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The Interaction of Health, Genetics, and Occupational Demands in SSDI Determinations

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Background

Evaluations of Social Security Disability Insurance (SSDI) applications consider health and vocational factors such as age, education, and work experience to determine whether individuals can meet workplace demands. Understanding the extent to which health and job demands contribute to SSDI application and receipt is important for policy solutions that seek to reduce the share of workers on DI benefits. However, disentangling their relative contributions is challenging, because selection into occupation by health is often unobserved and data on occupational demands for employment histories are limited.

In this study, we triangulate between these factors by using a rich set of data linkages from the *Health and Retirement Study* (HRS). First, we ask whether differences in SSDI application, receipt, and denial are a function of the occupational demands of applicants' employment histories. Second, we examine whether these differences can be explained by life course factors that affect occupational selection. Finally, we explore the role of health in the selection process by using genetic data as a proxy for underlying health. We find the following: Structural and social inequities that influence access to opportunity, including race and childhood socioeconomic status (SES), are more strongly associated with the probability of SSDI application than workplace demands. The exception is a positive psychosocial work environment that gives individuals greater control over how to best meet the demands of their jobs, which is negatively associated with SSDI application.

Conditional on SSDI application, physical, mental, and sensory job demands display stronger associations with SSDI approvals and denials than structural or social factors. Higher genetic risk for depression, cardiovascular disease, high BMI, dementia, and rheumatoid arthritis are independently associated with SSDI application and approval.

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Data, Sample, and Variable Measures

Data are from the HRS, a nationally representative study on Americans over age 50 with rich information on health and employment from 1992-2016. We merge demographic and life course socioeconomic data with restricted and sensitive health data from: 1) Form 831 Disability Records; 2) expert ratings of job demands from the Occupational Information Network (O*NET); and 3) polygenic risk scores (PGSs). Form 831 data contain information on dates of application and reasons for approvals or denials for respondents who applied for disability benefits under Title II (SSDI) and Title XVI (SSI). We focus on SSDI applications. The O*NET includes a rich set of over 200 job demand ratings that we link to HRS respondents using restricted three-digit occupation codes for their longest-held job.

Sample

Our total sample includes 22,752 individuals who are part of the nationally representative HRS sample born between 1924 and 1959. Of these, 1,665 respondents have an SSDI application record in the linked Form 831 file. Individuals with missing occupation data were excluded from the analysis. Our genetic subsample contains 8,638 European ancestry individuals.¹ Of these, 703 are in the Form 831 SSDI subsample.

SSDI Outcomes

We examine three SSDI-related outcomes: 1) whether a respondent applied to SSDI; 2) whether respondents in the Form 831 file were approved; and 3) whether respondents were approved or denied for medical or work capacity reasons. For occupation, three-digit Census occupation codes were used to classify workers into two-digit categories for their self-reported longest held job. These include white-collar (e.g., managerial, professional, administrative, sales), blue-collar (e.g., mechanical/construction, operators/fabricators, farmers), and service occupations.

¹ PGSs are calculated within ancestry groups because of evolutionary differences across populations (Martin et al. 2017). Estimates for one ancestral group are not necessarily accurate or valid for another. Thus, we restrict our analyses to individuals of European ancestry to avoid spurious conclusions in non-European ancestry populations.

Occupational Demands

Table 1 shows the job demand indicators we derived from the O*NET data using confirmatory factor analysis. Four composite indicators are aimed at mirroring the demands detailed in the SSA vocational grid: physical, mental, sensory, and environmental demands. We also incorporate a measure of the psychosocial environment (degree of control and influence) that is consistently found to discourage disability claims and premature retirement in the occupational health literature (e.g., Karasek and Theorell 1992, Ilmarinen and Rantanen 1999, Bakker et al. 2003).

	SSA work capacity requirements	Corresponding O*NET variables
Physical demands	Climbing, balancing, fingering and feeling (manual dexterity), kneeling and crawling, stooping, crouching, need to sit and stand, reaching and handling.	Climbing ladders, scaffolds, or poles, using hands to handle, control, or feel objects, tools, or controls, kneeling, crouching, stooping, or crawling, standing, or moving objects.
Sensory demands	Ability to hear and retain sufficient visual acuity to handle work and avoid ordinary hazards.	Auditory and speech abilities or visual abilities.
Mental demands	Ability to understand, carry out, and remember simple instructions, use judgement, respond appropriately to supervision, coworkers, and usual work situations.	Oral comprehension, organizational and communication skills, developing constructive working relationships, and being able to concentrate over a period of time without being distracted.
Environmental demands	Being near dangerous moving machinery, working with chemicals, or exposure to excessive dust, noise, extreme heat or cold.	Exposure to weather, extreme temperatures, light, noise, contaminants, or cramped spaces.
Psychosocial environment	N/A, based on evidence from occupational health models	Allows worker to use their abilities, gives them a sense of achievement, independence, variety, authority, creativity, and status.

Table 1. Job Demand Indicators Derived from the O*NET

Note: SSA work capacity requirements were obtained from the public version of the Program Operations Manual System (POMS) on the SSA website.

Polygenic Scores (PGSs)

We include five PGSs that overlap with prevalent medical impairments in SSDI applications: depressive symptoms (mental disorders), rheumatoid arthritis (musculoskeletal), high BMI (endocrine and metabolic disorders), myocardial infarction (cardiovascular problems), and general cognition (Okada et al. 2014, Nikpay et al. 2015, Davies et al. 2015, Okbay et al. 2016, Yengo et al. 2018). PGSs are continuous measures of genetic propensity that aggregate the contribution of millions of genetic markers across the genome to create a single scalar of genetic risk for a specific trait or disease. Unlike observed health, which is endogenous to DI claiming, genetic markers are exogenous because they are assigned at birth and are largely unknown to individuals. Thus, we conceptualize PGSs as measuring unobserved propensities that could contribute to health and job selection. One disadvantage of using PGSs is that they can display relatively weak signals and low explanatory power due to a number of technical reasons and to the fact that genetic propensities are by no means prescriptive and are influenced by, or work through, environmental factors.

Life Course Determinants of Occupational Selection

We include self-reported childhood health (in models without PGSs), composite measures of childhood SES that capture social capital (maternal investment and family structure), human capital (parental education), and financial capital (financial resources and instability) (Vable et al. 2017), childhood Census region, and completion of a GED/HS degree.

Empirical Model

Our primary model is a stepwise, linear probability model. We examine the probability of our three SSDI outcomes as a function of longest held job and, sequentially, occupational demands, education, childhood SES, and childhood health or genetic risk. All models control for baseline covariates (see Figure 1 note). In all analyses, we use weights provided by the HRS that adjust for bias from non-consent to SSA data linkage.

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Results and Discussion

DI Outcomes, Occupation, and Job Demands

Figure 1 displays the results of our stepwise model for the probability of SSDI claiming (excluded category is "professional"). The first set of bars display the occupational gradient in SSDI application, wherein white-collar workers have a much lower likelihood of SSDI application relative to their counterparts in blue-collar and service occupations. We observe this same gradient for approvals. The inclusion of job demands does very little to change the relationship between occupation and the probability of SSDI application or approvals. The exception is the degree of control and influence a worker has over their day-to-day workload, which is significantly associated with SSDI application and attenuates the occupational gradient for white-collar occupations. However, conditional on application, physical, mental, and sensory demands, but not psychosocial demands, are associated with the probability of SSDI approval. In other words, at the intensive margin, occupational demands specified in the SSA medical vocational grid are more strongly associated with DI outcomes.



Figure 1. Estimated Probability of SSDI Application across Occupations (Omitted Category: Professional)

Notes: N=22,752. Bars reflect coefficients from separate linear probability models that regress DI application on fixed effects for occupation, race, sex, survey year, HRS cohort, industry, and residential Census division. We also control for age and age₂ at first claim for applicants or at baseline for non-applicants. Model 2 adds the job demands listed in Table 1. Model 3 adds completion of a GED/HS degree. Model 4 adds childhood SES and health.

Life Course Selection Factors

To examine the role of selection in occupational choice and DI outcomes, we included important life course factors that may influence occupational choice: completed education, childhood SES, and self-reported childhood health. All factors are strongly associated with the probability of SSDI application. These associations disappear at the intensive margin when we examine approvals and reasons for approvals/denials. The inclusion of life course selection factors in our model also attenuates the remaining occupational gradient in DI application slightly, but strong relationships between blue-collar and service occupations and the probability of DI application remain (see Figure 1).

We interpret these findings to reflect the idea that structural and social inequities that influence access to opportunity and educational attainment (including race, childhood SES, and

Baseline model With occupational demands in model With education in model With childhood SES and childhood health in model

education) are important mechanisms in getting an individual "to the door" of the DI system; however, conditional on DI application, approvals and denials appear to be a function of the determination process itself and not of larger, life course selection mechanisms.

The Role of Health and Genetics

Finally, we consider the role of health selection into DI more carefully with PGSs, which we conceptualize as a measure of unobserved health. Table 2 confirms that PGSs capture statistically significant differences in underlying health between SSDI applicants and non-applicants. DI applicants have higher average genetic risk for depression, high BMI, myocardial infarction (MI), rheumatoid arthritis, and lower cognitive function. We also find that genetic risks correspond to the health conditions cited in DI applications; PGSs for depressive symptoms and MI are significantly associated with body system codes related to mental health cardiovascular function. We do not see any difference in genetic risk for approvals vs. denials or across reasons for approval or denial.

	Did not apply to SSDI		Did apply to SSDI			
Polygenic risk score (PGS)	Mean SE difference		Mean difference SE		Difference	
Depressive Symptoms PGS	-0.043	0.016	0.089	0.032	-0.132***	
BMI PGS	-0.034	0.013	0.166	0.044	-0.201***	
MIPGS	-0.024	0.018	0.113	0.044	-0.137***	
General Cognition PGS	0.018	0.017	-0.128	0.038	0.157***	
Rheumatoid Arthritis PGS	-0.125	0.012	-0.058	0.034	-0.0673*	

Table 2. Mean Differences in Polygenic Risk Scores by SSDI Application Status

Notes: SE: standard error. N= 8,638. ***p<0.01; **p<0.05; *p<0.10. BMI: body mass index. MI: myocardial infarction.

When we include PGSs in the stepwise model, we see strong associations between genetic propensity for depression and high BMI on the probability of application, and a remaining association with depression for approvals/denials. The inclusion of the PGSs explains ~1 percent of the model R₂ for DI application, which is similar to the explanatory power of self-reported childhood health. PGSs also attenuate the DI-occupational gradient to the same extent as childhood health. This suggests PGSs can act as exogenous proxies for underlying health, which our findings suggest is an independent contributor to SSDI application and receipt.

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Cognitive Ability, Cognitive Aging, and Debt Accumulation

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Introduction

While a large literature has examined savings behavior and accumulation among older adults, relatively little research has explored older adults' debt behaviors and outcomes. Recent work by Lusardi, Mitchell, and Oggero (2020) shows that older adults from recent generations tend to hold more debt than their predecessors, particularly mortgage debt, and correspondingly face greater financial insecurity near retirement age. While documenting such trends is an important first step, developing policy interventions to counteract them requires identifying the underlying drivers of the observed surge in debt burdens among recent older adults. One potential candidate is the increasing complexity of financial products targeted to consumers in the past few decades (Célérier and Vallee, 2017), particularly among mortgage products (Amromin et al., 2018). Figure 1 documents that originations of complex mortgages with zero or negative amortization surged in the early 2000s and subsequently reduced sharply after the financial crisis. Consumers from later cohorts may have difficulty appropriately selecting among and using these increasingly complicated instruments (Brown et al., 2017; Hastings and Mitchell, 2018). This may be particularly true for individuals with low cognitive ability and older individuals experiencing cognitive decline. As the financial landscape has become progressively more complex, the rise in debt burdens may be concentrated on those who are less cognitively able, raising concerns about the economic security of individuals who may not be adequately equipped to navigate the system.

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Figure 1. Increasing Complexity in Mortgage Products, 1998-2009

Note: The figure shows the composition of fixed-rate mortgages (FRM), adjustable-rate mortgages (ARM), interestonly mortgages (IO), and negative-amortization mortgages (NEGAM) originated between 1998 and 2009. *Source:* Amromin et al. (2018).

Approach

In this paper, we use data from the *Health and Retirement Study* (HRS) to examine how cognitive ability and cognitive aging are related to debt accumulation among older adults, and how this varies over time as financial products have become progressively more complex. In similar spirit to, and building upon, Lusardi, Mitchell, and Oggero (2020), we create three age groups, 56-61 (pre-retirement age), 62-67 (retirement age), and 68-73 (post-retirement age), each observed at three different points in time, namely 1998, 2006, and 2014, and therefore belonging to different cohorts (e.g., those 56-61 surveyed in 1998 were born 1937-42, those 56-61 surveyed in 2006 were born 1945-50, those 56-61 surveyed in 2014 were born 1953-58). The difference between time periods allows us to compare cohorts relatively unexposed to a surge in financial product complexity (1998), those exposed to increasing complexity, yet observed after the crisis (2014).

We complement this analysis with additional data drawn from the *Understanding America Study* (UAS). The UAS data span 2015-2019 and allow us to verify the robustness of the relationship between cognitive ability and debt burdens in more recent years. Furthermore, our UAS data contain a wealth of additional characteristics, including financial literacy, enabling us to examine the extent to which the relationship between cognitive ability and debt exposure is driven by financial sophistication.

Results

Similar to prior research, we find that debt burdens among those approaching retirement age have increased substantially in recent decades. We also show that this pattern extends to individuals who are post-retirement age (ages 68-73) as well. The fraction of individuals holding debt in this age group increased from 37 percent in 1998 to 54 percent in 2014, and average debt burdens more than doubled from approximately \$22,000 in 1998 to \$47,000 in 2014 (measured in 2014 dollars).

Of central interest to this paper, we find that cognitive ability is an important predictor of debt burdens in older age, and that this relationship has changed over time. In particular, those with higher cognitive ability have taken on *higher* debt levels relative to their counterparts in more complex financial environments. Table 1 shows that for each additional point on cognitive ability score, 1 older adults held \$1,100 additional dollars in total debt in 2006 and \$1,800 additional dollars in total debt in 2014 relative to before the increase in financial product complexity in 1998. This pattern holds across age groups, even for adults aged 68-73.

¹ The cognitive ability score is obtained as by summing scores on immediate and delayed word recall (0 - 20 points) test, a serial 7s test in which responds are asked to subtract seven from 100 and then continue to subtract seven from the resulting figure five times (0 - 5 points), and a backward counting test from 20 (0 - 2 points).

	(1)	(2)	(3)	(4)
	Total debt (\$10k)	Total debt (\$10k)	Total debt (\$10k)	Total debt (\$10k)
Variables	56-73	56-61	62-67	68-73
Cog ability	0.061***	0.098***	0.064***	0.021
	(0.014)	(0.027)	(0.022)	(0.020)
Cog abi * 2006	0.110***	0.207***	0.060	0.076**
-	(0.024)	(0.050)	(0.039)	(0.032)
Cog abi * 2014	0.180***	0.110***	0.214***	0.180***
-	(0.025)	(0.042)	(0.039)	(0.040)
2006	0.158	-0.941	0.963*	-0.106
	(0.347)	(0.788)	(0.586)	(0.447)
2014	-1.004***	-0.144	-1.484***	-0.783
	(0.350)	(0.646)	(0.562)	(0.560)
Age	-0.218***	-0.196***	-0.137***	-0.173***
-	(0.010)	(0.051)	(0.047)	(0.042)
Female	-0.770***	-0.852***	-0.706***	-0.831***
	(0.101)	(0.180)	(0.167)	(0.156)
Married	1.931***	2.863***	1.548***	0.940***
	(0.119)	(0.191)	(0.195)	(0.156)
Num children	0.098***	0.038	0.122***	0.157***
	(0.020)	(0.039)	(0.035)	(0.030)
White	0.402***	0.973***	-0.028	-0.431**
	(0.122)	(0.201)	(0.192)	(0.185)
More than HS	2.881***	3.660***	2.312***	2.186***
	(0.131)	(0.196)	(0.189)	(0.176)
HHI (\$10k)	0.040	0.026	0.121***	0.056**
	(0.025)	(0.021)	(0.031)	(0.025)
Poor health	-0.690***	-1.081***	-0.389**	-0.402***
	(0.104)	(0.184)	(0.179)	(0.138)
Constant	13.793***	10.923***	8.552***	12.681***
	(0.674)	(3.022)	(3.067)	(2.973)
Observations	30,211	11,014	10,443	8,754
R-squared	0.125	0.134	0.115	0.090

 Table 1. Cognitive Ability and Total Debt by Age Group over Time

Notes: Debt levels are winsorized at the 99% level. Robust standard errors in parentheses. For column 1, standard errors are clustered at the individual level. *** p<0.01, ** p<0.05, * p<0.1.

Much of the increase in total debt is due to individuals with higher cognitive ability taking on more mortgage debt, and we find evidence that older adults with higher cognitive ability take on more mortgage debt in response to increasing local home prices compared to their counterparts with lower cognitive ability. However, these patterns are not confined solely to housing debt – we also find that older adults with higher cognitive ability take on more "other debt" (which includes credit card debt) in more complex financial environments.

Using additional and more recent data from the UAS, we find that after controlling for financial literacy, the relationship between debt burdens and cognitive ability essentially vanishes, while financial literacy is strongly predictive of higher debt burdens. This highlights the fact that it is the more financially sophisticated who appear to be taking on more debt in increasingly complex financial environments. However, we find evidence that even higher cognitive ability individuals may have difficulty managing their debt burdens in more complex environments.

After the increase in financial complexity, and particularly after the financial crisis, individuals with higher cognitive ability hold less total wealth, less liquid wealth, and are more likely to have debt levels that exceed half their assets than their higher cognitive ability counterparts prior to the expansion in complexity. In particular, Table 2 shows that in 2014, after controlling for year fixed effects, a one-point increase in cognitive ability is associated with \$5,400 less total wealth than prior to the increase in financial complexity. The association is particularly acute for the pre-retirement and the retirement age groups – for individuals age 56-61 and 62-67, a one-point increase in cognitive ability is associated with \$8,700 and \$7,800 less wealth in 2014 relative to 1998, respectively.

Table 2 also documents that individuals with higher cognitive ability post-crisis are more likely to hold debt burdens that are more than half their assets relative to their counterparts prior to the increase in financial complexity. In particular, a one-point increase in the cognitive ability index is associated with a half a percentage point increase in being highly leveraged, a four percent increase relative to the mean. This association is driven by the youngest and oldest age groups, with similar magnitudes to the observed relationship in the population at large.

	(1)	(2)	(3)
	Total wealth (\$10k)	Debt/assets > 0.5	Liquid wealth (\$10k)
Variables	56-73	56-73	56-73
Cog ability	1.435***	-0.001	0.593***
	(0.144)	(0.001)	(0.061)
Cog abi * 2006	0.562**	0.001	-0.141*
	(0.218)	(0.001)	(0.077)
Cog abi * 2014	-0.540**	0.005***	-0.378***
	(0.230)	(0.001)	(0.092)
2006	-1.441	0.021	1.146
	(3.139)	(0.016)	(1.124)
2014	1.790	0.012	1.981*
	(2.944)	(0.018)	(1.188)
Age	1.435***	-0.008***	0.549***
	(0.097)	(0.000)	(0.036)
Female	0.059	-0.010**	0.417
	(0.950)	(0.004)	(0.428)
Married	23.907***	-0.040***	4.852***
	(1.507)	(0.005)	(0.586)
Num children	-1.773***	0.008***	-0.645***
	(0.167)	(0.001)	(0.078)
White	17.943***	-0.047***	5.730***
	(1.068)	(0.006)	(0.420)
More than HS	27.914***	-0.007*	9.048***
	(1.721)	(0.004)	(0.680)
HHI (\$10k)	0.924**	-0.001**	0.289*
	(0.432)	(0.000)	(0.158)
Poor health	-13.924***	0.052***	-3.671***
	(1.086)	(0.005)	(0.415)
Constant	-105.852***	0.631***	-41.467***
	(6.750)	(0.027)	(2.618)
Observations	30,211	30,211	30,211
R-squared	0.211	0.048	0.131

Table 2. Cognitive Ability and Financial Fragility

Notes: Wealth levels are winsorized at the 99 percent level. Robust standard errors in parentheses. For column 1, standard errors are clustered at the individual level. *** p<0.01, ** p<0.05, * p<0.1.

Perhaps of most concern, much of the reduction in wealth for higher cognitive ability older adults post-crisis came in the form of lower liquid wealth (wealth in checking and savings, certificates of deposit, and bonds and stock outside of retirement accounts).² Relative to the period prior to the expansion in financial complexity, in 2014 a one-point increase in cognitive

2 Overall patterns remain similar when we exclude stock holdings from liquid wealth.

ability is associated with \$3,800 less in liquid wealth. This relationship is particularly acute for adults age 68-73, for whom a one-unit increase in cognitive ability is associated with \$6,000 less in liquid wealth. Lower levels of liquid wealth may be particularly problematic for post-retirement age adults for whom it may be difficult to deal with unexpected financial shocks through additional engagement in the workforce.

Conclusion

We examine how cognitive ability is related to older adults' debt burdens, and how this varies over time with the increasingly complex financial landscape. Using data from the HRS and the UAS, we find that cognitive ability is an important predictor of debt burdens in older age, and that this relationship has changed over time during the period of expansion in financial complexity. Our results suggest that older adults with higher cognitive ability have taken on more debt relative to their counterparts in more complex financial environments. This relationship holds across our age groups of interest – adults 56-61 (pre-retirement age), 62-67 (retirement age), and 68-73 (post-retirement age) – and is particularly pronounced post-financial crisis. Much of the increase in total debt is due to older adults with higher cognitive ability taking on disproportionately more mortgage debt. Housing debt does not tell the entire story, however, as older adults with higher cognitive ability also took on more other debt (which includes credit card and medical debt) in the more complex financial environments.

While there has been some concern that increasing financial complexity will be borne on the backs of relatively unsophisticated consumers who will become increasingly indebted due to poor choice of debt instruments, this hypothesis does not seem well supported by the data. In fact, our results suggest that individuals with higher cognitive ability, and particularly higher financial literacy, are more likely to take on higher debt burdens in more complicated financial environments. This is consistent with research documenting that risky and complex financial instruments are more likely to be adopted by relatively financially sophisticated individuals (van Ooijen and van Rooij 2016; Amromin et al. 2018).

We also find evidence that higher cognitive ability individuals may be having difficulty managing their debt burdens in more complicated environments. After the increase in financial complexity, and particularly after the financial crisis, individuals with higher cognitive ability hold less total wealth, less liquid wealth, and are more likely to have debt levels that exceed half

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their assets than their higher cognitive ability counterparts prior to the expansion in complexity. All told, we find that individuals with higher cognitive ability disproportionately increased their debt burdens during the increase in financial product complexity, and that subsequently they were more financially fragile than similar individuals in previous cohorts.

While our findings are in line with and build upon prior work, our analysis is unable to establish causality between increasing financial complexity and increasing debt burdens among individuals with high cognitive ability. However, our results do underscore the fact that recent cohorts of older adults are increasingly financially fragile and that this fragility is not confined solely to those who are less sophisticated. Older adults with larger debt burdens are, all else equal, more likely to be adversely impacted by financial shocks. Retirement security for current and future retirees may be more in jeopardy across the financial sophistication spectrum, and older adults may be less financially resilient to financial shocks than past cohorts.

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Financial Consequences of Health and Healthcare Spending Among Older Couples

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Dementia, a chronic, degenerative disease characterized by deteriorating cognition, represents a particularly aggressive threat to older adults' financial well-being. Dementia-linked adverse financial events have the potential to deteriorate retirement savings, increasing financial strain and potentially demand for Medicaid and Supplemental Security Income. The presence of an unimpaired spouse may protect dementia patients if the unimpaired spouse intervenes, or both spouses may be harmed by financial errors committed by the dementia patient. Findings from this study will provide the Social Security Administration with important information about the impacts of dementia on the financial well-being of married couples and provide baseline information about the co-movement of spousal credit outcomes.

Since dementia typically occurs late in life and at a point when patients and their spouses face limited ability to replace retirement savings lost, early detection and strategies to prevent financial mistakes for these households can play an important role in household financial well-being.

The number of older adults living with dementia is rapidly growing. Dementia-linked adverse financial events have the potential to deteriorate retirement savings, increasing financial strain and demand for Medicaid and Supplemental Security Income. The presence of an unimpaired spouse may protect dementia patients if the unimpaired spouse intervenes, or both spouses may be harmed by financial errors committed by the dementia patient. Understanding the numbers of older Americans experiencing adverse financial events due to dementia can inform policies to protect a vulnerable population.

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