

Employment Status and Later Life Cognitive Functioning: A Gendered Perspective on the Moderating Role of the Social Network

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A Part of Sage

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Abstract

Gender disparities in later life cognition call for a deeper understanding of how social determinants interact to shape cognitive outcomes. This study investigates the gendered moderating role of the social network in the association between employment status (employed, retired, homemaker, unemployed) and cognitive functioning (episodic memory, verbal fluency) among adults aged 50+ in Europe. Using data from the Survey of Health, Ageing and Retirement in Europe (SHARE; waves 4 (2011–2012), 6 (2015–2016), 8 (2019–2020)), we apply linear multilevel models stratified by gender, with episodic memory and verbal fluency as outcomes (N = 145,107). Results indicate that a stronger social network may buffer negative effects of non-employment on episodic memory for women, whereas for men, benefits are primarily indicated at lower social network strength levels. Our findings highlight gender-specific cognitive advantages of social networks, suggesting that gender should be considered a structural factor, not merely a demographic characteristic, in studies of cognitive aging.

Keywords

aging, cognition, gender differences, social network, survey of health, ageing and retirement in Europe (SHARE)

Introduction

Good cognitive functioning is a requirement for living an independent life (Salthouse, 2012), and it is associated with enhanced well-being in later life (Llewellyn et al., 2008; Pfund et al., 2025). Several studies, however, highlight significant disparities in cognitive functioning among older adults across countries (Arnhold et al., 2025; Asperholm et al., 2019; Skirbekk et al., 2012) as well as within countries (Herlitz et al., 2015; Myrskylä & Margolis, 2014; Saenz et al., 2018; Weber et al., 2014), with gender playing a key role (Asperholm et al., 2019; Weber et al., 2014). To explain these cognitive disparities, several recent studies separately investigate the roles of employment (Vance et al., 2016) and the social network (Grasset et al., 2022; Kelly et al., 2017; Roth, 2022). We examine the two together from a gendered perspective to shed light on their interplay in explaining gendered heterogeneities in later life cognitive functioning.

According to the successful aging model by Rowe and Kahn (1997), participation in productive activities, such as employment, as well as social relations, can be considered as psychosocial enablers of good cognitive functioning in older age. Relatedly, the ‘use it or lose it’ hypothesis postulates that the continued engagement in cognitively stimulating activities

in older age promotes positive neuroplasticity, exerting a protective effect on cognitive functioning (Salthouse, 2006).

Prior empirical evidence indicates a compensatory relationship between activity participation (encompassing social, physical, intellectual, and recreational activities) and the social network related to cognitive functioning: for individuals engaging less in such activities, the social network appears to be particularly beneficial for maintaining cognitive functioning (Paiva et al., 2021). Furthermore, the social network-cognition nexus shows substantial gender

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differences (Zunzunegui et al., 2003), with older men and women navigating their social network differently (Antonucci et al., 2014; Schwartz & Litwin, 2018).

Building on these findings, this study investigates whether the social network moderates the association between employment in older age, measured as employment status (employed, unemployed, retired, homemaker), and cognitive functioning, measured as episodic memory and verbal fluency, and how such a moderating role differs by gender.

As such, this study is the first to systematically integrate a gender-informed perspective on the moderating role of social networks in the employment-cognition relationship, recognizing gender as a structuring force that shapes both social networks and cognitive outcomes. We therefore approach gender not only as a variable for subgroup analysis, but also as a lens through which we interpret the linkages between employment, the social network, and cognitive functioning. Furthermore, while prior studies have predominantly contrasted employment with retirement or treated non-employment as a homogeneous category, we explicitly distinguish between different forms of non-employment (retirement, unemployment, and homemaking).

Literature Review

Employment Status and Cognitive Functioning

Employment represents a central source of cognitive stimulation for older adults, requiring one to perform complex tasks and adapt to new environments while engaging in personal interaction with coworkers or clients (Vance et al., 2016). According to the ‘use it or lose it’ hypothesis, occupational cognitive stimulation results in neurogenesis, benefiting cognitive functioning (Salthouse, 2006). Additionally, employment may reduce psychological stress by providing income security, helping to establish daily routines, and fostering a sense of purpose and self-esteem which, in turn can positively affect cognitive performance (Goodman et al., 2017; Hakanen & Schaufeli, 2012; Stevens-Ratchford, 2011). Evidence predominantly confirms the positive role of employment for cognitive functioning of older adults (Bertogg & Leist, 2023; Greenberg & Burgard, 2021).

However, 62% of 50-year-olds and older in the EU-27 do not work (being either retired, unemployed, or homemakers), the majority being women (Eurostat, 2020). Notably, non-employed older adults are a heterogeneous group, with retirees, the unemployed, and homemakers encompassing differing social contexts and implications for cognitive functioning. Retirees, for instance, frequently engage in activities that are similarly structured as employment after their work careers, such as voluntary work, and tend to have more friend-based networks, whereas homemakers often center their lives around existing social networks and neighbors (Ajrouch et al., 2005; Burnett-Wolle & Godbey, 2007). Social networks of

unemployed older adults were observed to be family-centered (Haynes et al., 2014).

Research on the relationship between retirement and cognitive functioning predominantly presents non-significant or adverse effects (Alvarez-Bueno et al., 2021; White et al., 2025 for systematic reviews). Unemployment is recognized to negatively affect cognitive functioning (Vélez-Coto et al., 2021), while little is known about the association between homemaking and cognitive functioning (e.g. Bertogg & Leist, 2023; Ice et al., 2020 on the negative association between adult-life homemaking spells and later life cognitive functioning). These mixed findings suggest that the roles of retirement, unemployment and homemaking for cognitive functioning may depend on moderating factors.

Social Network and Cognitive Functioning

For older adults who are retired, unemployed, or homemakers, the social network may serve as an important substitute source for cognitive stimulation, considering that interacting with members of one’s social network involves interpreting body language, organizing and recalling information in conversations, and anticipating the reactions of conversation partners (Vance et al., 2016). Furthermore, regular social contact and emotional as well as instrumental support from network members contribute to fostering positive emotional states, reducing psychological stress, and mitigating the risk of depression (Berkman & Krishna, 2014; Fratiglioni et al., 2004).

Indeed, substantial evidence positively relates the social network to cognitive functioning and cognitive reserve (Fratiglioni et al., 2004; Kelly et al., 2017). Given the complexity of social networks and their strength depending on structural aspects, such as proximity of contacts and frequency of interactions, as well as on functional aspects, such as the roles of network members in providing emotional and instrumental support (Fiori et al., 2007), a diversified social network that fulfils a broader range of functions was often associated with improved cognitive functioning (Ellwardt et al., 2015; Paiva et al., 2021; Pan & Chee, 2020). Relatedly, networks rich in weak or peripheral ties (e.g., acquaintances, neighbors) expose individuals to novel information, diverse social cues, and cognitively demanding interactions (Burt & Burt, 2007; Granovetter, 1973). Research has linked social networks that include a high proportion of weak ties to improved cognitive outcomes (Perry et al., 2022).

Gender Differences in the Role of the Social Network

According to the convoy model, the social network is a group of individuals who accompany a person throughout their life, providing support and adapting alongside them as circumstances change (Kahn & Antonucci, 1980). It views the social network as a dynamic system that includes both stable and evolving ties, shaped by individuals’ personal and situational

changes over time (Antonucci et al., 2011). Emphasizing the contextual nature of social ties, the convoy model posits that gender-specific life courses lead to differences in the function of later life social networks between men and women (Antonucci et al., 2014), which may in turn structure the role of social networks for cognitive functioning.

Gender also structures the types of cognitive and social experiences embedded in employment. Men, on average, are more likely to work in positions characterized by greater occupational complexity and more frequent interactions with coworkers or clients, while women's employment trajectories are more often interrupted or concentrated in more relational but socially homogeneous roles (England, 2010; Fisher et al., 2014). These gendered exposures imply that the cognitive resources lost upon exiting employment differ for men and women, and that the kinds of social networks required to compensate for reduced employment-related stimulation may also diverge across genders.

Concerning gender differences in later life cognitive functioning, research indicates that women experience substantial cognitive benefits from a stronger social network (Tomioka et al., 2018; Zunzunegui et al., 2003). Moreover, engagement with weaker ties, such as friends, has been associated with decelerated cognitive decline in women only (Zunzunegui et al., 2003). A potential underlying mechanism is that women receive higher levels of emotional support from friends than men (Liao & Scholes, 2017; Liebler & Sandefur, 2002), with women's friend-based social networks being connected with improved mental health outcomes. Conversely, in men, the receipt of high social support from very close contacts, such as their spouse or partner, is associated with decelerated cognitive decline (Liao & Scholes, 2017).

Taken together, these strands of research suggest an integrated framework in which employment and social networks represent partially overlapping sources of cognitively enriching activity. Employment typically provides structured, socially diverse, and cognitively demanding engagement, whereas social networks can supplement or compensate for this stimulation (Berkman et al., 2000; Fratiglioni et al., 2004). In this view, social networks may operate as moderators in the employment–cognition relationship, altering the extent to which reduced employment-related stimulation translates into cognitive consequences. Gender, as a key organizing principle of life-course roles, shapes both employment experiences and network configurations (Risman, 2004), and therefore may condition the strength and direction of this moderating process.

The few existing studies on the association between employment status and the social network in relation to cognitive functioning predominantly focus on the transition from employment to retirement, highlighting the importance of the social network for cognitive functioning following retirement (Börsch-Supan & Schuth, 2013; Grotz et al., 2018). However, scientific evidence for other forms of later life non-employment is missing.

Moreover, empirical evidence has pointed to gender differences in the interlinkage between activity participation and the social network in relation to cognitive functioning (Tomioka et al., 2018; Zunzunegui et al., 2003), showing a more pronounced effect of social engagement on cognitive functioning for women. However, gender differences in the link between (non-)employment and the social network in relation to cognitive functioning have not been considered so far.

This study contributes to the literature by examining simultaneously how four employment statuses (employed, retired, unemployed, and homemaker) are associated with cognitive functioning and by investigating whether social network strength moderates these relationships in gender-specific ways using cross-national survey data.

Based on the literature discussed above, we hypothesize that cognitive functioning differs across employment statuses in later life, with employed individuals exhibiting higher cognitive functioning than those who are retired, unemployed, or engaged in homemaking and that the strength of the social network moderates the relationship between employment status and cognitive functioning. We expect that a strong social network positively moderates associations for retired, unemployed, and homemaking individuals by providing alternative sources of cognitive stimulation that partially compensate for the reduced exposure to cognitively demanding interactions that employment typically affords. In light of prior research indicating gender differences in the roles of the social network and activity participation in relation to cognitive decline, we expect the social network as a moderator to be particularly crucial for women's later life cognitive functioning.

Research Design

Data Source

We analyze data from the Survey of Health, Ageing and Retirement in Europe (SHARE), a panel survey on health, social, and economic conditions, as well as social engagement, of non-institutionalized people aged 50 and above in Europe and Israel (Börsch-Supan et al., 2013). In this study, we use data from waves 4, 6, and 8 (conducted in 2011–2012, 2015–2016, and 2019–2020, covering 27 countries), which include a social network module providing detailed information on the respondents' social surroundings (Bergman et al., 2019; SHARE-ERIC, 2024a; SHARE-ERIC, 2024b; SHARE-ERIC, 2024c).

We restrict the sample to observations of participants aged at least 50 years living in Europe with information on all variables used in our models. We further excluded observations of participants with current employment status *Don't know* (24 observations), *Other* (2127 observations), *Permanently sick or disabled* (4326 observations), or refused to answer (18 observations). Our final sample comprises

82,090 observations (28,231 in Wave 4; 29,874 in Wave 6; 23,985 in Wave 8) for women (N = 49,465) and 63,017 observations (21,914 in Wave 4; 23,300 in Wave 6; 17,803 in Wave 8) for men (N = 38,974). The average number of waves per respondent is 1.64 (SD = 0.74).

Outcome: Cognitive Functioning

The outcome variables cover *episodic memory* and *verbal fluency*, two dimensions of cognitive functioning that are sensitive to aging-related cognitive decline (Gonzalez-Burgos et al., 2019; Machado et al., 2018). The variable *episodic memory* represents the combined immediate and delayed recall test score, ranging from 0 to 20 total words recalled (mean = 9.16). In the immediate recall test, the interviewer reads a list of ten words aloud, asking the respondent to recall as many of these words as possible within 1 minute. The delayed recall test takes place a few minutes later, with the respondents being asked to recall as many words as possible from the previously read-out words without rehearing them. In the verbal fluency test, the participants are asked to name as many animals as possible within 60 seconds. Scores in our sample range from zero to 97 (mean = 20.09).

Independent Variables

The independent variables are social network strength and employment status. Social network strength is operationalized using a composite indicator. The social network scale (*sn scale*) is treated as an ordinal variable rather than continuous, as it was constructed from a composite of multiple discrete components and categorized into five meaningful levels. The highest category, *sn scale* = 4, indicates a strong social network, whereas the lowest category, *sn scale* = 0, is assigned only to individuals who reported having no social network at all. The *sn scale* was first introduced and validated by Litwin and Stoeckel (2016) and was composed using information on individuals' network size, proximity to contacts (number of contacts living within 25 km), their frequency of contact (number of individuals with weekly or more contact), received support (number of contacts with very close emotional ties), and diversity of contacts (number of different types of contacts). Weighing each of these traits equally, a raw score ranging from 0 to 20 was converted to the *sn scale* (0 = 0, 1 = 1–5, 2 = 6–10, 3 = 11–15, and 4 = 16–20). In our sample, the *sn scale* follows a bell-shaped distribution, centered on level 2, with 2.82% of total respondents in our samples at level 0, 25.91% at level 1, 46.44% at level 2, 21.34% at level 3, and 3.49% at level 4. For the categorical variable *employment status*, we use the participants' self-reported current employment status with the categories *employed* (including self-employed), *retired* (from own work only), *homemaker*, and *unemployed*.

We control for sociodemographic and economic factors that are potential confounders. The sociodemographic

variables include the continuous variable *age* at the interview (mean ages are 67.64 years (women) and 68.01 years (men)) and age squared, accounting for non-linear age-related cognitive decline. Highest *educational attainment* is divided into the three categories *primary* (International Standard Classification of Education [ISCED] levels 0-1), *secondary* (ISCED levels 2-4), and *post-secondary education* (ISCED levels 5-6). *Marital status* is divided into the categories *married* (including registered partnerships), *divorced*, *widowed*, and *never married*. Considering that parenthood is both related to employment status and the social network, we include a binary control variable *children*, indicating whether the respondent is childless (Fanelli & Profeta, 2021; Muller et al., 2020). We consider the economic situation of the respondent by including the *financial wealth quintile* – the relative wealth position within a country, based on self-reported real and financial assets per household, and adjusted for household size. We further include *survey wave* as a categorical variable and *learning*, a binary variable indicating first participation in the cognitive test, accounting for learning effects in repeated cognitive testing (Collie et al., 2003). Table 1 presents summary statistics for the *sn scale* and the control variables, categorized by employment status and gender.

Analytic Strategy

First, we provide a descriptive overview of the two cognitive functioning dimensions, episodic memory and verbal fluency, by employment status and social network strength, separately for men and women. Subsequently, we apply linear multilevel models with random intercepts, with observations on level 1, individuals on level 2, and countries on level 3, separately for men and women (supported by likelihood ratio tests) (Raudenbush & Bryk, 2002). We use this method to consider the hierarchical panel data structure of repeated observations of individuals and individuals being nested in countries of residence; country differences explain substantial shares of the total variations in episodic memory (10.6% for women and 6.3% for men) and verbal fluency (18.9% for women and 15.8% for men).

For each dependent variable (*episodic memory* and *verbal fluency*), we run two model specifications, separately for each gender. Models 1a (*episodic memory*) and 1b (*verbal fluency*) include *employment status* and *sn scale*, whereas models 2a-b additionally include an interaction term between *employment status* and *sn scale*. Models 1a-b evaluate the associations between employment status and cognitive functioning, as well as social network strength and cognitive functioning. Models 2a-b address the moderating role of social network strength in the relationship between employment status and cognitive functioning. In all models, we use *sn scale* = 2 as the reference category, as it represents the most common and median level in our sample, providing a stable baseline from which we can compare lower and higher levels more meaningfully.

Table 1. Descriptive Statistics of the Mean or Percentages for the Control Variables by Employment Status for Women and Men (Women/Men)

Variables	Employment situation (women/Men)				Total % or mean (women/Men)
	Employed	Retired	Unemployed	Homemaker	
<i>Outcomes</i>					
Episodic memory (Mean (SD))	11.44 (3.20)/10.45 (3.14)	8.85 (3.72)/8.23 (3.47)	9.95 (3.36)/9.08 (3.43)	8.24 (3.77)/8.70 (3.53)	9.42 (3.77)/8.83 (3.53)
Verbal fluency (Mean (SD))	23.64 (7.64)/22.73 (7.62)	19.39 (7.56)/18.91 (7.40)	20.56 (7.74)/19.72 (7.76)	16.30 (7.22)/19.40 (7.71)	20.06 (7.86)/20.13 (7.67)
<i>Covariates</i>					
sn scale = 0 (%)	14.99/22.32	69.88/71.77	2.47/5.32	12.66/0.59	100.00/100.00
sn scale = 1 (%)	18.41/25.80	62.10/70.20	2.60/3.64	16.88/0.37	100.00/100.00
sn scale = 2 (%)	21.12/25.66	62.09/71.08	2.53/2.94	14.26/0.32	100.00/100.00
sn scale = 3 (%)	26.82/27.21	58.33/70.19	2.32/2.36	12.53/0.25	100.00/100.00
sn scale = 4 (%)	29.79/28.73	53.73/68.68	2.55/2.29	13.93/0.30	100.00/100.00
Age (in years) (mean)	57.40/58.43	71.78/72.01	57.03/57.79	67.65/64.04	67.64/68.01
Primary education (%)	6.65/10.60	62.93/85.70	2.13/3.32	28.29/0.37	100.00/100.00
Secondary education (%)	21.69/27.00	62.45/68.89	2.95/3.72	12.92/0.39	100.00/100.00
Post-secondary education (%)	37.00/33.74	56.41/64.17	1.88/1.89	4.71/0.20	100.00/100.00
Married (%)	25.20/26.11	54.48/70.92	2.73/2.67	17.59/0.30	100.00/100.00
Widowed (%)	6.27/7.02	80.11/91.84	0.73/0.85	12.88/0.30	100.00/100.00
Divorced (%)	32.47/36.32	60.94/56.95	4.46/6.43	2.13/0.30	100.00/100.00
Never married (%)	34.03/34.68	59.61/56.12	3.59/8.39	2.77/0.81	100.00/100.00
Children: Yes (%)	21.99/25.79	60.70/71.05	2.48/2.87	14.83/0.30	100.00/100.00
Children: No (%)	23.36/27.59	64.79/66.26	2.64/5.53	9.20/0.63	100.00/100.00
Financial wealth: Q1 (%)	17.42/23.19	63.01/68.86	4.34/7.44	15.23/0.51	100.00/100.00
Financial wealth: Q2 (%)	22.81/26.67	58.85/69.87	2.63/3.14	15.71/0.32	100.00/100.00
Financial wealth: Q3 (%)	23.47/25.92	59.13/71.62	2.24/2.18	15.16/0.28	100.00/100.00
Financial wealth: Q4 (%)	23.29/25.21	61.64/72.80	1.60/1.77	13.47/0.23	100.00/100.00
Financial wealth: Q5 (%)	23.98/28.47	62.37/69.66	1.49/1.55	12.16/0.32	100.00/100.00
Survey wave 4 (%)	22.59/30.65	59.10/65.01	2.56/4.03	15.74/0.31	100.00/100.00
Survey wave 6 (%)	17.78/25.99	68.18/70.61	1.77/3.15	12.26/0.24	100.00/100.00
Survey wave 8 (%)	25.26/20.13	57.03/77.46	3.03/1.94	14.68/0.47	100.00/100.00
Learning: 1st participation (%)	27.28/34.36	54.06/60.04	4.08/5.26	14.58/0.33	100.00/100.00
Learning: Re-participation (%)	20.34/23.01	63.42/74.30	1.95/2.36	14.28/0.33	100.00/100.00
N (total)	18,146/16,356	50,111/44,490	2,047/1,964	11,786/207	82,090/63,017
% (total)	22.10/25.95	61.04/70.60	2.49/3.12	14.36/0.33	100.00/100.00

Robustness and Sensitivity Checks

We conduct several robustness and sensitivity checks to test the stability of our findings. These are presented in the supplementary materials (Tables S.3-10; Figures S.1-2).

We address potential confounding and reverse causality by performing the main analysis (models 2a-b) excluding (i) all observations from wave 8 as parts of the data collection for

wave 8 were conducted during COVID-19 lockdowns using computer-assisted telephone interviews (CATI), while lockdown measures may have temporarily affected components of our social network measure, such as the frequency and diversity of contacts (Table S.3); (ii) observations of individuals with no social network (sn scale = 0) (Table S.4); and (iii) reporting cognitive impairment (diagnosed with dementia or any other serious memory impairment) (Table S.5), in the

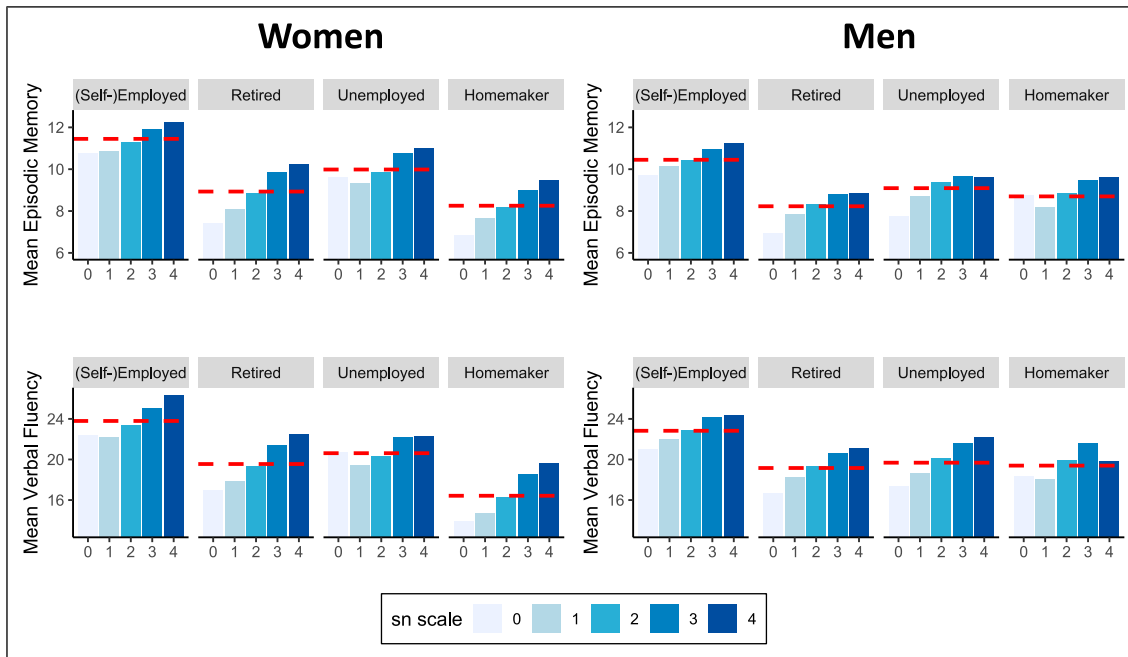


Figure 1. Mean Episodic Memory and Verbal Fluency by Employment Status and *sn scale* for Women and Men.

Note: The dashed red line denotes the mean cognitive outcome of the related employment status. Own calculations on SHARE waves 4, 6, and 8

light of research linking cognitive impairment to social network decline and social isolation (Dyer et al., 2021; Hajek & König, 2025) and resulting reverse causality concerns. (iv) We test gender differences in interaction effects by estimating a pooled model with three-way interactions (*employment status* × *sn scale* × *gender*) (Table S.6) and (v) test robustness to differences in age composition or potential survivor bias by restricting the sample to participants aged 50 to 69 years (Table S.7). We test sensitivity to the social network operationalization using (a) the continuous raw score underlying the *sn scale*, ranging from 0 to 20 (Table S.8); and (b) two separate components of the *sn scale*: (i) very close contacts (0 = 0, 1 = 1, 2 = 2–3, 3 = 4–5, and 4 = 6–7 persons) and (ii) diversity of contacts (presence of spouse; other family; friend; and other) (Tables S.9–10; Figures S.1–2). Both indicators range from 0 to 4 (reference: 2), probing the extent to which each facet drives the gendered moderation of the composite *sn scale*. Prior research suggests weak ties may be particularly important for women’s cognitive stimulation (Perry et al., 2022; Tomioka et al., 2018; Zunzunegui et al., 2003), while close supportive ties may be more central for men (Liao & Scholes, 2017).

Results

Descriptive Statistics

Women. Among women, employed respondents exhibit the highest cognitive scores (mean = 11.44, SD = 3.20 in episodic

memory; mean = 23.64, SD = 7.64 in verbal fluency), while homemakers show the lowest score (mean = 8.24, SD = 3.77; mean = 16.30, SD = 7.22) – with the unemployed (mean = 9.95, SD = 3.36; mean = 20.56, SD = 7.74) and retirees (mean = 8.85, SD = 3.72; mean = 19.39, SD = 7.56) ranging in between (Figure 1, left-hand side). A positive social network gradient is evident in episodic memory scores among employed, retired, and homemaking respondents. In verbal fluency, we observe a positive gradient for retirees and homemakers. In both cognitive domains, the gradient is the steepest for retirees and homemakers.

Men. Similarly, in men (Figure 1, right-hand side), employed respondents score the highest (mean = 10.45, SD = 3.14 in episodic memory; mean = 22.73, SD = 7.62 in verbal fluency). Lower scores are observed in the unemployed (mean = 9.08, SD = 3.43; mean = 19.72, SD = 7.76) and retirees (mean = 8.23, SD = 3.47; mean = 18.91, SD = 7.40). In men, we observe a positive social network gradient in episodic memory scores among employed and retired respondents. In verbal fluency, there is a positive gradient among the employed, the retirees, and the unemployed. In both cognitive domains, the gradient is the steepest for unemployed men. Our sample includes only 124 observations of homemaking men; therefore, we refrain from further interpreting related results.

In summary, the descriptive results hint at a positive association of both employment and social network strength with cognitive functioning. However, the social network gradient varies between employment categories, being most

pronounced among retirees and homemakers for the subsample of women and among the unemployed for the subsample of men. Table S.1 in the supplementary materials displays the distribution of *sn scale* scores within each employment status.

The Role of Employment and the Social Network

To analyze how the employment status and the social network relate to cognitive functioning, we perform multilevel models. Tables 2 and 3 show the results of models 1a-b for episodic memory and verbal fluency, respectively, with full regression tables presented in the supplementary material (Table S.2).

Women. Episodic memory is significantly negatively associated with being *retired* ($\beta = -0.163, p < 0.01$),

unemployed ($\beta = -0.410, p < 0.01$) and being a *homemaker* ($\beta = -0.405, p < 0.01$), in reference to being employed (Table 2, model 1a). Model 1a further reveals a positive association between episodic memory and the *sn scale* (reference: *sn scale* = 2).

In verbal fluency among women (Table 2, model 1b), being *retired* ($\beta = -0.613, p < 0.01$), *unemployed* ($\beta = -0.745, p < 0.01$), and being a *homemaker* ($\beta = -1.135, p < 0.01$) show negative associations. Furthermore, model 1b positively relates verbal fluency to the *sn scale*.

Men. Among men (Table 3, model 1a-b), unemployment shows a pronounced negative association with episodic memory ($\beta = -0.453, p < 0.01$) in comparison to employment. We also find a significant negative association for being *retired* ($\beta = -0.273, p < 0.01$). In addition, we observe a positive

Table 2. Women: Results of the Random Intercept Models With the Outcome Variables Episodic Memory and Verbal Fluency

	Episodic memory		Verbal fluency	
	Model 1a b (SE)	Model 2a b (SE)	Model 1b b (SE)	Model 2b b (SE)
<i>Fixed effects</i>				
<i>Employment status</i> (ref.: Employed or self-employed)				
Retired	-0.163*** (0.038)	-0.180*** (0.046)	-0.613*** (0.077)	-0.629*** (0.095)
Unemployed	-0.410*** (0.070)	-0.532*** (0.098)	-0.745*** (0.144)	-0.901*** (0.202)
Homemaker	-0.405*** (0.045)	-0.421*** (0.058)	-1.135*** (0.093)	-1.091*** (0.120)
<i>sn scale</i> (ref.: <i>sn scale</i> = 2)				
<i>sn scale</i> = 0	-0.509*** (0.066)	-0.191 (0.167)	-0.583*** (0.136)	-0.149 (0.344)
<i>sn scale</i> = 1	-0.200*** (0.027)	-0.069 (0.060)	-0.508*** (0.055)	-0.445*** (0.124)
<i>sn scale</i> = 3	0.276*** (0.026)	0.142*** (0.051)	0.670*** (0.053)	0.563*** (0.105)
<i>sn scale</i> = 4	0.396*** (0.052)	0.263*** (0.097)	1.247*** (0.108)	1.308*** (0.199)
<i>Interaction</i> (Ref.: Employed or self-employed x <i>sn scale</i> = 2)				
<i>sn scale</i> = 0				
Retired x <i>sn scale</i> = 0		-0.370** (0.184)		-0.439 (0.379)
Unemployed x <i>sn scale</i> = 0		0.179 (0.455)		0.905 (0.938)
Homemaker x <i>sn scale</i> = 0		-0.522** (0.250)		-1.175** (0.515)
<i>sn scale</i> = 1				
Retired x <i>sn scale</i> = 1		-0.163** (0.068)		-0.024 (0.141)
Unemployed x <i>sn scale</i> = 1		-0.194 (0.172)		0.053 (0.355)
Homemaker x <i>sn scale</i> = 1		-0.151* (0.089)		-0.310* (0.184)
<i>sn scale</i> = 3				
Retired x <i>sn scale</i> = 3		0.172*** (0.060)		0.109 (0.124)
Unemployed x <i>sn scale</i> = 3		0.582*** (0.169)		0.550 (0.347)
Homemaker x <i>sn scale</i> = 3		0.138* (0.087)		0.238 (0.179)
<i>sn scale</i> = 4				
Retired x <i>sn scale</i> = 4		0.134 (0.118)		-0.087 (0.244)
Unemployed x <i>sn scale</i> = 4		0.386 (0.336)		-0.213 (0.691)
Homemaker x <i>sn scale</i> = 4		0.344** (0.168)		-0.074 (0.346)
Intercept	4.760*** (0.581)	4.804*** (0.581)	10.189*** (1.267)	10.205*** (1.268)
Random effects: Var.				
country	0.838	0.839	8.02	8.014
country-individuals	3.845	3.843	17.486	17.487
Residual	5.526	5.525	22.852	22.849
Number of observations	82,090	82,090	82,090	82,090

Note. Models 1a (Women) and 1b (Men) are without interactions. Models 2a (Women) and 2b (Men) include an interaction term between *Employment status* and the *sn scale*. Significance levels are * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3. Men: Results of the Random Intercept Models With the Outcome Variables Episodic Memory and Verbal Fluency

	Episodic memory	Episodic memory	Verbal fluency	Verbal fluency
	Model 1a b (SE)	Model 2a b (SE)	Model 1b b (SE)	Model 2b b (SE)
<i>Fixed effects</i>				
<i>Employment status (ref.: Employed or self-employed)</i>				
Retired	−0.273*** (0.040)	−0.211*** (0.050)	−0.654*** (0.088)	−0.629*** (0.107)
Unemployed	−0.453*** (0.072)	−0.279*** (0.106)	−1.043*** (0.155)	−0.947*** (0.231)
Homemaker	−0.332 (0.203)	−0.277 (0.305)	−0.784 (0.441)	−0.433 (0.662)
<i>sn scale (ref.: sn scale = 2)</i>				
sn scale = 0	−0.618*** (0.067)	−0.338** (0.140)	−1.039*** (0.146)	−0.794*** (0.303)
sn scale = 1	−0.156*** (0.027)	−0.056 (0.053)	−0.486*** (0.059)	−0.413*** (0.114)
sn scale = 3	0.157*** (0.032)	0.182*** (0.061)	0.504*** (0.070)	0.488*** (0.133)
sn scale = 4	0.296*** (0.072)	0.501*** (0.135)	0.823*** (0.157)	0.634*** (0.292)
<i>Interaction (Ref.: Employed or self-employed × sn scale = 2)</i>				
<i>sn scale = 0</i>				
Retired × sn scale = 0		−0.326** (0.159)		−0.254 (0.345)
Unemployed × sn scale = 0		−0.936*** (0.328)		−1.121 (0.713)
Homemaker × sn scale = 0		−0.232 (0.885)		−1.677 (1.920)
<i>sn scale = 1</i>				
Retired × sn scale = 1		−0.128** (0.061)		−0.088 (0.132)
Unemployed × sn scale = 1		−0.291* (0.153)		−0.259 (0.332)
Homemaker × sn scale = 1		−0.241 (0.452)		−0.862 (0.980)
<i>sn scale = 3</i>				
Retired × sn scale = 3		−0.028 (0.072)		0.015 (0.156)
Unemployed × sn scale = 3		−0.137 (0.208)		0.243 (0.451)
Homemaker × sn scale = 3		0.058 (0.619)		0.027 (1.343)
<i>sn scale = 4</i>				
Retired × sn scale = 4		−0.283 (0.159)		0.249 (0.345)
Unemployed × sn scale = 4		−0.453 (0.489)		0.613 (1.059)
Homemaker × sn scale = 4		1.098 (1.328)		1.477 (2.882)
Intercept	5.948*** (0.698)	5.875*** (0.699)	10.884*** (1.569)	10.858*** (1.571)
Random effects: Var.				
country	0.461	0.461	6.46	6.463
country-individuals	3.665	3.662	18.231	18.229
Residual	5.414	5.415	24.957	24.962
Number of observations	63,017	63,017	63,017	63,017

Note. Models 1a (Women) and 1b (Men) are without interactions. Models 2a (Women) and 2b (Men) include an interaction term between *Employment status* and the *sn scale*. Significance levels are * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

association between episodic memory and the *sn scale*. Notably, a complete lack of social connections (*sn scale* = 0) exhibits a particularly pronounced negative relationship with episodic memory ($\beta = -0.618$, $p < 0.01$) in men.

Verbal fluency of men is negatively associated with being *retired* ($\beta = -0.654$, $p < 0.01$) and being *unemployed* ($\beta = -1.043$, $p < 0.01$), and positively associated with the *sn scale* (Table 3, model 1b). As in episodic memory, the association between the lack of a social network (*sn scale* = 0) and verbal fluency in men is substantial in size ($\beta = -1.039$, $p < 0.01$).

In summary, models 1a-b hint at a positive relationship between employment and cognitive functioning, as well as a positive relationship between social network strength and cognitive functioning. While women show substantial positive

associations between higher *sn scale* levels and cognitive functioning, men exhibit a pronounced negative relationship between the lack of a social network and cognitive functioning.

The Social Network as a Moderator

To examine the moderating role of social network strength on the relationship between employment status and cognitive functioning, we conducted multilevel models, adding interaction terms between employment status (reference: *employed or self-employed*) and the *sn scale* levels (reference: *sn scale* = 2) (Tables 2 and 3, models 2a-b). Figure 2 visualizes the estimated marginal means with 95% confidence intervals.

Women. Table 2 (Model 2a) shows that for women, the association between being *retired* and episodic memory is

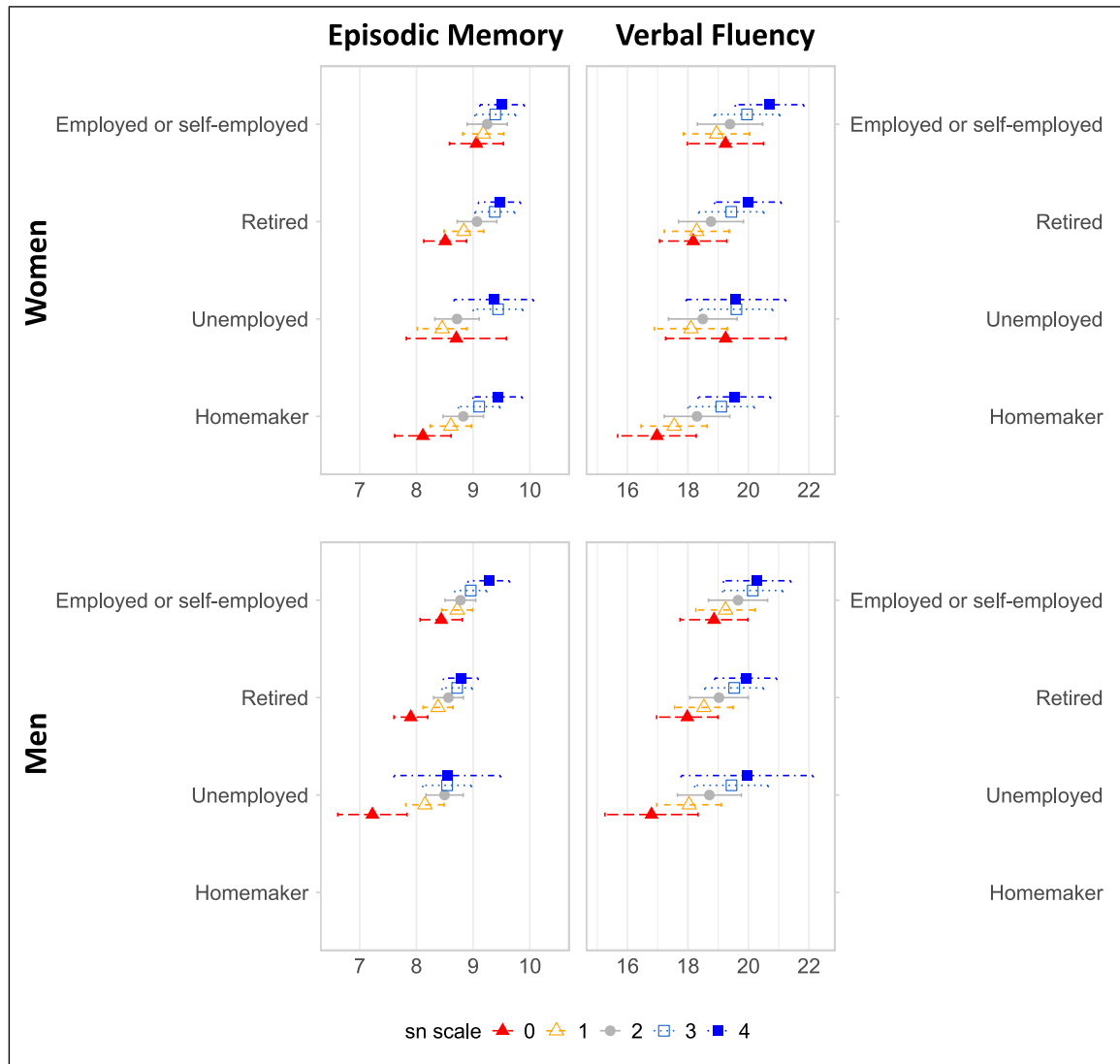


Figure 2. Episodic Memory and Verbal Fluency by Gender and Employment Status: Estimated Marginal Means With 95% Confidence Intervals for $sn\ scale = 0$, $sn\ scale = 1$, $sn\ scale = 2$, $sn\ scale = 3$, and $sn\ scale = 4$.
 Note: Own calculations on SHARE waves 4, 6, and 8 (82,095 observations of women and 63,019 observations of men). Discrete predictors are held constant at their proportions

mostly positively moderated by the $sn\ scale$ ($sn\ scale = 0$: $\beta = -0.370, p < 0.05$; $sn\ scale = 1$: $\beta = -0.163, p < 0.05$; $sn\ scale = 3$: $\beta = 0.172, p < 0.01$), but no significant interaction is observed for $sn\ scale = 4$. For unemployed women, we find a pronounced positive interaction for $sn\ scale = 3$ ($\beta = 0.582, p < 0.01$), but no significant interactions for the other $sn\ scale$ levels, where the number of observations is relatively low. For homemaking women, our results reveal significant positive interactions ($sn\ scale = 0$: $\beta = -0.522, p < 0.05$; $sn\ scale = 1$: $\beta = -0.151, p < 0.1$; $sn\ scale = 3$: $\beta = 0.138, p < 0.1$; $sn\ scale = 4$: $\beta = 0.344, p < 0.05$).

For women’s verbal fluency (Table 2, model 2b), we find positive interactions between homemaking and social network strength for below-reference levels ($sn\ scale = 0$: $\beta = -1.175, p < 0.05$; $sn\ scale = 1$: $\beta = -0.310, p < 0.1$).

Men. For episodic memory in men (Table 3, model 2a), retirement shows significant positive interactions with the social network for levels up to the reference level ($sn\ scale = 0$: $\beta = -0.326, p < 0.05$; $sn\ scale = 1$: $\beta = -0.128, p < 0.05$), while we observe no significant interactions for higher $sn\ scale$ levels. Similarly, we find positive interactions between unemployment in men and the $sn\ scale$ up to the reference level: a reference level score ($sn\ scale = 2$) as opposed to $sn\ scale = 0$ exhibits a pronounced positive interaction, whereas the positive interaction is considerably lower in magnitude and only marginally significant for $sn\ scale = 1$ ($sn\ scale = 0$: $\beta = -0.936, p < 0.01$; $sn\ scale = 1$: $\beta = -0.291, p < 0.1$). For verbal fluency in men, we find no significant interactions between *employment status* and the $sn\ scale$.

For both genders, models 2a-b show that most statistically significant coefficients correspond to modest adjusted differences between employment statuses (<0.15 SD). Substantively larger gaps are concentrated among respondents with low *sn scale* scores, such as in unemployed men with *sn scale* = 0 (−0.34 SD in episodic memory) and homemaking women with *sn scale* = 0 (−0.25 SD in episodic memory).

Robustness and Sensitivity Checks

To test the stability of our findings, we conducted several robustness and sensitivity checks (Tables S.3-10; Figures S.1-2).

Excluding SHARE wave 8 observations, results remain consistent with our main models in terms of statistical significance and direction of effects (Table S.3). When excluding respondents with no social network (*sn scale* = 0), the positive moderating role of the social network persists for both genders, with women showing significant interactions for retirement and homemaking across *higher sn scale* levels, and men continuing to show pronounced interactions for retirement and unemployment at *sn scale* = 1 (Table S.4). The results are robust to the exclusion of cognitively impaired respondents (Table S.5). The three-way interactions (*employment status* × *sn scale* × *gender*) (Table S.6) reveal that the moderating role of the *sn scale* differs significantly by gender for unemployment and retirement in selected *sn scale* scores, consistently favoring women. Restricting the sample to respondents aged 50-69 yields results mostly consistent with the main models (Table S.7). The moderating patterns remain largely intact: for women, stronger social networks continue to buffer the negative associations of non-employed statuses for episodic memory. For men, the protective role of the social network at lower levels (*sn scale* = 0 and 1) persists for retirement and unemployment in episodic memory. Using the continuous raw score underlying the *sn scale* (ranging from 0 to 20) instead of the categorical measure (Table S.8) confirms positive interactions between non-employment and the social network for both genders.

We re-estimated in a sensitivity check the gender-stratified multilevel models 2a-b, replacing the *sn scale* with two of its components (i) *diversity* of contacts and (ii) *very close contacts* (Tables S.9-10; Figure S.1-2 of the supplementary material). Among women, a greater diversity of contacts is associated with higher predicted episodic memory in retirees and homemakers compared to employed respondents. Episodic memory patterns for very close contacts are less uniform. For verbal fluency, diversity shows selective positive interactions, while they are mostly non-significant for very close contacts (Table S.9). Among men, the diversity of contacts shows comparatively limited interactions with non-employment concerning episodic memory, yet lower levels of very close contacts are linked to lower episodic memory scores for retirees and the unemployed, compared to the

employed. Verbal fluency interactions remain mostly non-significant (Table S.10).

Discussion

This study examined how employment status (employed, retired, unemployed, homemaker) relates to cognitive functioning and whether social network strength moderates these associations differently for women and men. Overall, the findings suggest a positive moderating role of the social network for non-employed statuses, revealing gender-specific patterns. For women's episodic memory, our results indicate a buffering role of social ties when employment-related cognitive stimulation is absent. For men, moderation effects are concentrated among individuals with weak or absent social ties.

In aging societies, it becomes increasingly important to identify contributors to maintaining good cognitive functioning into advanced age and reduce inequalities in cognitive functioning. Previous studies examining the interplay between older people's activity participation and their social network and its association with cognitive functioning have predominantly focused on activities considered as social engagement, such as voluntary work or participation in clubs or community organizations (Litwin & Stoeckel, 2016; Paiva et al., 2021). These studies found more pronounced associations between social network strength and cognitive functioning for less socially engaged individuals. Unlike prior studies, which mainly focus on social engagement activities, our study analyzes employment status from a gender-informed perspective and tests whether social networks moderate its association with cognitive functioning, thus addressing an understudied mechanism for cognitive resilience in later life.

The hypothesis of a positive interaction between non-employment and social network strength is mostly confirmed for women's episodic memory, underscoring a potential additional importance of social connections for older women who are retired or homemakers. For men, the findings are more mixed. A weak social network appears to exacerbate the adverse effects of unemployment and retirement on episodic memory, with particularly large negative associations for unemployed men lacking any social ties. For verbal fluency, less support is found for our hypothesis. Negative associations with a weak social network are observed primarily among homemaking women and unemployed men. The weaker results for verbal fluency align with existing evidence indicating that aging has a more adverse impact on episodic memory compared to semantic memory, which is assessed in the verbal fluency test (Levine et al., 2002). We refrain from interpreting estimates for homemaking men or drawing gender comparisons for homemakers, considering their low number of observations.

Motivated by research showing gender differences in the roles of weak ties (cognitive stimulation) and very close

ties (support), we examined the moderating roles of the diversity of contacts and very close contacts on the relationship between employment status and cognitive functioning. Following prior literature, we conceptualize the diversity of contacts as bridging ties that provide cognitively stimulating exposure to novel social interactions, whereas very close contacts represent bonding ties that supply emotional support (Liao & Scholes, 2017; Tomioka et al., 2018).

The results suggest that the observed moderation patterns may be driven by different social network dimensions for women and men. For women, higher diversity of contacts is consistently linked to higher predicted episodic memory in retirees and homemakers, suggesting that diverse ties may partly substitute for employment-related cognitive stimulation. Among men, very close (bonding) ties appear to be more relevant moderators for retirement and unemployment, suggesting that emotionally close ties may be particularly important when employment-related social interaction is absent. These findings align with evidence linking women's diversified, friend-rich networks to improved cognition (Tomioka et al., 2018; Zunzunegui et al., 2003) and men's particular reliance on close, often spouse-centered ties (bonding ties), for socioemotional resources, which may in turn affect cognitive functioning (Liao & Scholes, 2017).

Theoretically, our findings underscore the notion that social networks operate as role-contingent resources that shape cognitive resilience in later life. Furthermore, our study highlights gendered patterns in the relationship between employment status, social network strength, and cognitive functioning, pointing to structural differences in how older adults access and benefit from social and cognitive resources. The substantial estimated benefits of a strong social network for women's episodic memory align with prior research, showing that women benefit from broad social networks that are more emotionally supportive and functionally diverse than men's (Liebler & Sandefur, 2002; Zunzunegui et al., 2003). These networks may act as substitute forms of cognitive stimulation when employment is absent, supporting the 'use it or lose it' hypothesis within gendered social realities. In contrast, men often rely more heavily on their spouses for emotional support, which may lead to the cognitive functioning – non-employment relationship being more pronounced in the absence of those core connections (Liao & Scholes, 2017; Schwartz & Litwin, 2018). Decomposing the *sn scale* into diversity of contacts and very close contacts supports this interpretation, suggesting that men's episodic memory may be more contingent on the presence of core, very close contacts, while women's outcomes may be more responsive to cognitively stimulating, diverse networks. From a gender-relational perspective (Risman, 2004), these findings reflect how socially constructed roles and expectations differentially position men and women to accumulate or deplete forms of social capital that support cognitive resilience in later life.

Limitations

The study has some important limitations. First, our models rely on current employment status and do not capture heterogeneity in cognitive demands of the work respondents perform or have performed in the past. This matters, first, because the theoretical argument linking employment to cognition rests on differences in cognitive stimulation that may vary between professions and, second, in the light of the cognitive reserve theory, arguing that lifelong cognitively stimulating experiences (e.g. employment) may protect against age-related decline (Stern et al., 2020). However, SHARE provides only broad measures of the current occupation group for employed respondents (International Standard Classification of Occupations 2008 major group), constraining interpretations concerning occupational cognitive demand.

Second, sample composition and selection may affect generalizability. SHARE surveys community-dwelling older adults, which may result in underrepresentation of individuals with severe health limitations. In addition, the employment status groups differ markedly in age, raising the possibility of age-related selection (e.g., survivor bias among retirees). We address this concern by flexibly controlling for age and by conducting robustness checks restricting the sample to ages 50-69; nevertheless, selection processes may still influence the estimated associations. Furthermore, although robustness checks yielded consistent results, selective attrition cannot be fully ruled out in longitudinal survey data.

Third, our study design estimates adjusted associations rather than causal effects. For instance, reverse mechanisms remain plausible. Cognitive decline can affect employment status (e.g., ability to work) and may also lead to social withdrawal (Dyer et al., 2021; Hajek & König, 2025). Furthermore, although the multilevel models account for the nested structure of the data, they cannot rule out confounding through unobserved characteristics, such as early-life cognitive abilities, that may jointly shape employment, social networks, and later-life cognition (Hofer & Clouston, 2014). Gender-specific moderation patterns should be interpreted cautiously, as they may partly reflect underlying differences in baseline distributions and sample composition, including selection into employment and social network categories, rather than distinct underlying mechanisms. We mitigate these concerns with robustness checks, excluding respondents reporting diagnosed cognitive impairment and respondents without social ties; however, the observational design still does not rule out reverse causality or unobserved confounding.

Conclusion

The present study provides important insights, using the *sn scale* as a proxy for social network strength, which considers functional and structural aspects, allowing us to draw a more comprehensive picture of participants' social relationships. The

results demonstrate that social networks may compensate for the cognitive stimulation lost from non-employment, with women benefiting from diverse networks and men relying on close ties. These findings have practical implications for promoting cognitive health among non-employed older adults and highlight the importance of considering gender as a structural factor shaping access to cognitively protective resources.

Future research and data collection on later life cognitive functioning may consider work histories and social networks to identify causal processes. Furthermore, it should unpack how institutionalized gender roles and their intersection with class and family structures shape gendered trajectories of cognitive aging and access to social capital in older adulthood.

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Supplemental Material

Supplemental material for this article is available online.

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