Exploring Mental Health: The Journey Across Life Cycle and Time*

Diego Ascarza-Mendoza[†], Walter Ruelas-Huanca[LI], and Christian Velasquez[‡]

[†]University of Minnesota

[LI]Central Reserve Bank of Peru

[‡]Boston College

November 10, 2023

Abstract

This paper documents the evolution of mental health over the life cycle and the last twenty years in the United States. We focus on depression and use data from the Panel Study of Income Dynamics (PSID) and the Health and Retirement Study (HRS). We document a U-shape of depression incidence over the life cycle with an inflection point around retirement age. Using a regression analysis, we document large disparities by income, wealth, sex, race, marital status, and the presence of children over the life cycle. We find that the rich, males, married individuals, whites, and individuals with children have a lower expected depression incidence than their counterparts. Over time, we find strong fluctuations corresponding to major events such as The Great Recession and the COVID-19 pandemic. Interestingly, while the average level of depression incidence has been usually stable, we document that the differences in mental health across individual characteristics have not been reduced in the last 20 years. To investigate the inflection point around retirement further, we use an event study design to study the impact of retirement on mental health. We find that retirement increases depression incidence by 5% at the time of retirement and that this effect reaches 11% six years later.

Keywords: Mental health, Retirement, Depression

*The views expressed herein are those of the authors and not necessarily those of the Central Reserve Bank of Peru

1 Introduction

The mental well-being of individuals is closely tied to their overall health and happiness, which in turn depends on their satisfaction with their lives and sense of belonging in society. As policymakers and academics increasingly recognize mental health as a crucial aspect of overall well-being, it is essential to examine economic and non-economic factors that impact it. To develop effective policies, it is necessary to collect empirical data on mental health at different life stages and over time. This paper aims to provide a comprehensive empirical analysis of mental health, focusing on depression, using widely-used datasets in Economic research. Specifically, we aim to document various facts about mental health throughout different life stages and over time.

We use two datasets in our study: the Panel Study of Income Dynamics (PSID) and the Health and Retirement Study (HRS). The PSID has been collecting information on mental health since 2001 and is valuable for analyzing individuals over the life cycle and over time. On the other hand, the HRS is more representative of the elderly population in the United States and has been collecting mental health measures since 1996. Our analysis focusing on the life stages before retirement mainly relies on the PSID, while the HRS is our primary data source for gathering information on the elderly.

Our analysis starts documenting empirical facts for the life stages before retirement. Using the PSID, we measure mental health with the Kessler Psychological Distress Scale (K6), a measure of psychological distress based on emotional state questions, to assess depression levels. We normalize this indicator to take a maximum value of 100 points. Higher values of this measure are interpreted as stronger depression symptoms. Leveraging on the longitudinal features of our datasets, we aim to answer the following questions: 1) How does the mental health of individuals evolve overall and across different characteristics over their life cycle? 2) What is the association between different individual characteristics and mental health? 3) Controlling for individual characteristics, how does the expected mental health evolve over the life-

cycle and over time?

Our findings reveal that mental health improves on average from young ages until retirement around the sixties. This decline aligns with narratives suggesting increased stability, both economically and emotionally, during this period. However, beyond the age of 65, we observe a subsequent increase in depression incidence, coinciding with the retirement age. When comparing individuals by income, we find that higher income is associated with lower depression incidence. We also find that while the path of depression incidence is decreasing for all income quintiles, there are differences in the slope of this pattern. These differences become visible when noticing that the income gap significantly shrinks after the fifties.

Subsequently, we conduct a life cycle analysis, exploring variations in sex, race, marital status, and the number of children. To have more precision about the effect of different characteristics, we use predictions from an econometric analysis that allow us to control for economic and noneconomic individual variables. In particular, we write an econometric specification that has our measure of depression incidence as the dependent variable, and we add sex, marital status, race, the presence of children in the household unit, physical health, income, and time-fixed effects as controls. Our econometric analysis depicts positive coefficients for the dummies associated with females and negative coefficients for the dummies of married individuals and those who live with children in the same household unit. In other words, we find that keeping everything else constant, males, married individuals, and those who live with children are associated with lower depression incidence. Interestingly, we find that with the mentioned controls, the coefficient associated with race (nonwhite individuals) is not statistically significant.

We next turn to compute the expected depression incidence using the predictions of our specification to study the evolution of depression incidence for different demographic groups and the evolution of the gap within groups over the life cycle. We start our analysis by documenting that females have, on average, an 8% higher expected

depression incidence than men. We also find that the gender gap increases until the forties and flattens afterward.

Regarding marital status, we find that nonmarried individuals have, on average, a 30% higher expected depression incidence than their counterparts. We also find that while this gap decreases until the fifties, it increases afterward. We interpret this result as suggesting that marriage overall has a positive effect on mental health directly and through other channels, such as higher income at the household level. Regarding race, we find that the expected depression incidence for nonwhite individuals is higher than the one for whites over the life cycle. Considering that we find a negative effect of income and physical health on depression incidence, we believe that differences in these observables at least partially account for this result. We also find that the racial gap grows over the life cycle.

The analysis of the presence of children is revealing. We find that the expected depression incidence for those who do not live with children is consistently decreasing over the life cycle. However, this is not the case for those who live with children. We find that those living with children exhibit a decreasing pattern only until the middle forties, and then they exhibit an increasing pattern. . Importantly, we find that while at early ages, individuals living with children have a lower expected depression incidence than their counterparts, this trend reverts after reaching the fifties. We interpret this as a very time-variant effect of children on mental health. In particular, the financial pressures from childcare expenses and a declining path of income after the fifties could be one of the explanations for this finding.

Next, our focus shifts towards examining the temporal changes in depression incidence over the period from 2003 to 2021. Employing the time-fixed effects from our baseline analysis, we identify two significant spikes in depression incidence during this timeframe: the Great Recession and the COVID-19 pandemic. We find that the spike generated during the pandemic was significantly higher than the one corresponding to the Great Recession, both in terms of the magnitude of the values for the time fixed-

effects coefficients and when computing the expected depression incidence for those years. Importantly, we find that despite swings, the gaps in 2021 by sex, race, and marital status have not been reduced relative to 2023.

The last section of the paper studies the evolution of mental health for the elderly using data from the HRS. Given the data availability in the HRS, We use the Center for Epidemiologic Studies Depression Scale (CES-D) scale indicator that also summarizes symptoms related to depression. As with our previous indicator, we normalize this measure to take a maximum value of 100, with higher values denoting more depression incidence. Consistent with our documentation from the PSID, we find that depression incidence decreases until reaching the sixties. However, we find that this pattern increases afterward. Motivated by the flip in the trend around retirement, we adopt an event study approach to study the effect of retirement on mental health. We find that retirement increases depression incidence by 5% at the time of the event and that this effect grows in subsequent years until reaching a value of around 11%. Importantly, this result is robust to different depression indicators and different specifications.

2 Related Literature

We engage with two strands of the literature. First, there is literature dedicated to provide empirical documentation regarding mental health and how this is related to different sociodemographic characteristics. For instance, there is a large body of literature that studies differences in mental health by sex. Among these studies, we can mention Rosenfield (1980), Harkness et al. (2010) and Albert (2015). Some studies focus on the effect of race on mental health. Among these studies, notable works include Harris et al. (2005), Williams et al. (1997), Dobalian and Rivers (2008) and Blanco et al. (2007). Most of these studies document disparities in mental healthcare and mental health problems by race. In particular, this literature finds that nonwhite individuals tend to do worse in terms of mental health than whites. The literature

has also documented a positive effect of marriage on mental health. For instance, Strohschein et al. (2005), Cotten (1999), and Johnson and Wu (2002) document the positive effects of marriage on mental health that poor economic conditions can offset. There is also a body studying whether children have any effect on the mental health of parents. Among these studies, Pollmann-Schult (2014) finds that parenthood by itself has positive effects on life satisfaction. While the literature has provided different studies that separately study the effect of specific sociodemographic characteristics on mental health, no study provides a unified set of empirical facts comparing different groups. In other words, we contribute by going one step back and first establishing a set of facts that will need an explanation in future research. The closest study to ours is Luo et al. (2023), which provides documentation for the elderly, but it does not include a comparison by economic groups. Also, to the best of our knowledge, this is the first study that provides empirical documentation using the PSID, a dataset that economists widely use.

The second strand of the literature we engage with seeks to understand the causal effect of retirement on mental health. There is a large number of studies trying to answer this question, and there is a rich variability in methodologies, datasets, and institutional contexts. Among these studies, we can mention Jokela et al. (2010), Vo et al. (2015), Drentea (2002), Kulik (2023), Buxton et al. (2005) Gorry et al. (2018), Heller-Sahlgren (2017), Dave et al. (2008), Nielsen (2019), Celidoni et al. (2017), Leimer and van Ewijk (2022). So far, there is no consensus in the literature regarding the sign and the magnitude of the effect of retirement on mental health. While some studies find a positive effect, very often, these results are found in countries with generous public pension systems in Europe. For the United States, the literature mostly finds a negative effect of retirement on mental health. Some of these studies have found these results using difference-in-difference regressions, fuzzy Regression Discontinuity Design, and combinations of fixed effect regressions with instrumental variables. We also find that retirement has a negative effect on mental health for different measures of depression

incidence using an event study design.

3 Mental health along the life-cycle

In this section, we show how mental health evolves over the life-cycle using the data from the Panel Study and Income Dynamics (PSID), which is a longitudinal survey representative of the U.S. population, conducted annually since 1968 and biennially since 1997. Since 2001, this survey contains rich information regarding different symptoms of depression and other mental disorders. We focus on studying depression and restrict our sample to include heads of households and their spouses[1]. While mental health is a multidimensional object and possibly measured in different ways, including many deficits, due to data availability, we approximate mental health with depression incidence, but through the paper, we use both terms interchangeably. In particular, we use the Kessler Psychological Distress Scale (K6, developed by Dr. Ronald Kessler) as the main indicator of depression incidence. This variable assesses psychological distress through six questions about a person's emotional state. The survey asks participants, in the past 30 days, how often they felt sad, nervous, restless, and hopeless, to which degree everything was an effort, and they felt worthless. Each question is scored from 0 (None of the time) to 4 (All of the time). The indicator is then obtained by summing the Scores of the six questions, yielding a minimum score of 0 and a maximum score of 24. To make interpretations easier, we further normalized this indicator to take a maximum value of 100.

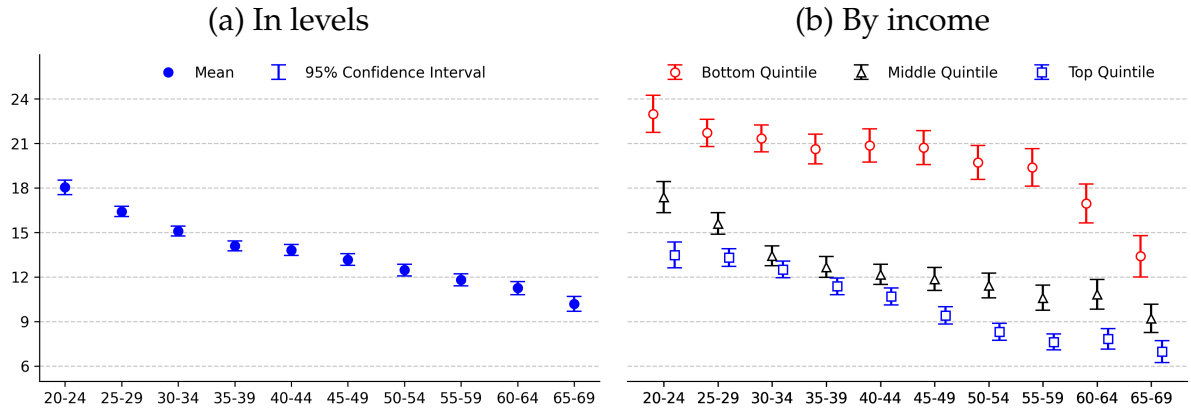
To show the path of our variable of interest and minimize problems related to small samples, for this part of the paper, we report the mean of the K6 over five-year age groups and restrict our sample to individuals who are between 20 and 69 years old. In what follows, we will call such reported moments depression incidence. We restrict our sample age to 69 because the PSID does not represent the elderly. Instead,

[1]A description of what a head is can be found in Heathcote et al. (2010)

in the next sections, we provide empirical facts for the elderly using the Health and Retirement Study (HRS).

Panel (a) of figure 1 shows the evolution of mental health over the life cycle. The figure shows that mental health consistently improves over the life cycle, going from a score of 18 points to a value of around 10 points when people reach their sixties. In panel (b) of the same figure, we illustrate the average depression incidence by different quintiles in the income distribution. The figure shows two important contrasts across income groups.

Figure 1: Depression incidence along the life cycle



Note: Income is calculated as the labor income of the home (head and spouse) adjusted by the family size and in real terms. The quintiles of income are calculated for each age group.

First, richer individuals tend to report lower depression incidence. In particular, there is a large difference between individuals at the bottom of the income distributions and those in the middle and the top quintiles. This aligns with lower stress levels and higher life satisfaction because of a better consumption capacity of goods and services. Also, the differences between individuals at the bottom of the income distribution and those at the middle are significantly larger than the difference between those at the top and those in the middle quintiles. This nonlinear relationship reflects a decreasing marginal utility of consumption that comes from expanding the consumption set.

Second, the shape of mental health follows different trends across the income distribution. In particular, it can be observed that there is an inflection point at the end of the fifties for those who are at the middle and the top quintiles of the income

distribution. Interestingly, it can be observed that for those at the bottom of the distribution, the incidence of depression quickly declines after the fifties. These facts could be consistent with a story in which the labor force participation of those at the bottom of distribution declines, and therefore, they experience an increase in their well-being that is derived from having more leisure. This feature could also be linked to individuals facing less economic obligations toward dependents, with the possibility of improving their self-care. In the case of those in the other quintiles, the flat pattern of depression incidence after the fifties could be associated with a significant decline in perceived income during those years that do not fully compensate for potential gains in welfare from leisure.

3.1 Depression incidence along the life-cycle by household characteristics

Besides the differences in depression incidence generated by different incomes, there are non-economic factors that can influence mental health. In this section, we use an econometric analysis to test whether these non-economic factors affect the incidence of depression[2]. Extensive literature has shown important differences in mental health between males and females (see Rosenfield (1980), Harkness et al. (2010), Albert (2015), among others). Thus, we include sex at birth as the first individual characteristic. The second set of characteristics captures the importance of the family situation and the presence of significant people as drivers of mental health. Following Strohschein et al. (2005), Cotten (1999), and Johnson and Wu (2002), who find that marriage can generate dispersion in mental health among individuals, we include this variable as one of our covariates. We also include living with children in the same household unit as one of our controls. This is motivated by previous studies that investigate the effect of children on mental health, including Pollmann-Schult (2014), which finds that parenthood by itself has substantial and enduring positive effects on life satisfaction.

The literature has also documented large disparities in the diagnosis and the usage

[2]A recent study Luo et al. (2023) performs a similar study with the HRS data

of mental healthcare by race and ethnicity. These studies include Harris et al. (2005), Williams et al. (1997), Dobalian and Rivers (2008), Blanco et al. (2007), among others. In particular, these studies find that nonwhite individuals tend to report more symptoms of depression than whites and that there is also a large racial gap in terms of healthcare and treatment of mental health issues. Thus, we include race as one of our covariates. Finally, because mental health and physical health are narrowly related, it is important to control for physical health in our analysis. Following Hosseini et al. (2022), we measure health using a frailty index. In Figure (9), we illustrate this strong connection between mental health and physical health. Let S denote a vector of characteristics, $S = \{\text{sex}, \text{married}, \text{child}, \text{race}\}$ and $s \in S$ be an individual characteristic, then our baseline specification is:

$$y_{ijt} = \alpha_0 + \sum_{s \in S} \beta_s D_{sjt} + \gamma_1 t + \sum_{s \in S} \gamma_3^s D_{sjt} t + \delta_w W_{ijt-1} + \delta_f f_{ijt-1} + \sum_{\tau} \theta_\tau + \epsilon_{ijt} \tag{1}$$

where y_{ijt} denotes our measure of mental health for an individual i in year j of age group t. The variable t is a categorical variable representing a certain 5-year age group. We do this to have a higher number of observations by age. This variable is monotonic, which makes it plausible to interpret any coefficient associated with it. The variables D_{sjt} correspond to dummies for each individual characteristic $s \in S$. To add the observed differences along the life cycle, we include a linear age-group trend denoted by t. Our specification also allows this evolution to differ across characteristics by interacting the trend with each category. The coefficients β_s represent the impact of dummy variables. The linear change throughout the lifecycle is denoted by γ_1. As for the interaction between demographic groups and lifecycle stages, we use γ_3^s to capture this relationship. Based on the previous discussion, we include income as a control. For our analysis, we measure income as the sum of labor incomes from the head of the household and the spouse, adjusted by family size (W_{ijt}). We also control for physical health (f_{ijt}), which is measured with a frailty index. Notice that when controlling for physical health and income, we add the lag of these variables as our covariates. We

do this to mitigate possible endogeneity problems arising from reverse causality. The exact definition of the frailty index and how to build it can be found in the Appendix B . Furthermore, we add time-fixed effects θ_τ to control for the business cycle and other aggregate phenomena.

Table 1: Regression results for determinants of *K6*

	K6			
	(1)	(2)	(3)	(4)
Female	1.35***	0.96***	1.28***	1.08***
	(6.22)	(3.77)	(4.97)	(4.25)
Married	-4.59***	-4.98***	-3.63***	-4.12***
	(-18.25)	(-16.22)	(-11.61)	(-13.43)
With children	-1.77***	-2.41***	-3.51***	-3.27***
	(-7.06)	(-7.89)	(-11.28)	(-10.67)
No white	0.50**	0.20	-0.70**	-0.19
	(2.21)	(0.73)	(-2.49)	(-0.71)
Agegroup	-0.65***	-1.31***	-1.04***	-1.43***
	(-13.63)	(-23.91)	(-18.65)	(-26.20)
Female # agegroup	-0.13***	-0.17***	-0.17***	-0.20***
	(-3.43)	(-4.20)	(-4.02)	(-4.86)
Married # agegroup	-0.06	0.17***	0.05	0.19***
	(-1.36)	(3.26)	(0.91)	(3.72)
With children # agegroup	0.24***	0.41***	0.54***	0.55***
	(5.17)	(7.75)	(9.90)	(10.37)
No white # agegroup	-0.05	-0.09**	0.01	-0.09*
	(-1.25)	(-2.00)	(0.12)	(-1.89)
Observations	109616	86196	86196	86196
Time fixed effects	x	x	x	x
Lag of log of household income			x	x
Lag of physical health		x		x

Note: Age variable has been diminished by the lowest value and divided by 10.
Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

The results of our main specification are reported in column (4) of Table (1). This table reports coefficients for our regression with different twists in the specification. We find that men and married people are associated with lower levels of depression incidence. Furthermore, we find that having children is associated with lower depression incidence, but this effect shrinks with age. We also find that without controlling for economic factors or physical health, non-white individuals are associated with a slightly positive effect on depression incidence. However, once we control for these

variables, the effect of race on mental health becomes negligible. Finally, consistent with our narrative of better economic conditions as a good vehicle for lower depression incidence and good physical health as narrowly related to good mental health, we find that the coefficients for these controls are negative and statistically significant.

Regarding sex, the coefficient associated with the dummy that indicates being a female is positive, meaning that keeping everything else constant, there is a positive association between depression incidence and women. This association, however, shrinks over time since the coefficient that interacts age groups with sex is negative. This result is robust to different specifications. In panel (a) of Figure (2), we show the expected depression incidence by sex using the predictions of our specification. The figure depicts a consistent positive gap in expected depression incidence between women and men, consistent with the sign of our coefficients. Specifically, we find that females have, on average, an 8% higher depression incidence than men and that the gender gap is increasing until the forties and flat afterward. In terms of levels, the average depression incidence for females is around 20 in their twenties and declines until almost 12 when reaching their sixties. For males, this number is around 19 points around their twenties and almost 10 points when reaching their sixties.

Next, we analyze the association between marital status by considering two groups: married individuals and nonmarried[3]. Our analysis shows a negative association between marriage and depression incidence. While this effect shrinks with age because of the positive sign of the interaction between marital status and age, it does it at a relatively slow pace. In panel (b) of Figure (11), we illustrate the expected depression incidence of married and nonmarried individuals over the life cycle. As can be seen, when controlling for different covariates, nonmarried individuals, on average, have a 30% higher expected depression incidence than married individuals. Interestingly, the picture depicts a declining path in the gap by marital status up to reaching the fifties,

[3]Married individuals also include couples living in the household unit. Nonmarried individuals include singles, divorced, and widows

and then a sudden jump in the gap can be observed. At first glance, it is difficult to suggest what drives this break. These differences are greater than 4 points but lower than 6 points in levels. In levels, nonmarried individuals report a depression incidence of around 20 points in their twenties and reach a minimum of almost 16 points around their fifties. Married individuals report an expected depression incidence around 16 in their twenties, and this goes down to almost 10 in their sixties. We interpret these results as suggesting that marriage, on average, has a positive effect on mental health directly and through other channels, such as higher income at the household level.

We find that living with children under 18 in the same home unit has a negative effect on depression incidence is negative. However, this effect shrinks with age. In panel (c) of Figure (2), we show and compare the depression incidence for individuals who live and who do not live with children. Surprisingly, we find that while the gap between those with and without kids is negative up to middle age, the sign of this gap becomes positive later on. In particular, we find that while the path of depression incidence for individuals without children consistently declines with age, this is not the case for those with children. Individuals who have children at home report an increasing pattern of depression incidence after reaching the fifties. Many factors could be behind this feature. For instance, because most households experience a declining income path after the fifties, having children at those ages can be a potential source of financial stress, given the significant economic responsibilities of raising children. Additionally, this could be partially driven by selection. For instance, those who report living with children after their fifties could have a higher likelihood of having more children than those who do not. Because of the large number of children, the financial stress of these individuals could be higher. All of this, of course, would need an extensive study. The expected depression incidence of those without children is around 21 points in their twenties, and this decreases until reaching almost 11 points in the sixties. For those who live with children, this number is around 18 points in their twenties, decreases to reach a value of around 12 points in their fifties, and then

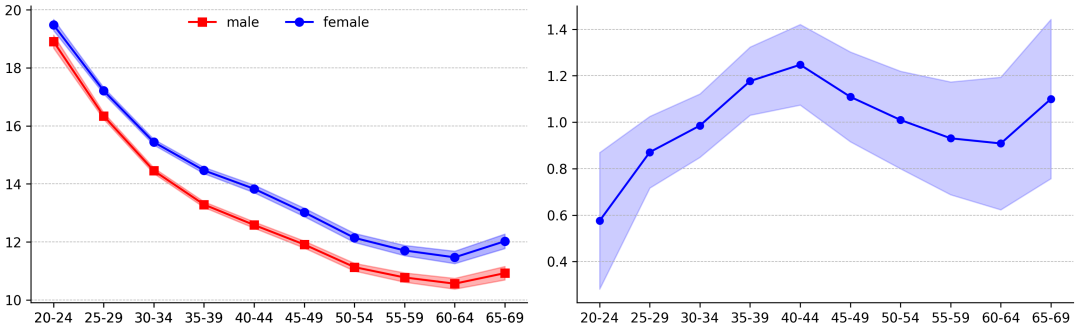
it increases again afterward until reaching 15 points.

Our analysis by race suggests that when physical health and income are omitted, race has a positive coefficient on depression incidence. However, once we incorporate these controls, we find that race does not affect depression incidence. Panel (d) in Figure (2) shows the expected depression incidence by race. The figure shows that there is a consistent positive gap in the expected depression incidence between nonwhite and white individuals. Importantly, the figure shows that these differences are statistically significant and widen at the end of life. Because the coefficient associated with race is nonsignificant, this picture shows that disparities in other observables, such as income and physical health, account for the observed racial disparities over the life-cycle. In terms of levels, the expected depression incidence for nonwhite individuals is around 20 points in their twenties, reaches a minimum of 12 points around the fifties, and remains flat afterward. White individuals report a depression incidence around 19 around their twenties, and this number consistently declines until reaching the sixties, taking a value of around 10 points.

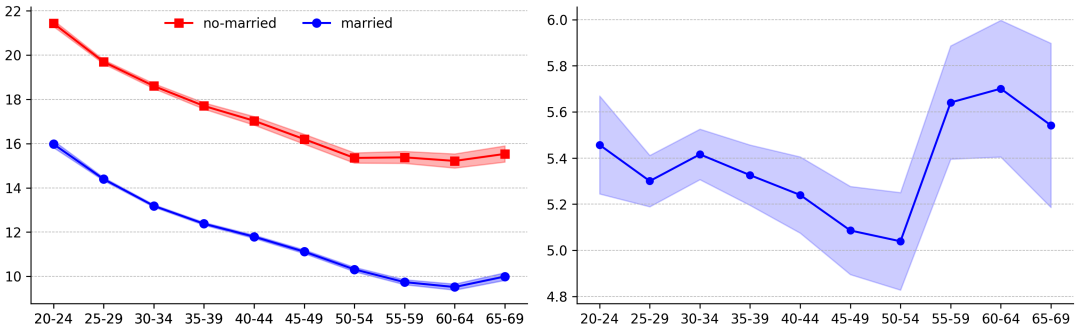
Overall, our results suggest that women, nonmarried individuals, and nonwhite individuals have a higher expected depression incidence than their counterparts over the life cycle. Furthermore, the effect of living with children depends heavily on the age at which this happens. For young and middle-aged individuals, the expected depression incidence of those living with children is lower than their counterparts, but this is the opposite for the elderly. Finally, we show that while race itself does not affect depression incidence, there are significant differences in expected depression incidence between white and nonwhite individuals that are accounted for by other variables such as income and physical health.

Figure 2: Depression incidence by household characteristics over the life cycle

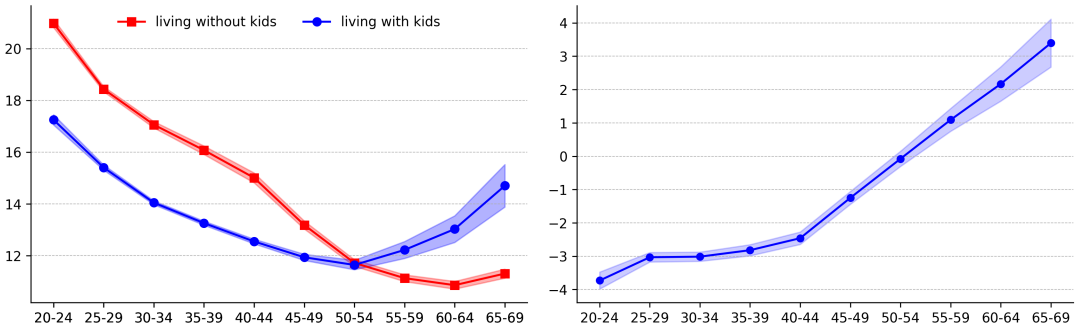
(a) sex at birth in levels and gap



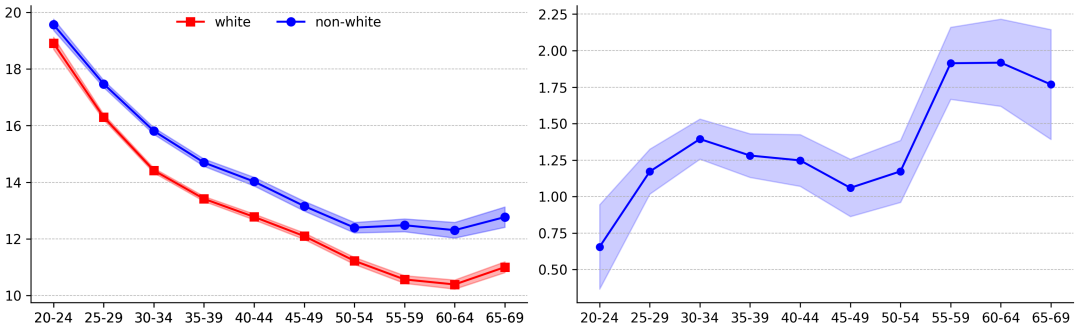
(b) marital status in levels and gap



(c) living with children in levels and gap

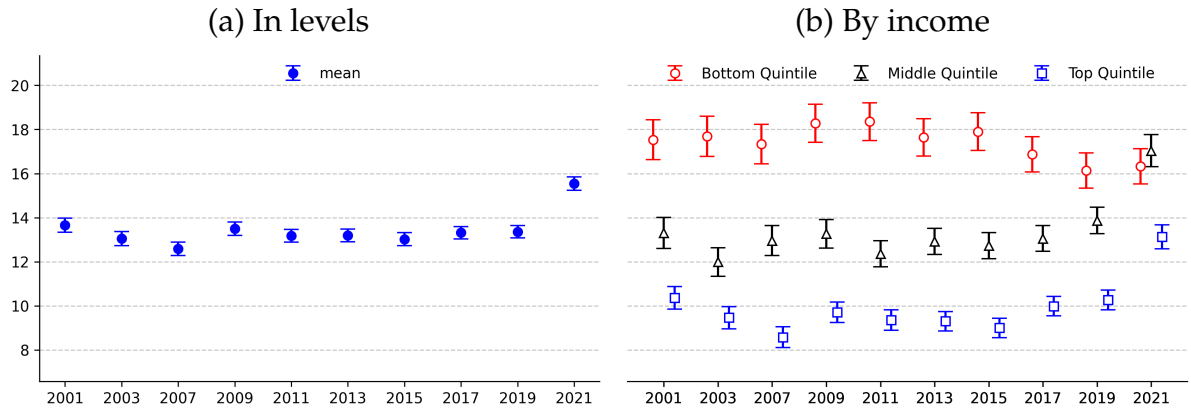


(d) whites vs non-whites in levels and gap



Note: The point estimates represent the average by age groups from the predictions of our baseline specification (equation 3.1). The bands are at 95% confidence. Gaps are calculated based on a mean test.

Figure 3: Depression incidence over time



Note: Income is calculated as the sum of the labor income of head and the spouse, adjusted by family size. The quintiles of income are calculated for each year.

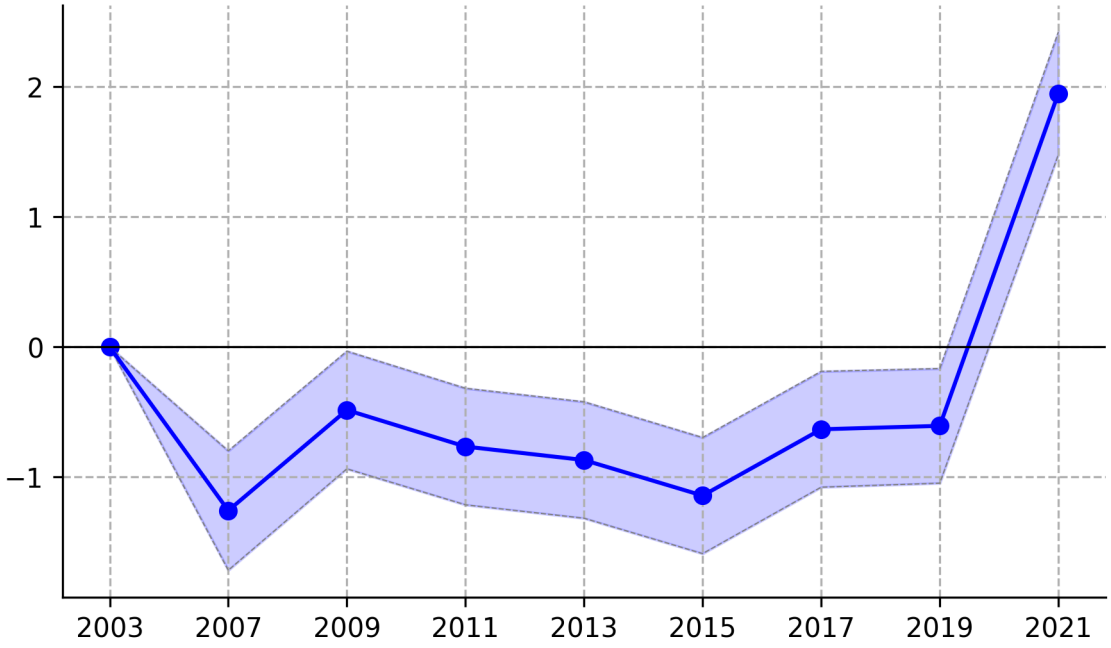
4 The time dimension

This section studies the evolution of mental health from 2003 to 2021. As a first exploration, using our baseline specification in 3.1, we plot the coefficients associated with time-fixed effects to see how mental health has evolved relative to 2003. One caveat of our exercise is that we do not have data for 2005, so our exercise does not include that period. Figure 4 shows that the coefficient associated with the time effect in 2009 was higher than all periods except the one associated with the COVID-19 pandemic. This would imply that while the aggregate effect coming from the Great Recession and the pandemic positively affected depression incidence, the effect of the latter was substantially larger. Overall, the picture suggests that while individual characteristics shape the profile of the mental health of individuals, this can also be significantly affected by aggregate phenomena such as economic crises or pandemics.

4.1 How have differences within groups evolved over time?

In this section, we use our econometric analysis in 3.1 to study how the differences within categories in demographic groups have evolved, controlling for observable characteristics. To do this, we compute the average depression incidence by demographic characteristics and year. The results are shown in Figure 5.

Figure 4: The evolution of depression incidence over time



Note: The unconditional mean of depression incidence in 2003 was 13.1%.

Panel (a) shows the evolution of expected depression incidence by sex over time. The figure shows that depression incidence had a relatively stable path between 2003 and 2019 for both males and females. The COVID-19 pandemic had an important effect on both groups. The effect of the Great Recession was milder. In terms of gaps, our picture shows that the gap in depression incidence between men and women has not shrunk at all. Instead, it can be observed that the gap in expected depression incidence by sex is higher in 2021 than in 2003.

Panel (b) the expected depression incidence by marital status. The picture depicts a stable pattern of expected depression incidence for both groups, with a significant increase generated by the COVID-19 pandemic. Over time, married individuals have presented a lower expected depression incidence than their counterparts. Also, our analysis shows that while the gap by marital status has been declining since 2013, it still can be observed that the gap between these two groups is higher than in 2003.

Panel (c) shows the evolution of expected depression incidence over time for individuals who live with children and those who do not. The picture shows a very

similar evolution for these two groups, a stable pattern in most of our study period and with an important jump during the pandemic. However, it is interesting to notice that while the difference between these two groups was not statistically significant until 2017, the difference has become negative and statistically significant since 2019 in favor of those who live with children. Looking back to 2015, we can observe that starting in 2015, the point estimates of the difference in expected depression incidence between these two groups followed a downward trend.

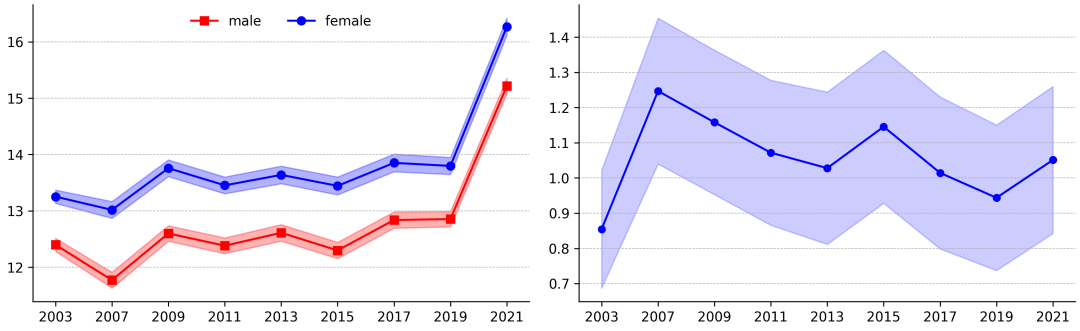
5 The Mental Health of the Elderly

In our analysis over the life-cycle, we restricted our analysis to individuals younger than 70. This is because the PSID is not very representative of older individuals. Instead, to study the mental health of the elderly, we use the Health and Retirement Study (HRS). The HRS is a nationally representative sample of individuals over the age of 50. It is run biennially. We use the Core final release of 12 waves of the HRS (1996-2018). Our mental health measures focus on depression and its symptoms. In particular, we measure depression with the Center for Epidemiological Studies-Depression (CESD) scale. The CESD scale summarizes symptoms related to depression. This measure is extensively used in the literature. The indicator is built using eight sub-indicators. There are six negative sub-indicators (depression, everything is an effort, sleep is restless, loneliness, sadness, could not get going) and two positive indicators (happiness and enjoyed life). The respondent is asked whether they experienced each symptom during the week before the interview. Each of these symptoms can take values of 0 or 1. Our indicator is built by adding up the values of all symptoms, and then we normalize the total to 100. The higher the indicator, the worse mental health is.

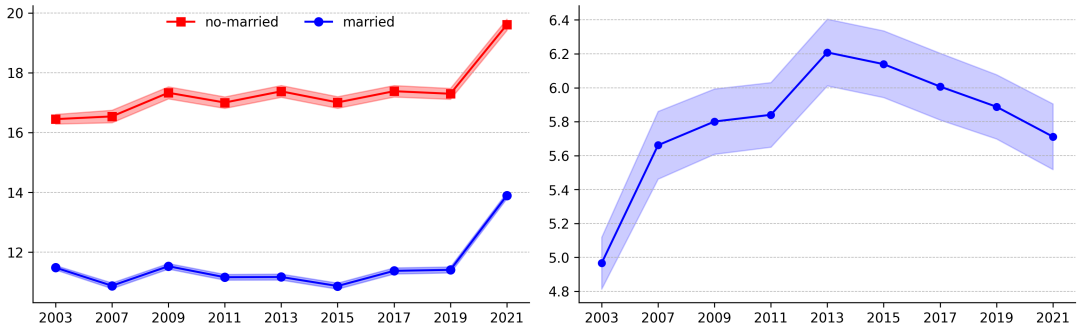
Our analysis starts by showing how the incidence of depression varies after reaching 50 years old. To show the path of depression over the life cycle and minimize problems related to a small sample size, as in the analysis using the PSID, we report the mean of

Figure 5: Depression incidence by household characteristics over time

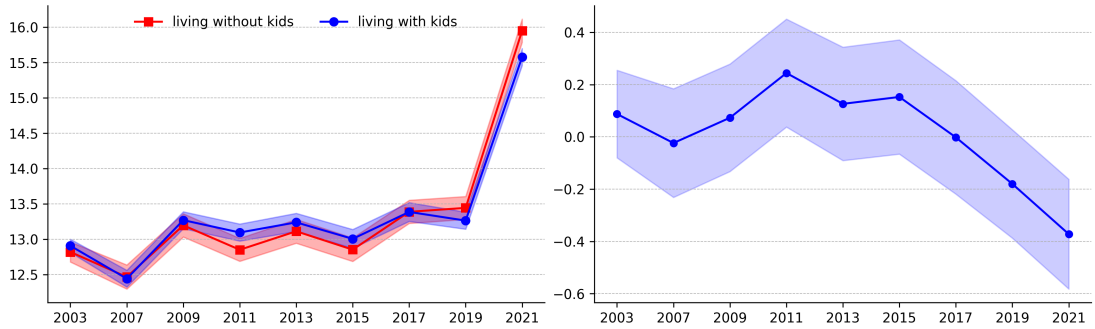
(a) sex at birth in levels and gap



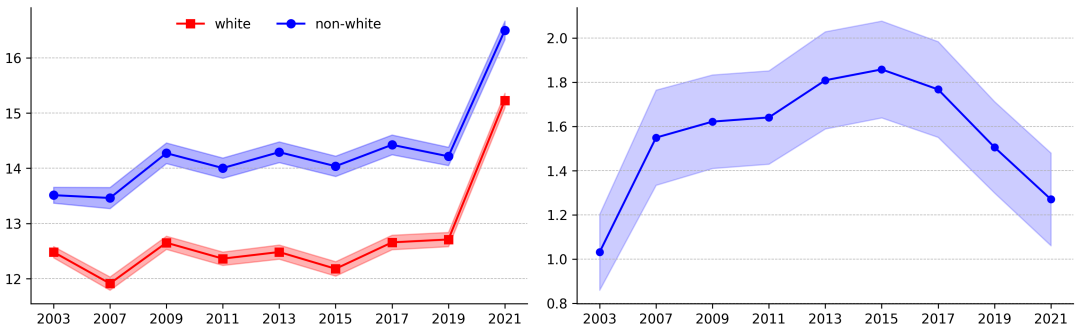
(b) marital status in levels and gap



(c) living with children in levels and gap



(d) whites vs non-whites in leveles and gap



Note: The point estimates represent the average by year of the predicted depression incidence from our core specification (equation 3.1), and the bands are at 95% confidence. Gaps are calculated based on a mean test.

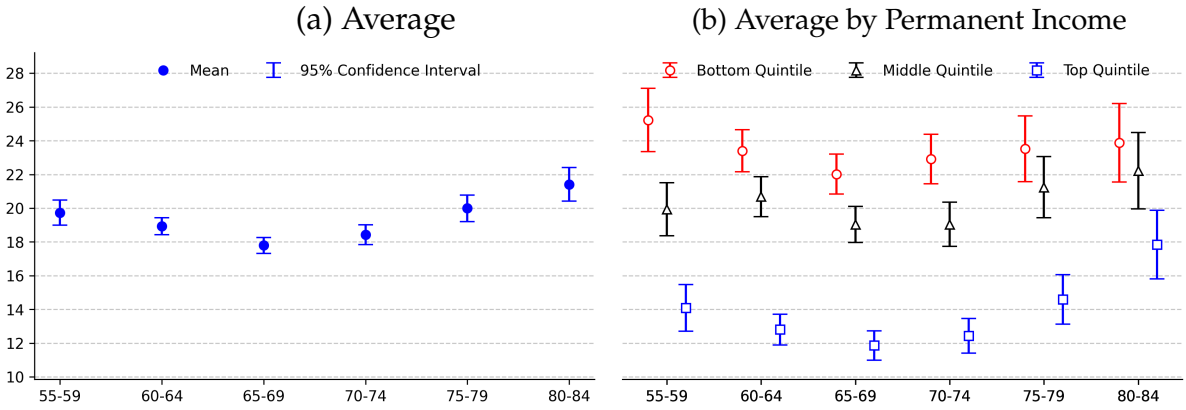
our CESD scale indicator over five-year age groups. In what follows, we will call such reported moment depression incidence.

Panel (a) of Figure (6) shows that -on average- there is a decline in the depression incidence in people younger than 70 years old. After that period, the incidence of depression increases from 18% to more than 21%. The pattern follows a U-shape and can be consistent with the fact that individuals are at their peak in terms of assets and income between 55 and 65 years old, and after that, because of retirement or lower labor participation, they start perceiving less income. To show whether this behavior is related to income, we compute our indicator for different quintiles of the permanent income distribution. Following De Nardi et al. (2010), we measure permanent income as the average income perceived over the life cycle by each individual. Because the income perceived after retirement is typically a function of past labor earnings, this is a good proxy for permanent income. We calculate the quintiles on an age group base. In particular, for each age group, we compute the permanent income distribution. Our results show that, regardless of the ranking in permanent income, the evolution of depression incidence exhibits a U-shape for the elderly. Consistent with our analysis using the PSID, we find important differences in levels between the rich and the poor. In particular, on average, the rich tend to report lower depression incidence than the poor.

There are two additional features to highlight from this figure. First, the increase in depression incidence after the sixties is much steeper for the rich than for the poor. In particular, at the end of life, the picture suggests that the differences in depression incidence between the rich and the poor mostly disappear. Second, considering that most retirement decisions happen between 60 and 65 years, the figure suggests that retirement can act as a breaking point in terms of the evolution of mental health for the elderly. This last feature is surprising since there is not a strong prior regarding how retirement can affect mental health. On one side, individuals may enjoy more leisure, which is positive for mental health, but on the other side, they stop receiving

labor income, and their physical health starts to deteriorate faster, and stopping work to work might have a negative non-pecuniary effect on mental health. The next section elaborates more on the effect of retirement on mental health, and as we will see, it turns out that in the United States, retirement increases depression incidence.

Figure 6: Depression incidence of the elderly over the life cycle



Note: Permanent income is approximated as the social security income in real terms. The quintiles of income are calculated for each age group.

5.0.1 Depression incidence for the elderly by household characteristics

As in the previous sections, we study the evolution of depression incidence by different demographic groups. We consider three demographic characteristics that could influence depression incidence: 1) sex, 2) marital status, and 3) number of children. Our findings show the following facts: first, the U-shape pattern of depression incidence remains for each demographic group. Second, as before, there are important differences in levels by sex and marital status, but not by number of children. The results are displayed in Figure (7).

Panel (a) shows that -on average- women report higher depression incidence than the mean. These differences are significant and vary between 4% and 7% in levels. After controlling for permanent income effects, we observe that these differences are reduced at every quintile of permanent income, but they are especially significant for the bottom and the top quintiles. The analysis by permanent income can be found in Figure (12).

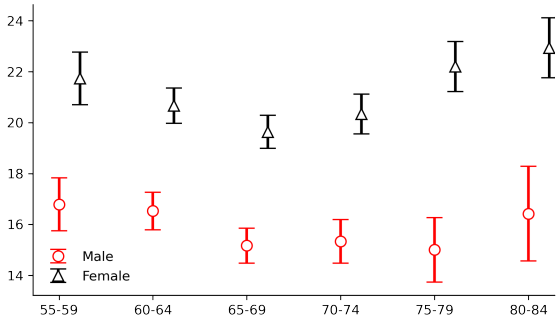
In panel (b), we perform the same analysis by marital status. As before, we consider two groups: married and non-married individuals. Our results show that nonmarried individuals report higher depression incidence than married individuals, and these differences are large. In levels, they oscillate around 10%, which represents more than half of the reported value of married individuals. When comparing quintiles of the permanent income distribution, we find that these differences shrink, but they do not fully disappear. In other words, at advanced ages, economic conditions could not fully compensate for the effect of a sense of loneliness on mental well-being.

In panel (c), we do the same analysis comparing individuals with and without children. An important difference with respect to our previous analysis is that here, having children means being a parent but does not necessarily mean living with children. Our results show, on average, no significant differences exist between individuals with and without children. When comparing these two groups by permanent income, we find this result invariant to the quintile of permanent income. The main caveat in this exercise is that we do not have many observations of married individuals without children. However, we do have enough observations of no married individuals without children, and we find that for that group, it turns out that, surprisingly, there are no significant differences in depression incidence.

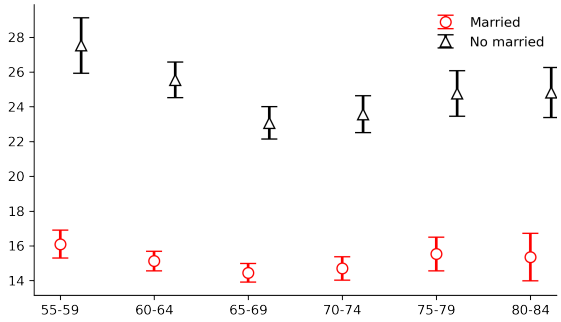
Overall, the analysis by different groups suggests that there are important differences in levels by marital status and sex. Also, while there are differences in levels, it is interesting to observe that all these groups exhibit a U-shape pattern of depression incidence over age. In particular, the sixties seem to act as a breaking point in mental health, which leads us to consider the following: First, it is important to control for the life-cycle effect to perform a causal analysis. Second, it is important to control by different demographic characteristics, given that there are important differences in levels across demographic groups. Finally, considering that most individuals retire when they are in their sixties, it is important to study whether this breaking point reflects a possible effect of retirement on mental health. In the next section, we perform

Figure 7: Depression incidence for the elderly by household characteristics

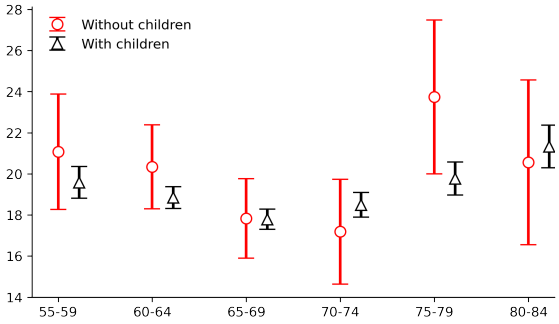
(a) sex at birth



(b) marital status



(c) number of children



Note: Bands are at 95% confidence.

a causal analysis of the effect of retirement on mental health.

5.1 The Impact of Retirement on Mental Health

The HRS is a longitudinal study that allows us to build a panel of individuals. In particular, we can track demographic characteristics, mental health measures, and information regarding retirement timing. Given the characteristics of our dataset and our interest in studying the effect of retirement on mental health, which happens at different times for different individuals, we adopt an event study design. Our outcome of interest is our measure of mental health, and our event consists of retiring. The event study approach has the additional advantages of tracing out the full dynamic trajectory of the effects and being precise as it exploits individual-level variation in retirement timing. We denote by $t = 0$, the time in which an individual retires, and we index all those years relative to this event.

Although the age of retirement is not exogenous, the event of retiring generates sharp changes in depression incidence that are arguably orthogonal to unobserved determinants of depression, as they should have a smooth evolution over time. In our baseline specification, we consider a panel of individuals that can be observed between six years before they retire and ten years after they retire. We study the evolution of depression incidence as a function of event time. Also, since we are interested in the effect of retirement, we restrict our sample to individuals between 55 and 70 years old since most retirement decisions happen during this time frame. Denote by Y_{ist} the CES-D scale indicator for an individual i in year s at event date t. Our baseline specification is as follows:

$$Y_{ist} = \sum_{j \neq 1} \alpha_j, \mathbb{I}[j = t] + \sum_k \beta_k . \mathbb{I}[k = age_{is}] + \sum_y \gamma_y \mathbb{I}[y = s]$$
$$+ \sum_z \varphi_z \mathbb{I}[\text{ind. characteristics}] + \psi h_{ist} + v_{ist}$$

We omit the event time dummy at $t = -1$, implying that the event time coefficients $\alpha's$ measure the impact of retirement relative to two years before retirement. By including a full set of age dummies, we control non-parametrically for underlying life-cycle trends. By including a full set of year dummies, we control non-parametrically for time trends such as business cycles. We can identify the effect of all dummy sets because, conditional on age and year, there is variation in time events. As we saw in the previous section, individual characteristics such as marital status, sex, and having children could impact our measure of mental health. Because of this, we add these variables as covariates. Specifically, we control for those characteristics and collect their coefficients in a set of individual dummies denoted by φ_z. We also control for physical health using a frailty index, following Hosseini et al. (2022). We control for physical health as it is highly correlated with mental health, and because the HRS has a rich set of health measures that allow us to build this indicator. In Appendix B, we

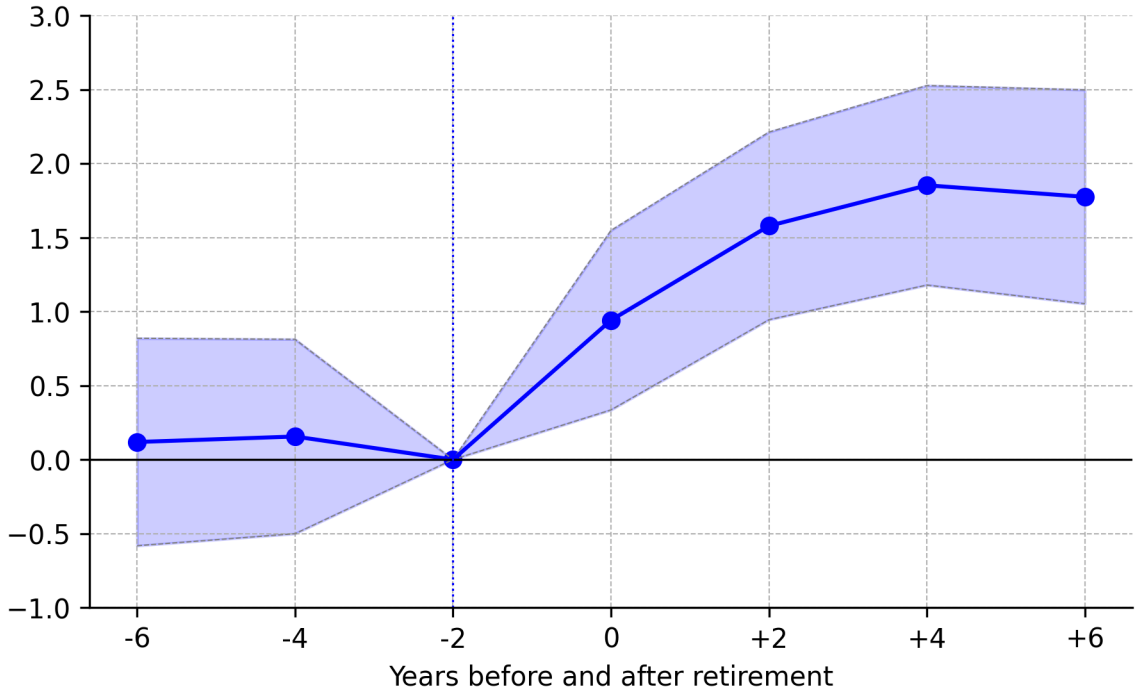
list the deficits used to build the frailty index.

5.2 Estimating the Impact of Retirement

In this section, we present estimates of the impacts of retirement on the trajectory of the incidence of depression. Figure (8) plots the coefficients of our event dummies. As can be seen, the effect of retirement on depression incidence is positive, statistically significant, and large, implying that retirement has a negative effect on mental health in the United States. The coefficients' magnitude indicates an increase in depression incidence by 6% at the moment of retirement and that this effect keeps growing in the next years to reach almost 12%. This suggests that retirement has a short-run effect on mental health, which contrasts with other studies such as Heller-Sahlgren (2017) that find a mild effect of retirement on mental health in European countries. The figure also shows that this effect is persistent and grows over time. Interestingly, our exercise suggests that the effect of retirement on mental health is not anticipated by individuals, at least in the six years before retirement. This is observed with the flat pattern of the coefficients before the event and their non-significance. In Table (2), we report the coefficients associated with our other controls for different specifications. The table shows that our coefficients are consistent with our former results. In particular, we find a positive coefficient associated with sex, reflecting that keeping everything else constant, females are associated with higher depression incidence. The coefficient for marital status is negative and large. Interestingly, we find that having children has a positive coefficient, indicating that they increase depression incidence. Finally, consistent with our observation that richer individuals report lower levels of depression, we find a negative and significant coefficient for permanent income.

To test the robustness of our results, we perform a similar exercise using different measures of depression. We consider two alternative indicators: 1) The first one converts our CESD scale into a dummy variable by using a threshold $c = 0.3$ such that

Figure 8: The impact of retirement on mental health



Note: 17.59 percent is the overall mean sample of depression incidence two years before retirement. Bands represent 95% confidence interval.

if the CESD scale takes a value that is higher than the threshold, then the modified indicator takes the value of 1. We find that our results are robust to different measures of mental health.

6 Conclusions

We study the evolution of mental health with a focus on depression incidence over the life cycle and over time. We provide several interesting and novel empirical findings. First, we show that depression incidence has a U-shape over the life cycle with a breaking point around retirement age. Second, we show that there are important heterogeneities in levels and slopes by demographic characteristics. In particular, we document that males, whites, married people, and individuals with children report lower expected depression incidence than their counterparts. We also show that a significant fraction of these differences are accounted for by income and physical health.

Table 2: Event Study Design regression results

	CESD (8)			CESD (8)>c			Depression		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Female	2.880***	2.726***	0.973***	-0.601*	0.553	-3.075***	3.694***	4.011***	2.322***
	(0.199)	(0.505)	(0.183)	(0.355)	(0.892)	(0.338)	(0.274)	(0.671)	(0.267)
Married	-8.805***	-8.943***	-6.917***	-10.16***	-11.71***	-7.419***	-8.143***	-7.488***	-6.618***
	(0.222)	(0.553)	(0.204)	(0.379)	(0.941)	(0.361)	(0.312)	(0.747)	(0.305)
With children	2.030***	2.312**	0.732*	1.547**	2.430	-0.239	1.689***	0.0689	0.685
	(0.417)	(1.061)	(0.383)	(0.727)	(1.836)	(0.689)	(0.577)	(1.483)	(0.562)
PIH	-3.322***	-3.320***	-2.046***	-6.252***	-6.261***	-4.427***	-3.525***	-3.520***	-2.511***
	(0.158)	(0.158)	(0.138)	(0.274)	(0.274)	(0.252)	(0.214)	(0.213)	(0.204)
N	63217	63217	63217	67867	67867	67865	67867	67867	67865
Cohort FE	x	x	x	x	x	x	x	x	x
Time FE	x	x	x	x	x	x	x	x	x
Age group	x	x	x	x	x	x	x	x	x
Physical health			x			x			x
Dummy events	x	x	x	x	x	x	x	x	x
i.X # dummy event		x			x			x	

Note: PIH denotes permanent income by household, which is scaled by the natural logarithm.
Standard errors in parentheses.
* p<0.10, ** p<0.05, *** p<0.01.

In our analysis over time, we show that the average level of depression incidence has exhibited a stable pattern with important spikes during the Great Recession and the COVID-19 pandemic. We also find that there has not been a reduction in the gap in mental health by sex, race, and marital status. Finally, using an event study design, we find that retirement increases depression incidence by 6% and that this effect is persistent and grows up to 12% six years after retirement.

This paper provides a comprehensive set of empirical facts regarding mental health with an emphasis on depression. In future research, it would be important to find causal explanations to the facts we document in this study. Also, it would be interesting to document empirical facts associated with other mental health issues, such as anxiety. Our causal analysis of retirement can be highly improved with the availability of datasets that allow researchers to exploit exogenous shifts in retirement due, for instance, to reforms.

References

Albert, P. R. (2015). Why is depression more prevalent in women? *Journal of Psychiatry and Neuroscience*, 40(4):219–221.

Blanco, C., Patel, S. R., Liu, L., Jiang, H., Lewis-Fernández, R., Schmidt, A. B., Liebowitz, M. R., and Olfson, M. (2007). National trends in ethnic disparities in mental health care. *Medical care*, pages 1012–1019.

Buxton, J. W., Singleton, N., and Melzer, D. (2005). The mental health of early retirees: National interview survey in britain. *Social psychiatry and psychiatric epidemiology*, 40:99–105.

Celidoni, M., Dal Bianco, C., and Weber, G. (2017). Retirement and cognitive decline. a longitudinal analysis using share data. *Journal of Health Economics*, 56:113–125.

Cotten, S. R. (1999). Marital status and mental health revisited: Examining the importance of risk factors and resources. *Family Relations*, pages 225–233.

Dave, D., Rashad, I., and Spasojevic, J. (2008). The effects of retirement on physical and mental health outcomes. *Southern Economic Journal*, 75(2):497–523.

De Nardi, M., French, E., and Jones, J. B. (2010). Why do the elderly save? the role of medical expenses. *Journal of Political Economy*, 118(1):39–75.

Dobalian, A. and Rivers, P. A. (2008). Racial and ethnic disparities in the use of mental health services. *The journal of behavioral health services & research*, 35:128–141.

Drentea, P. (2002). Retirement and mental health. *Journal of aging and health*, 14(2):167–194.

Gorry, A., Gorry, D., and Slavov, S. N. (2018). Does retirement improve health and life satisfaction? *Health economics*, 27(12):2067–2086.

Harkness, K. L., Alavi, N., Monroe, S. M., Slavich, G. M., Gotlib, I. H., and Bagby, R. M. (2010). Gender differences in life events prior to onset of major depressive disorder: the moderating effect of age. *Journal of abnormal psychology*, 119(4):791.

Harris, K. M., Edlund, M. J., and Larson, S. (2005). Racial and ethnic differences in the mental health problems and use of mental health care. *Medical care*, pages 775–784.

Heathcote, J., Perri, F., and Violante, G. L. (2010). Unequal we stand: An empirical analysis of economic inequality in the united states, 1967–2006. *Review of Economic Dynamics*, 13(1):15–51. Special issue: Cross-Sectional Facts for Macroeconomists.

Heller-Sahlgren, G. (2017). Retirement blues. *Journal of Health Economics*, 54:66–78.

Hosseini, R., Kopecky, K. A., and Zhao, K. (2022). The evolution of health over the life cycle. *Review of Economic Dynamics*, 45:237–263.

Johnson, D. R. and Wu, J. (2002). An empirical test of crisis, social selection, and role explanations of the relationship between marital disruption and psychological distress: A pooled time-series analysis of four-wave panel data. *Journal of marriage and family*, 64(1):211–224.

Jokela, M., Ferrie, J. E., Gimeno, D., Chandola, T., Shipley, M. J., Head, J., Vahtera, J., Westerlund, H., Marmot, M. G., and Kivimäki, M. (2010). From midlife to early old age: health trajectories associated with retirement. *Epidemiology (Cambridge, Mass.)*, 21(3):284.

Kulik, L. (2023). Sources of empowerment and mental health among retired men and women: An ecological perspective. *Journal of Women & Aging*, 0(0):1–19. PMID: 37310726.

Leimer, B. and van Ewijk, R. (2022). No "honeymoon phase": whose health benefits from retirement and when. *Economics Human Biology*, 47:101171.

Luo, M., Li, L., Liu, Z., and Li, A. (2023). Sociodemographic dynamics and age trajectories of depressive symptoms among adults in mid- and later life: a cohort perspective. *Aging & Mental Health*, 27(1):18–28. PMID: 34865567.

Nielsen, N. F. (2019). Sick of retirement? *Journal of Health Economics*, 65:133–152.

Pollmann-Schult, M. (2014). Parenthood and life satisfaction: Why don't children make people happy? *Journal of Marriage and Family*, 76(2):319–336.

Rosenfield, S. (1980). Sex differences in depression; do women always have higher rates? *Journal of Health and Social Behavior*, 21(1):33–42.

Strohschein, L., McDonough, P., Monette, G., and Shao, Q. (2005). Marital transitions and mental health: are there gender differences in the short-term effects of marital status change? *Social science & medicine*, 61(11):2293–2303.

Vo, K., Forder, P. M., Tavener, M., Rodgers, B., Banks, E., Bauman, A., and Byles, J. E. (2015). Retirement, age, gender and mental health: findings from the 45 and up study. *Aging & Mental Health*, 19(7):647–657. PMID: 25271125.

Williams, D. R., Yu, Y., Jackson, J. S., and Anderson, N. B. (1997). Racial differences in physical and mental health: Socio-economic status, stress and discrimination. *Journal of health psychology*, 2(3):335–351.

APPENDIX

A Additional Figures with the PSID Sample

Figure 9: Frailty index vs depression incidence (K6 index)

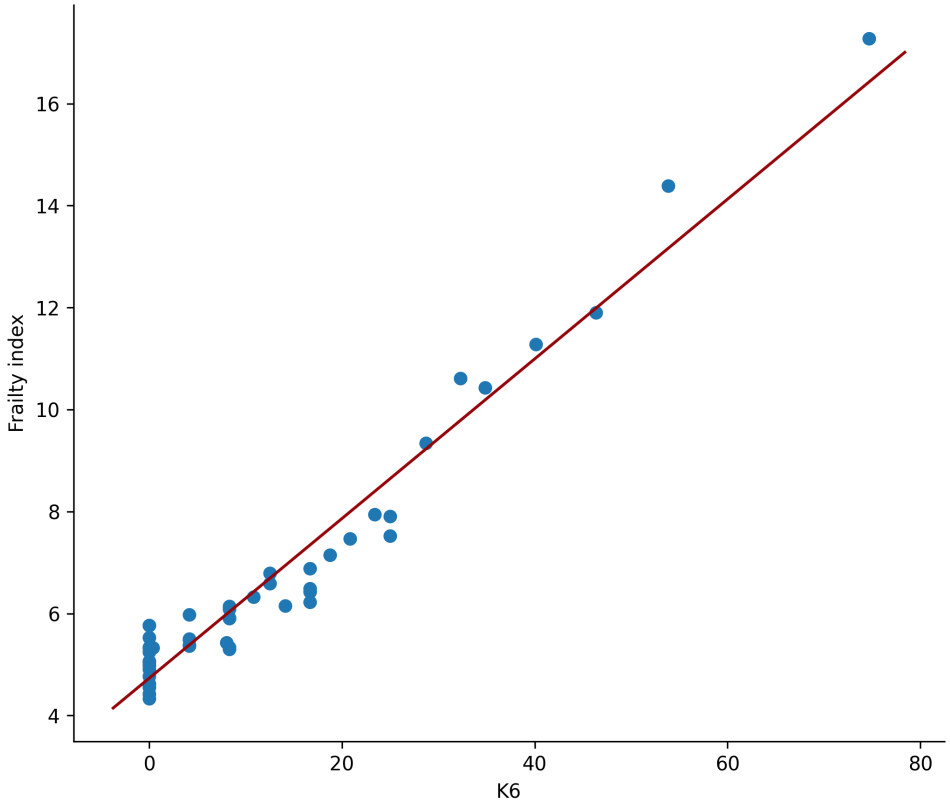
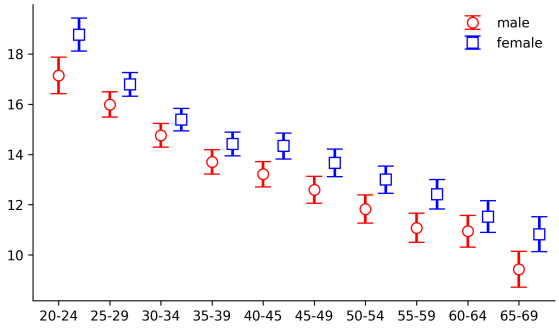
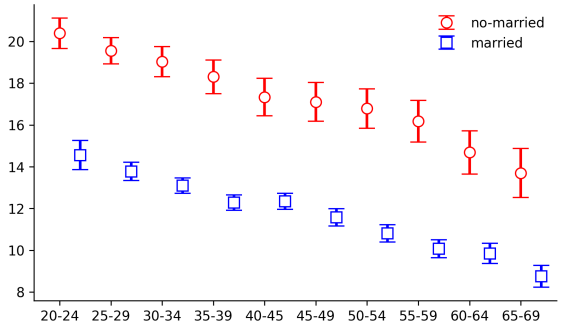


Figure 10: Depression incidence by household characteristics over the life cycle

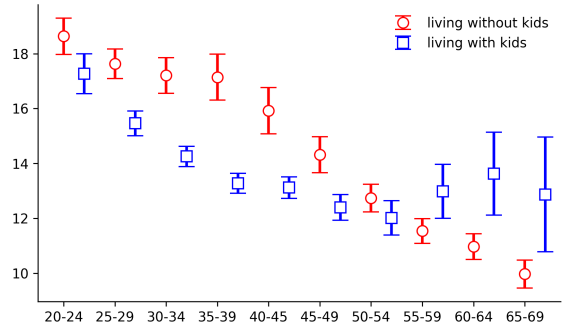
(a) sex at birth



(b) marital status



(c) number of children



(d) race

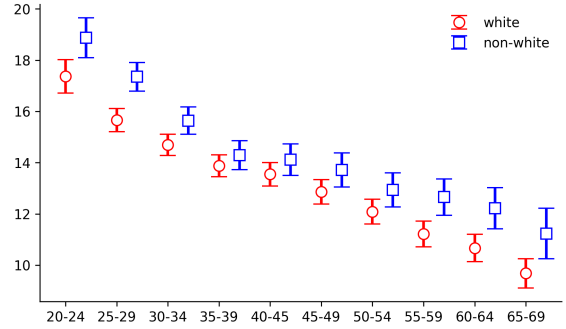
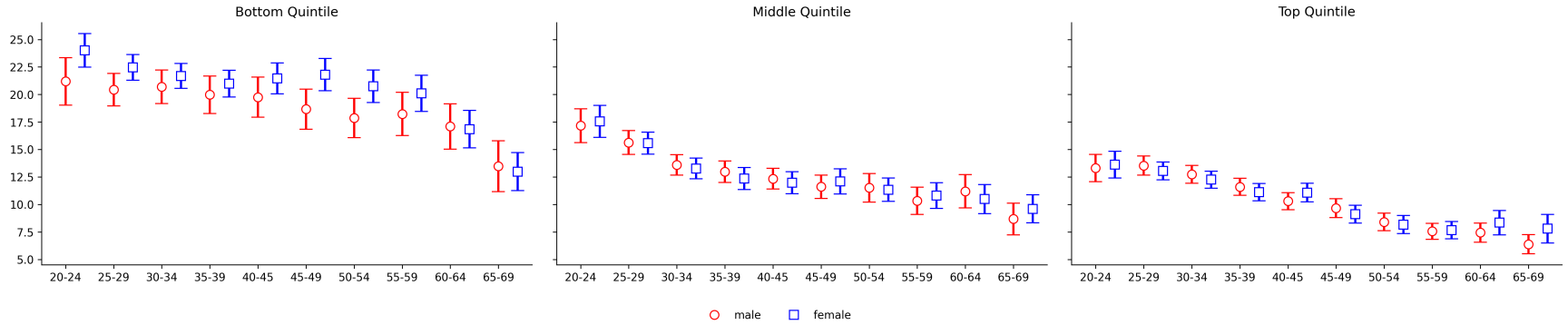
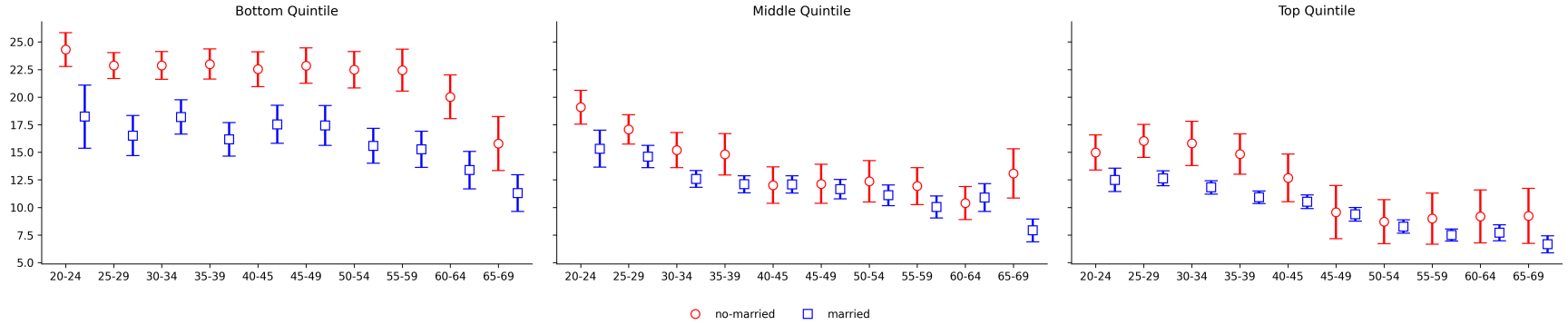


Figure 11: Depression incidence over the life cycle by household characteristics and income

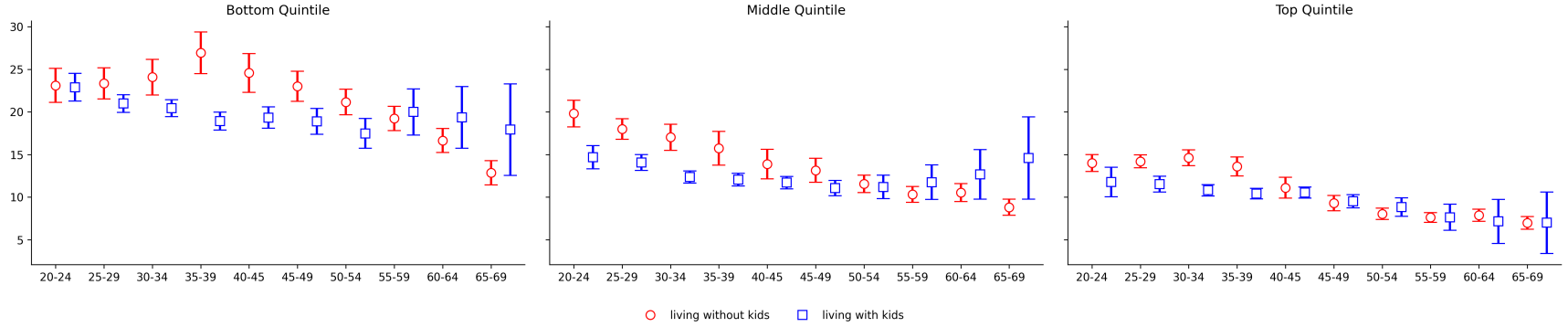
(a) sex at birth



(b) marital status



(c) presence of children



B Frailty index

Table 3: Variables used in the frailty index (PSID)

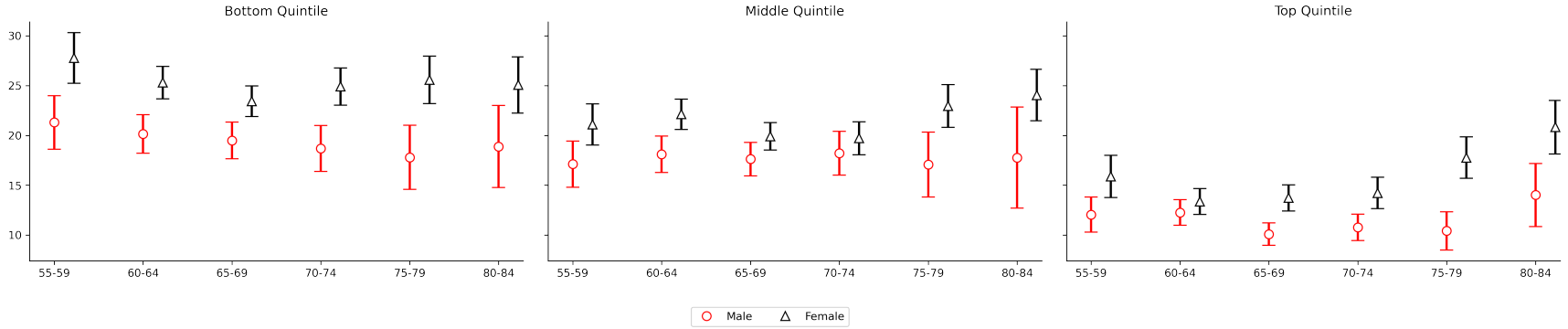
Variable	Value
Some difficulty with ADL/IADLs:	
Eating	Yes=1, No=0
Dressing	Yes=1, No=0
Getting in/out of bed or chair	Yes=1, No=0
Using the toilet	Yes=1, No=0
Bathing/showering	Yes=1, No=0
Walking	Yes=1, No=0
Using the telephone	Yes=1, No=0
Managing money	Yes=1, No=0
Shopping for personal items	Yes=1, No=0
Preparing meals	Yes=1, No=0
Heavy housework	Yes=1, No=0
Light housework	Yes=1, No=0
Getting outside	Yes=1, No=0
Ever had one of following conditions:	
High Blood Pressure	Yes=1, No=0
Diabetes	Yes=1, No=0
Cancer	Yes=1, No=0
Lung disease	Yes=1, No=0
Heart disease	Yes=1, No=0
Stroke	Yes=1, No=0
Arthritis	Yes=1, No=0
Asthma	Yes=1, No=0
Other serious, chronic condition	Yes=1, No=0
BMI ≥ 30	Yes=1, No=0

Table 4: List of health deficits employed to construct frailty index (HRS)

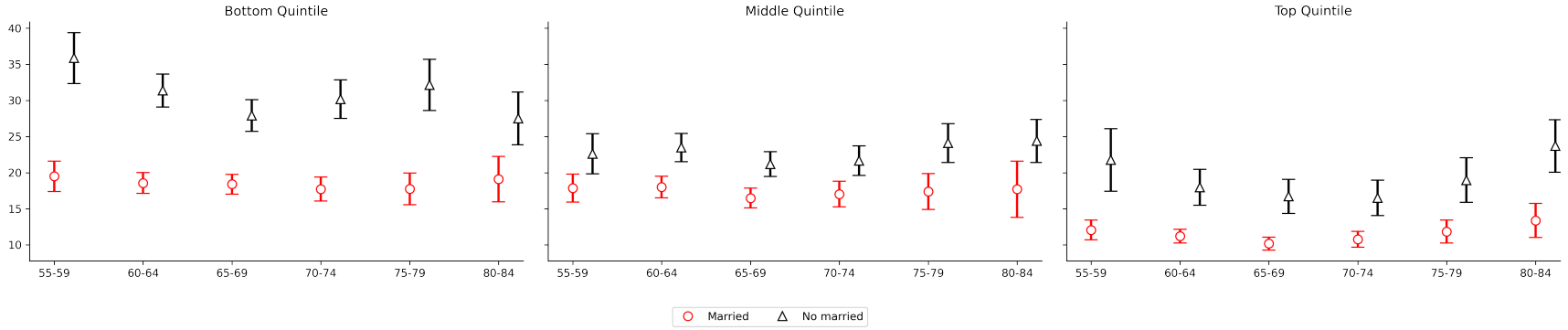
Variable	Value
Some difficulty with ADL/IADLs	
Eating	Yes= 1, No= 0
Dressing	Yes= 1, No= 0
Getting in/out of bed	Yes= 1, No= 0
Using the toilet	Yes= 1, No= 0
Bathing/shower	Yes= 1, No= 0
Walking across room	Yes= 1, No= 0
Walking several blocks	Yes= 1, No= 0
Using the telephone	Yes= 1, No= 0
Managing money	Yes= 1, No= 0
Shopping for groceries	Yes= 1, No= 0
Preparing meals	Yes= 1, No= 0
Getting up from chair	Yes= 1, No= 0
Stooping/kneeling/crouching	Yes= 1, No= 0
Lift/carry 10 lbs	Yes= 1, No= 0
Using a map	Yes= 1, No= 0
Taking medications	Yes= 1, No= 0
Climbing 1 flight of stairs	Yes= 1, No= 0
Picking up a dime	Yes= 1, No= 0
Reaching/extending arms up	Yes= 1, No= 0
Pushing/pulling large objects	Yes= 1, No= 0
Ever had one of the following conditions	
High Blood Pressure	Yes= 1, No= 0
Diabetes	Yes= 1, No= 0
Cancer	Yes= 1, No= 0
Lung disease	Yes= 1, No= 0
Heart disease	Yes= 1, No= 0
Stroke	Yes= 1, No= 0
Psychological problems	Yes= 1, No= 0
Arthritis	Yes= 1, No= 0
BMI $\geq$ 30	Yes= 1, No= 0
Has ever smoked	Yes= 1, No= 0
Back pain	Yes= 1, No= 0
Doctor visit	Yes= 1, No= 0
Hospital visit	Yes= 1, No= 0
Home care visit	Yes= 1, No= 0
Nursing home stay	Yes= 1, No= 0

Figure 12: Depression incidence by household characteristics and permanent income quintiles

(a) sex at birth



(b) marital status



(c) presence of children