
Social Security Income (in $1000's)	−0.012 (0. 003)	−0.033 (0.027)	−0.007 (0.004)	−0.078 (0.009)
P-value	<0.001	0.212	0.081	<0.001
First Stage Notch Coefficient	-	1.23	-	0.802
First Stage F-Statistic	-	7.62	-	14.17
Rho		0.265 (0.364) P=.462		0.964 (0.277) P=.001
N	930	930	1342	1342

Note: Models include full set of individual age fixed effects, dummies for household structure, race, ethnicity, and MSA. Marginal effects from probit models are presented, with robust standard errors clustered on primary beneficiary's year of birth in parentheses.

Table V

Probit and IV-Probit models of Any Psychiatric Diagnosis

	Males		Females	
	Probit	**IV-Probit**	**Probit**	**IV-Probit**
Social Security Income (in $1000's)	−0.00004 (0.003)	−0.008 (0.015)	−0.002 (0.003)	−0.067 (0.009)
P-value	0.989	0.585	0.552	<0.001
First Stage Notch Coefficient	-	1.56	-	0.788
First Stage F-Statistic	-	14.90	-	13.38
Rho		0.182 (0.290) P=.532		1.008 (0.175) P<.001
N	1098	1098	1465	1465

Note: Models include full set of individual age fixed effects, dummies for household structure, race, ethnicity, MSA, and proxy status. Marginal effects are presented in the first row, with robust standard errors clustered on primary beneficiary's year of birth are in parentheses.